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ZAĻĀ PĀRVEIDE

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Rīga, Latvija | 27.-29.06.2023.

# ZAĻĀ PĀRVEIDE

World Congress of Latvian Scientists

# Phytochemical Profiles and Antibacterial Properties of Genus *Vaccinium* Fruit Extracts

Ance Bārzdiņa[1,2], Ksenija Stojane[2], Ingus Skadiņš[2,3], Dace Bandere[1,2], Agnese Brangule[1,2]

[1] Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Rīga Stradiņš University, Rīga, Latvia
[2] Baltic Biomaterial Centre of Excellence, Headquarters at Rīga Technical University, Rīga, Latvia
[3] Department of Biology and Microbiology, Rīga Stradiņš University, Rīga, Latvia

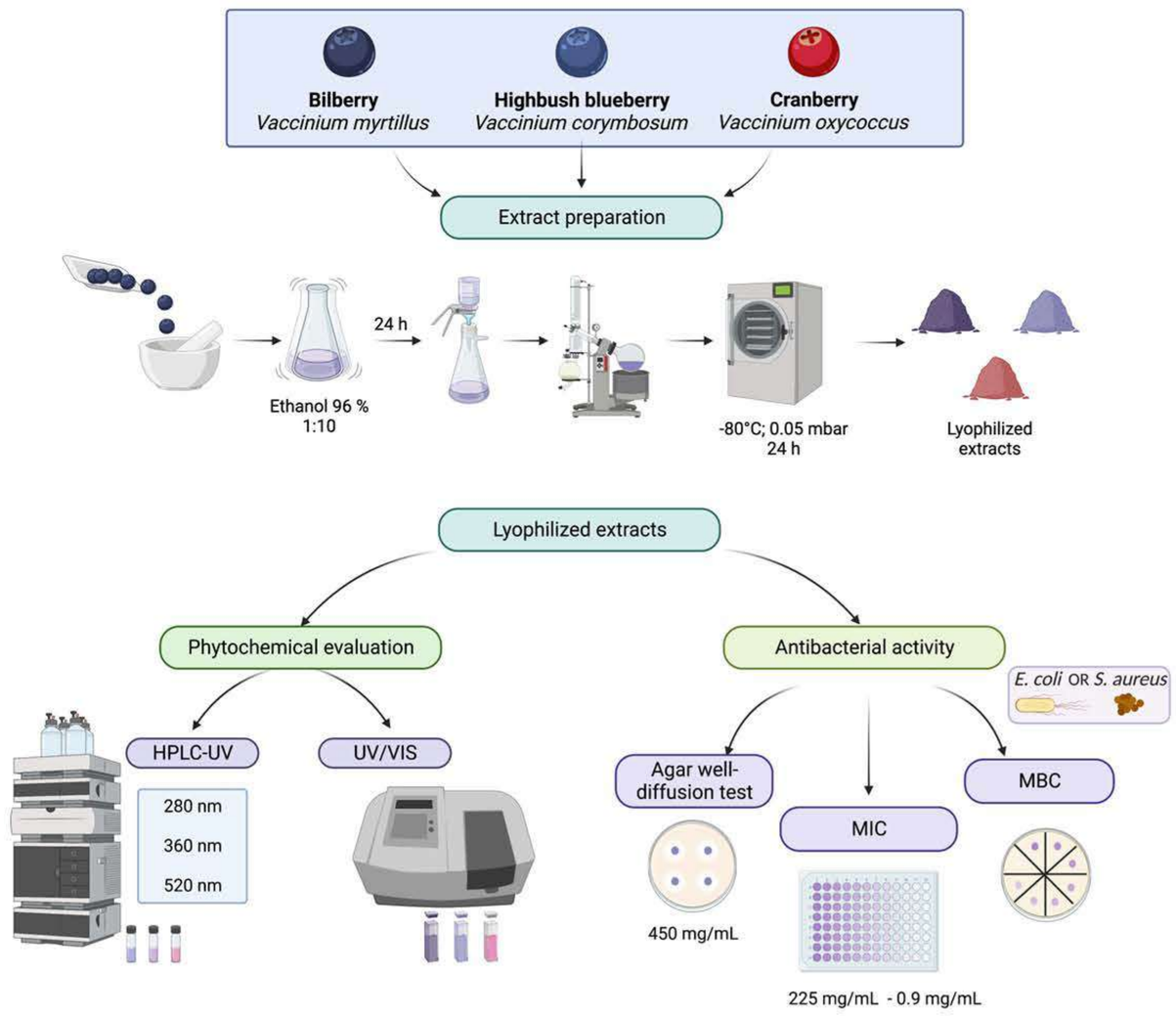
## Introduction

With the increase in public demand for ecologically friendly health products and the emerging crisis of antibacterial resistance, medicinal plants and the biological activity of their secondary metabolites are increasingly being researched.

Genus *Vaccinium* contains various fruit-producing shrubs – **cranberries, bilberries, and highbush blueberries** that are commonly found in gardens and forests of Latvia. The potential of these fruits as sources of bioactive agents has not been thoroughly examined thus far.

**This study aimed** to compare and analyze the phytochemical profiles of highbush blueberry, bilberry, and cranberry fruit extracts and to evaluate their antibacterial properties against ***Escherichia coli*** (ATCC 25922) and ***Staphylococcus aureus*** (ATCC 25923) reference cultures.

## Methods




## Results

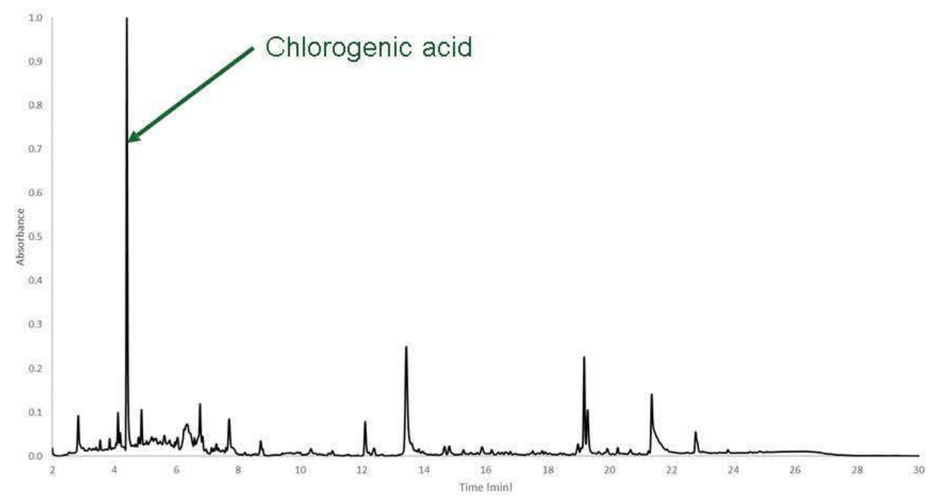
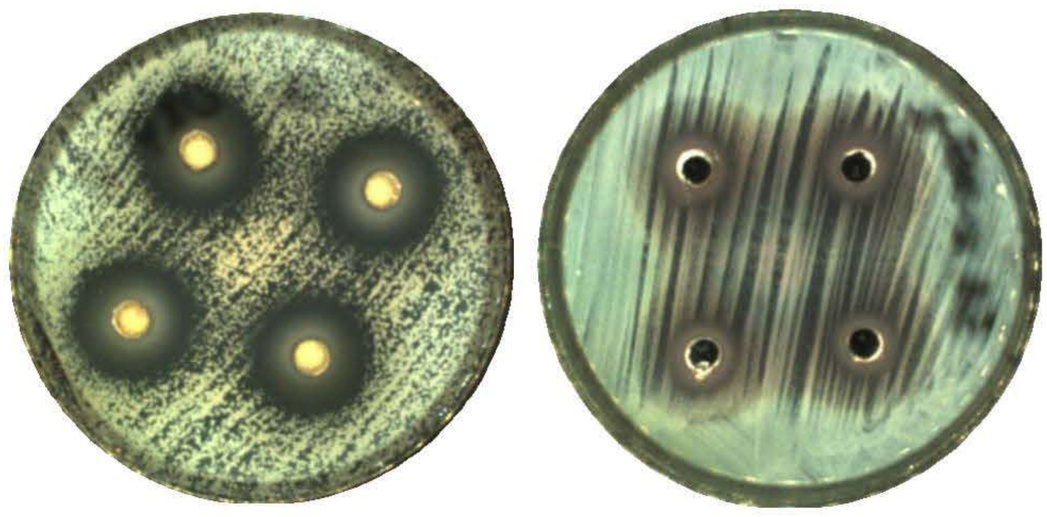



**Figure 1**. Chemical profile of highbush blueberry extract, HPLC, 280 nm



Cranberry

Highbush blueberry

**Figure 2**. Comparison of agar well-diffusion test results between cranberry and highbush blueberry extracts against *S. aureus*

**Table 1**. Identified compounds in analyzed extracts

| Identified compound | Bilberry | Highbush blueberry | Cranberry |
|---|---|---|---|
| Phenolic acids | | | |
| Caffeic acid | + | + | + |
| Chlorogenic acid | + | + | + |
| Ellagic acid | + | + | + |
| Syringic acid | + | + | + |
| Flavonoids | | | |
| Apigenin | + | | |
| Apigenin - 7 - glucoside | + | + | |
| Catechin | | + | |
| Quercetin | + | | + |
| Rutin | + | + | + |
| Anthocyanins | | | |
| Cyanidin - 3 - O - galactoside | + | + | + |
| Myrtillin | + | + | |
| Delphinidin - 3 - O - galactoside | + | + | |

**Table 2**. Minimum inhibitory concentration (MIC) values of genus *Vaccinium* fruit extracts

| Type of extract | MIC (mg/mL) | |
|---|---|---|
| | *S. aureus* | *E. coli* |
| Cranberry | **14.1** | 28.1 |
| Bilberry | 28.1 | 28.1 |
| Highbush blueberry | 56.3 | 56.3 |

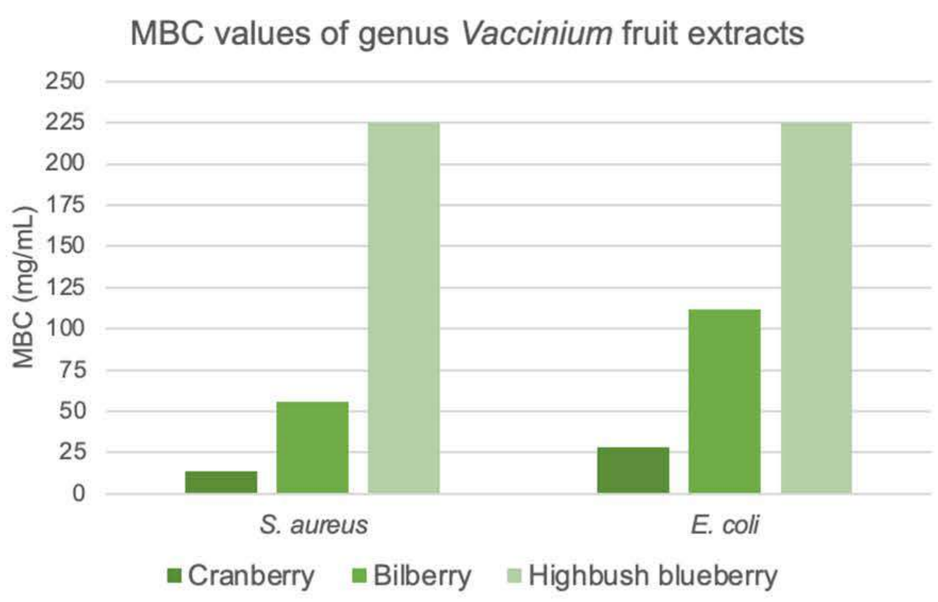



**Figure 3**. Minimum bactericidal concentration (MBC) values of genus *Vaccinium* fruit extracts

## Conclusions

Genus *Vaccinium* fruit extracts are rich in phenolic acids, flavonoids, and anthocyanins. Cranberry extracts have significantly stronger antibacterial activity than bilberry and highbush blueberry extracts against *S. aureus* and *E. coli* reference cultures.

## Contact Information

Ance Bārzdiņa - ance.barzdina@rsu.lv

The authors acknowledge the access to the infrastructure and expertise of the BBCE – Baltic Biomaterials Centre Of Excellence (European Union's Horizon 2020 research and innovation programme under the grant agreement No. 857287).

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# Decoupled electrolysis based on $WO_3$ auxiliary electrode

Mairis Iesalnieks, Mārtiņš Vanags, Andris Šutka

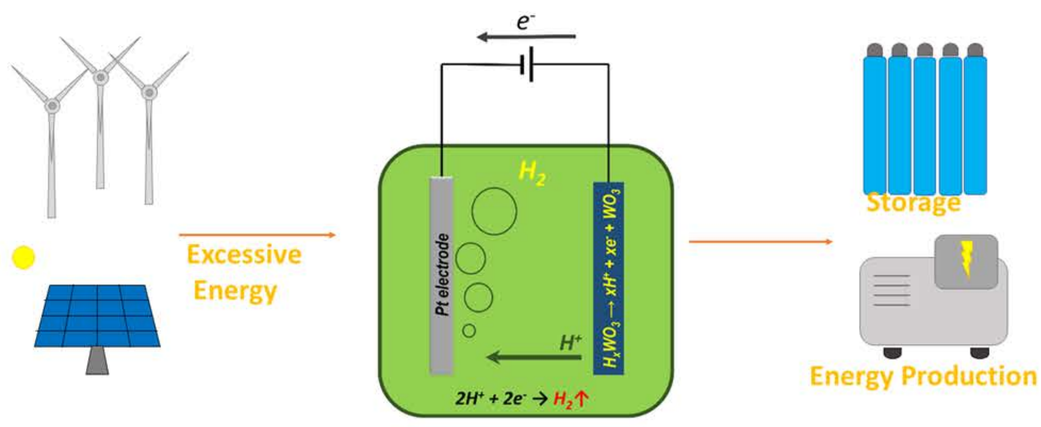
Institute of Materials and Surface Engineering, Riga Technical University

## Introduction

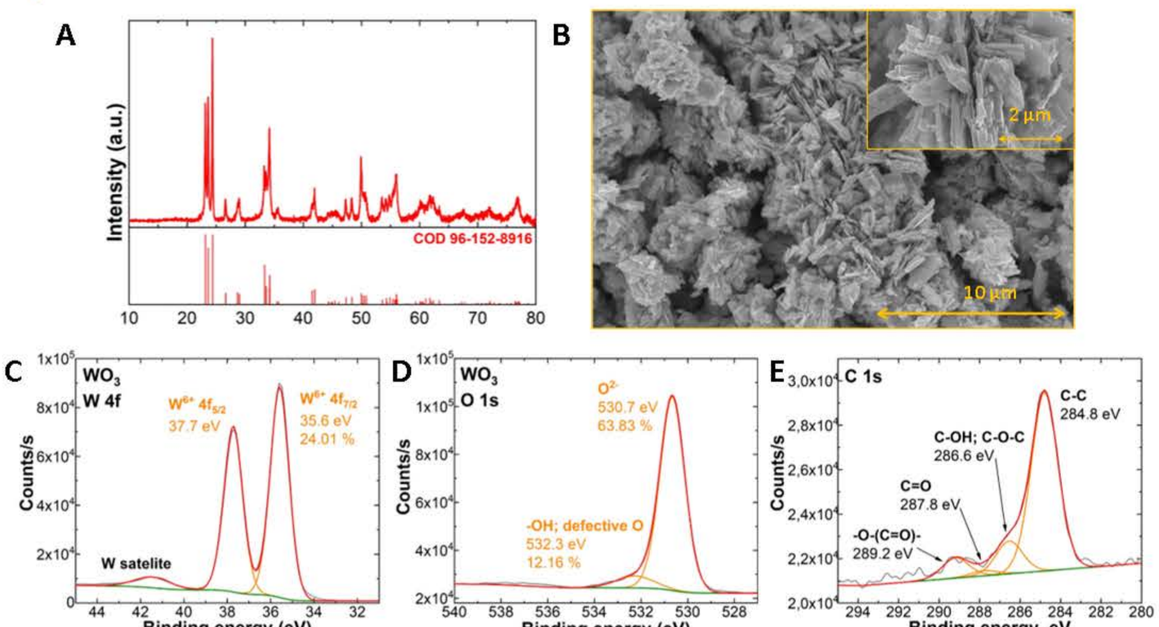
World demand for energy is increasing and new and environmentally friendly methods for energy harvesting and storage are essential to reduce the negative effects of climate change. Nowadays most commonly used renewable energy sources, such as Hydro, solar or wind suffers from intermittence in their production and mismatch in production and consumption cycles. Energy storage using batteries is expensive and problematic due to the use of rear-earth metals. Due to these two aspects, a cheap and abundant energy storage medium is needed. Hydrogen is one of the most perspective energy storage media due to its high gravimetric energy density of 33.3 kW/h per kg and abundance. Hydrogen could be used directly in fuel cells or as a syngas for other liquid fuels, such as methanol or dimethyl ether.

## Research Objective

The majority of produced hydrogen comes from gas byproducts and only 4% of globally produced hydrogen comes from electrolysis. Most commonly used electrolyzers rely on the use of polymer electrolyte membranes to avoid the formation of dangerous gas mixtures, which increase production costs and wastes energy due to overpotential. To avoid membrane deterioration, extensive gas equalization systems are needed. In this research, we demonstrate a novel and safe method for hydrogen production using decoupled electrolysis without the need for a membrane.



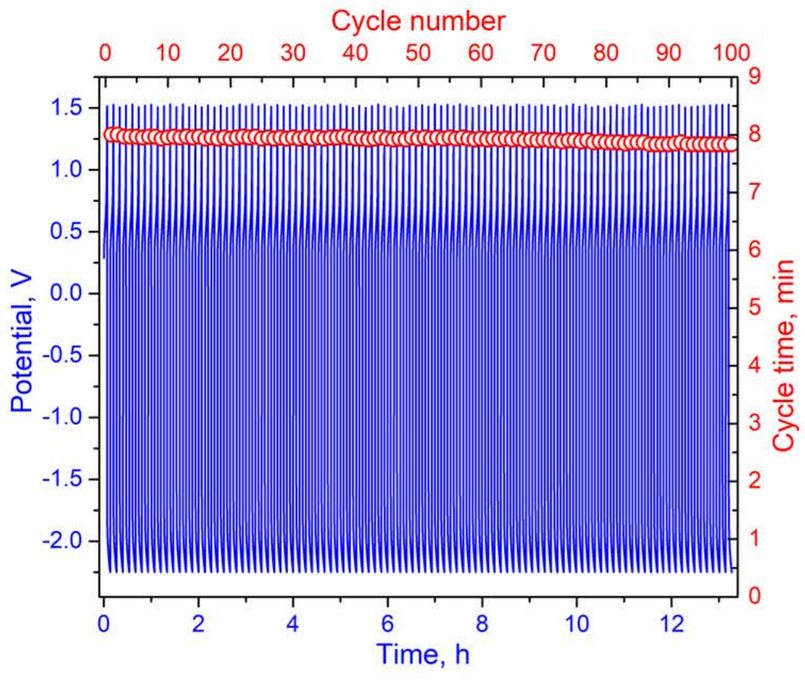

## Results & Discussion




$WO_3$ for the auxiliary electrode was prepared using the solvothermal method. In accordance with SEM (B), XRD (A) and XPS (C-E) data, $WO_3$ nanoplates were formed with plate thicknesses of 50-100 nm consisting of a monoclinic crystalline phase. No presence of lower oxidation states was observed. Electrochemical measurements were performed in 3 electrode system. The capacity of the $WO_3$ auxiliary electrode (AE) was observed to be 325 F/g at a scanning speed of 2 mV/s (H) and decreased with an increase of it due to limited charge diffusion. Peak transition associated with $W^{5+} \rightarrow W^{6+}$ changes polynomially with an increase in scan speed. It can be associated with $WO_3$ pseudocapacitive behaviour. EIS (I) show the formation of incomplete arc at high frequencies and linear correlation at lower frequencies. Chrono potentiometry shows high stability in time without any material degradation.

## Conclusions

We were able to produce a high-capacity auxiliary electrode for electrochemical water splitting, with produced gas purity above 99%. $WO_3$ AE was stable in time and didn't show any signs of deterioration even after 400 cycles. Faradaic efficiency reached 90.2% when a current density of 100 mA/g was used. Total electrolyzer efficiency was determined to be 65% taking into account both OER and HER cycles.




*100 cycles of chronopotentiometry at the current density of 500 mA/g.*

## Contact Information

Institute of Materials and Surface Engineering, Paula Valdena Street 3/7, Riga

https://imse.rtu.lv/

mairis.iesalnieks@rtu.lv

*This work has been supported by the European Social Fund within the Project No 8.2.2.0/20/I/008 «Strengthening of PhD students and academic personnel of Riga Technical University and BA School of Business and Finance in the strategic fields of specialization» of the Specific Objective 8.2.2 «To Strengthen Academic Staff of Higher Education Institutions in Strategic Specialization Areas» of the Operational Programme «Growth and Employment»*

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Osvalds Verners,
Linards Lapčinskis,
Līva Ģermane,
Kaspars Mālnieks,
Andris Šutka

Materiālu un virsmas tehnoloģiju institūts, MLĶF, RTU

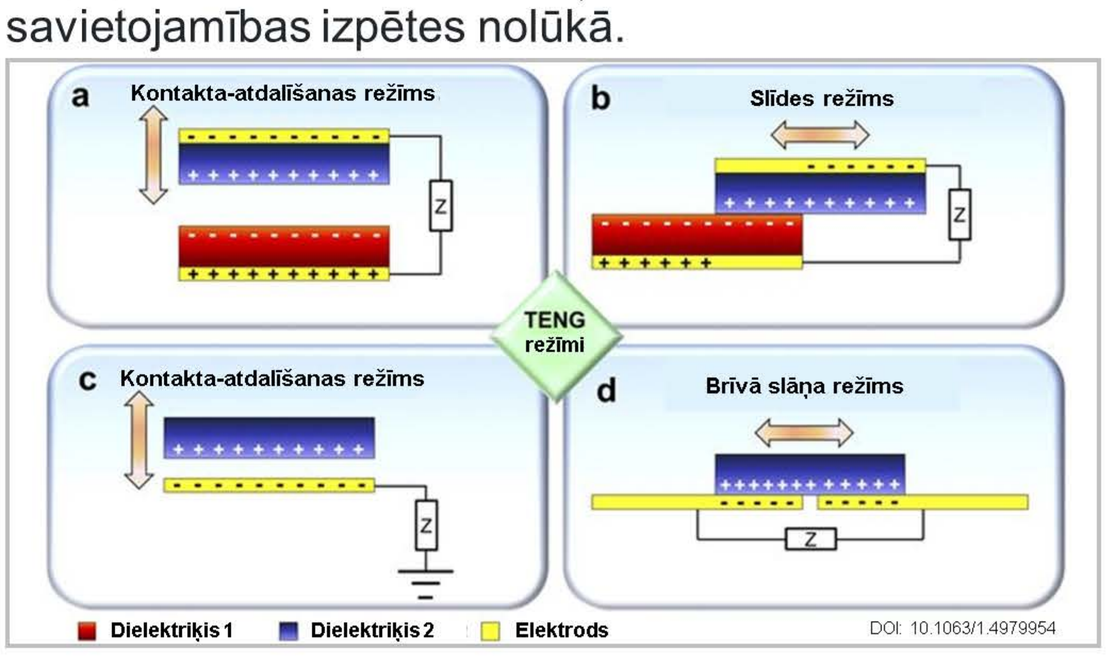
# Triboelektriski nanoģeneratori zaļajai pārvadei un to strukturālā un ķīmiskā optimizācija pielietojot skaitliskās metodes

## Ievads

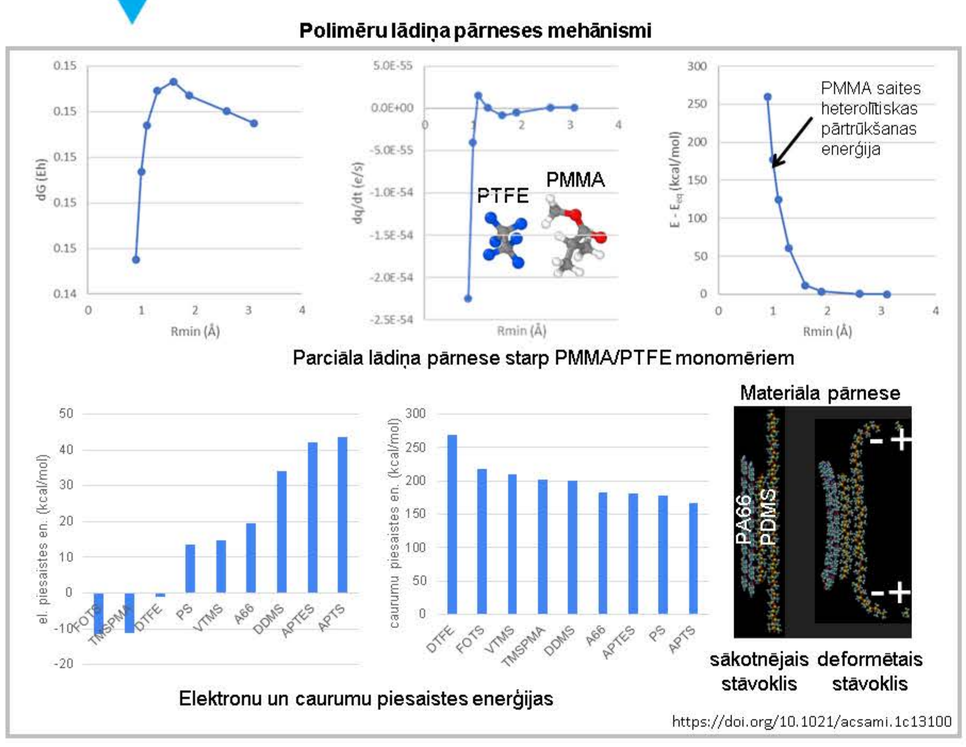
**Kaut arī statisku lādiņu iegūšana kontakta elektrizācijas (KE) rezultātā kā fizikāls process ir zināma kopš senatnes, to iegūšanas ķīmiskie mehānismi joprojām nav skaidri noteikti daudzām materiālu grupām, ietverot arī polimērus. Neraugoties uz to, triboelektriski nanoģeneratori (TENĢ) pašlaik tiek uzskatīti par videi draudzīgu enerģijas iegūšanas veidu mazu jaudu, t. sk., autonomu devēju un lietu interneta, darbības nodrošinājuma pielietojumiem. To galvenās priekšrocības saistāmas ar liela sprieguma ieguvi, salīdzinoši vienkāršu konstrukciju, darbības stabilitāti, kā arī ļoti plašu pielietojamo materiālu klāstu. Savukārt kā galvenie TENĢ potenciālie trūkumi minami zemas izejošās strāvas un virsmas lādiņa noturība. Šo trūkumu mazināšanai būtiski izprast vadošos KE lādiņa veidošanās mehānismus un tos ierobežojošos apstākļus.**

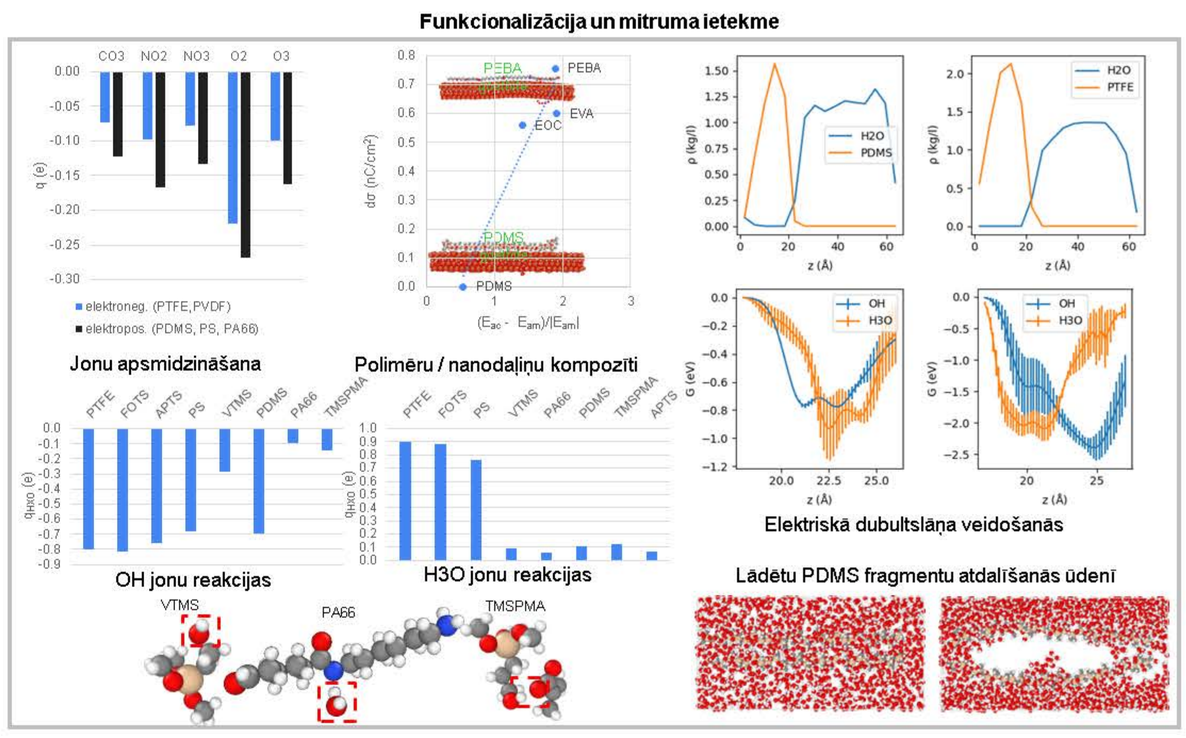
## Pētījuma mērķis

Pētījuma mērķi balstīti uz tipiskāko TENĢ materiālu kontakta elektrizācijas mehānismu skaitlisku izpēti, īpašu uzmanību pievēršot polimēru laminātu pielietojumiem, paralēli aplūkojot TENG ierīču un kontaktvirsmu strukturālās izveides iespējas to optimālam pielietojumam, kā arī kontaktvirsmu funkcionalizācijas un materiāla tilpuma modifikācijas iespējas un vides mitruma ķīmisko ietekmi materiālu savietojamības izpētes nolūkā.




## Rezultāti un diskusija

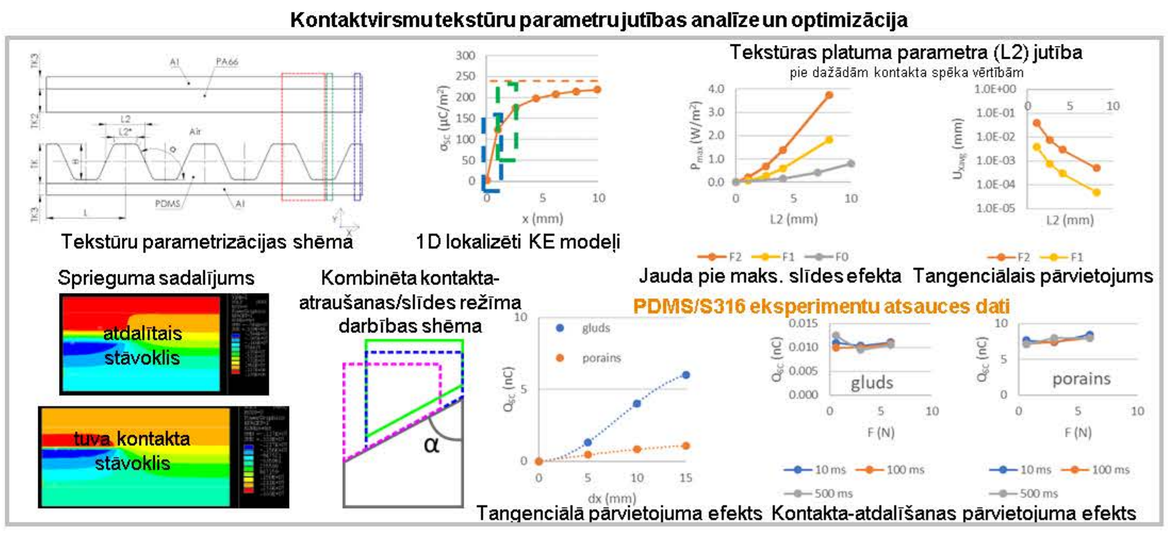



**Balstoties uz lādiņa parciālās pārneses un heterolītiskas trūkšanas enerģiju salīdzinājumu, par galveno polimēru KE mehānismu uzskatāma lādētu fragmentu pārnese adhēzijas rezultātā, kas var pastiprināties mitrā vidē. Polimēru KE uzlabošanai piemērotas metodes ietver gan polarizējamu funkcionalizācijas molekulu, gan jonu apsmidzināšanas, gan augstākas sakārtotības apgabalu veidojošu nanodaļinu kompozītu pielietojumus. Kā papildus iespēja KE uzlabošanai mitrā vidē minama atšķirīgi veidotu elektrisku dubultslāņu izmantošana.**

## Secinājumi

Papildus materiāla īpašību modifikācijām kā perspektīvs TENĢ attīstības virziens minama lokālam slīdes / atraušanas režīmam piemērotu kontaktvirsmu tekstūru struktūras optimizācija. Šeit īpaša uzmanība būtu jāvelta elementu savietojamībai ar ekvivalento lokālo modeļu darbības principiem, virsmu gluduma izvēlei, kontakta materiālu adhezīvajām īpašībām, kā arī ierīces ilgmūžības aspektiem.




## Kontaktinformācija

Materiālu un virsmas tehnoloģiju institūts, Materiālzinātnes un lietišķās ķīmijas fakultāte,
Rīgas Tehniskā universitāte, Rīga, Latvija

Šis darbs izstrādāts ar Eiropas Reģionālās attīstības fonda atbalstu darbības programmas "Izaugsme un nodarbinātība" 1.1.1. specifiskā atbalsta mērķa "Palielināt Latvijas zinātnisko institūciju pētniecisko un inovatīvo kapacitāti un spēju piesaistīt ārējo finansējumu, ieguldot cilvēkresursos un infrastruktūrā" 1.1.1.2. pasākuma "Pēcdoktorantūras pētniecības atbalsts" ietvaros (Nr.1.1.1.2/VIAA/4/20/636).

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# “Green” waste biomass and its advanced utilization

**A.Verovkins, S. Vitolina, G. Shulga, B. Neiberte, J. Brovkina, J. Ozoliņš, S. Reihmane**

Latvian State Institute of Wood Chemistry, Riga, LV-1006
Riga Technical University, Riga, LV-1048

## Introduction

The principles of the Circular Economy are based on the sustainable and efficient management of wastes and by-products because their annual volume remarkably increases and negatively affects the environment. On other hand, waste recovery can provide a huge secondary resource for producing new materials and reducing their costs. Recently, much attention has been paid to wastewater treatment and rational utilization of waste wood biomass formed as sludge at woodworking enterprises as a result of wastewater treatment, keeping in mind that the qualitative and quantitative treatment of woodworking wastewater allows returning the purified water into the technological cycle, which is important from both economic and ecological viewpoints. The production of veneer in many countries of East Europe is accomplished by the hydrothermal treatment of birch wood in special open water basins. The formed wastewater contains wood biomass in the form of hemicelluloses, lignin’s compounds and extractives, which are responsible for the high values of TOC, COD and color.

## Purpose of the Study

The aim of the study was to show the effectiveness of the developed composite coagulants based on polyaluminium chloride (PAC) in removing the waste wood biomass from the wastewater and to present perspective trends in the possible application of the obtained biomass sludge.

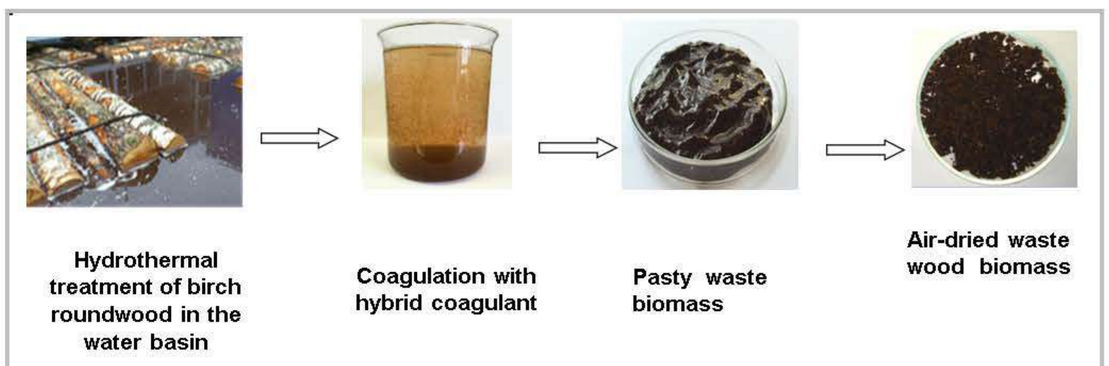
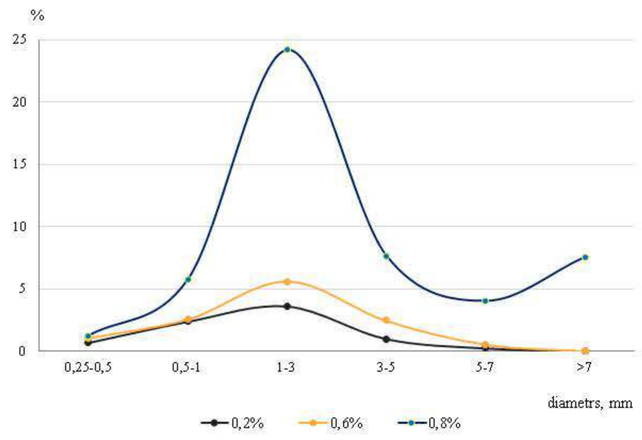



**Table 1.** Efficiency of the developed coagulants

| Parameters | KHPAC | PEI-KHPAC |
|---|---|---|
| Optimal dosage, mg/L | 100 | 80 |
| Optimal pH | 6 | 6 |
| Biomass removal, mg/L | 1304 | 1358 |
| Color removal, % | 85.4 | 89.8 |
| COD removal, % | 46.7 | 49.7 |
| Al ions residual, mg/L | 0.063 | 0.032 |

## Results and discussion

### Waste wood biomass sludge as a soil structuring agent








### Waste wood biomass sludge for the improvement of wood-plastic composite


**Table 2.** Mechanical properties (tensile, bending) of wood–plastic composite samples with the waste biomass

| Waste Wood Biomass Content, % | Tensile Strength, MPa | Young’s Modulus, MPa | Tensile Deformation, % | Bending Strength, MPa | Bending Modulus, MPa | Bending Deformation, mm |
|---|---|---|---|---|---|---|
| 0 (initial dust) | 20.9 ± 0.4 | 670.2 ± 6.5 | 15.6 ± 1.5 | 21.5± 0.7 | 1395 ± 25.5 | 9.6± 0.5 |
| 1 | 28.7 ± 0.7 | 849.8 ± 7.3 | 12.1 ± 1.9 | 31.3 ± 0.9 | 2140 ± 28.9 | 7.9 ± 0.7 |
| 3 | 29.3 ± 0.3 | 880.5 ± 7.7 | 11.0 ± 1.8 | 33.4 ± 0.7 | 2291 ± 26.9 | 7.3 ± 0.6 |
| 5 | 32.4 ± 0.3 | 950.7 ± 6.6 | 9.8 ± 1.5 | 37.1 ± 0.6 | 2540 ± 24.9 | 6.6 ± 0.5 |
| 10 | 28.1 ± 0.8 | 835.5 ± 9.1 | 11.9 ± 2.1 | 31.6 ± 0.9 | 2196 ± 29.1 | 7.7 ± 0.8 |

«

## Conclusions

The performed investigations showed that the wood wastewater biomass sludge obtained as a result of the model wastewater treatment with the developed coagulants can be successfully used for structuring dusty soils, modification of clay-based coagulants as well as in the form of a functional bio-additive for improvement of the properties of wood-plastic composites based on recycled polymer.


**References**

LV Patent, No. 15410
LV Patent, No. 14789

## Kontaktinformācija

Dr.chem. Anrijs Verovkins, Dr.sc.ing. Sanita Vitolina, Laboratory of Lignin Chemistry,
Latvian State Institute of Wood Chemistry, Dzērbenes St. 27, Rīga; sanita.vitolina@kki.lv, t. 26825988

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# Ekoloģisku biokompozītu izveide no sēņu micēlija un atjaunojamiem dabas resursiem

**Ilze Irbe, Inese Fiļipova, Mārīte Škute, Marija Terēze Dzierkale, Laura Andže**

Latvijas Valsts koksnes ķīmijas institūts

## Ievads

**Vides piesārņojums** pasaules mērogā ar **plastmasas atkritumiem** rada nepieciešamību attīstīt jaunus, ilgtspējīgus un videi draudzīgus materiālus. Jo

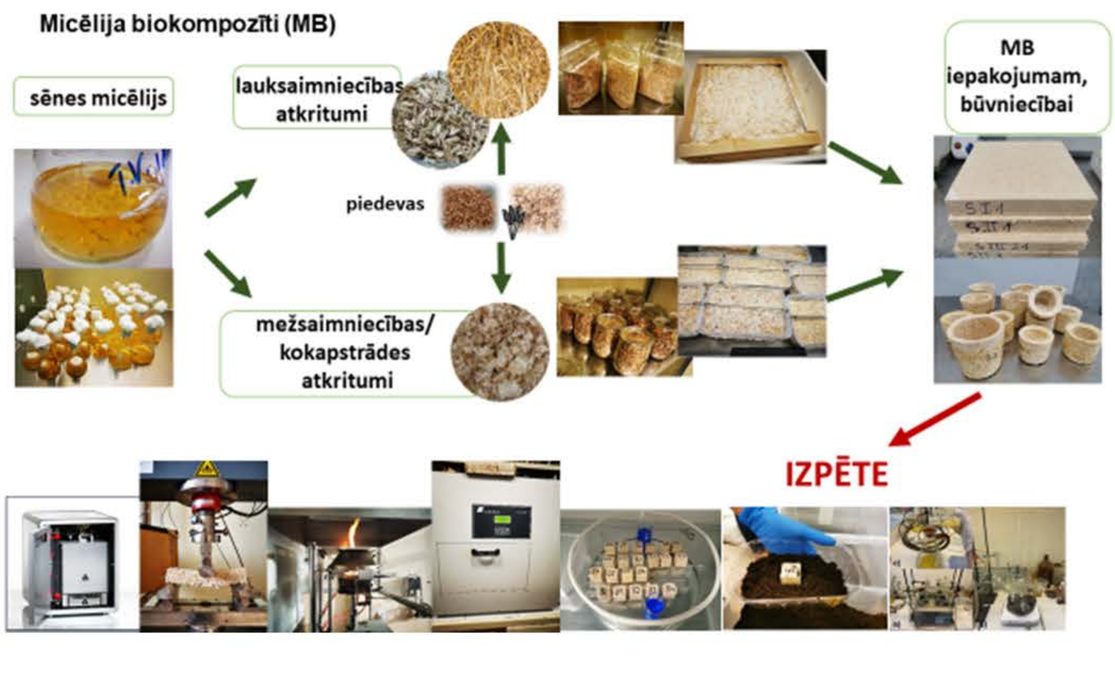
- ✓ katru gadu pasaulē saražo vairāk nekā **300 M tonnu plastmasas**;
- ✓ plastmasas **piesārņojums** ietekmē **pārtikas** drošību, cilvēku **veselību**, tūrismu un **klimata izmaiņas**

(The International Union for Conservation of Nature (IUCN), 2021)

**Micēlija tehnoloģija** ir viens no perspektīviem inovatīvu biomateriālu izveides virzieniem.
Micēlija biokompozīta (MB) izveide ir balstīta uz **sēnes micēlija** augšanu **lignocelulozes** substrātā, kā rezultātā bioloģiskā procesā izaug dažādas formas un izmēru **3D kompozīti.**

## Pētījuma mērķis

Pētījuma mērķis bija izstrādāt **ekoloģiskus biokompozītus** no bazīdijsēņu micēlija un atjaunojamiem dabas resursiem – vietējiem **lauksaimniecības** un **koksnes pārstrādes** biomasas atkritumiem **iepakojuma** un **būvniecības** materiālu izveidei.

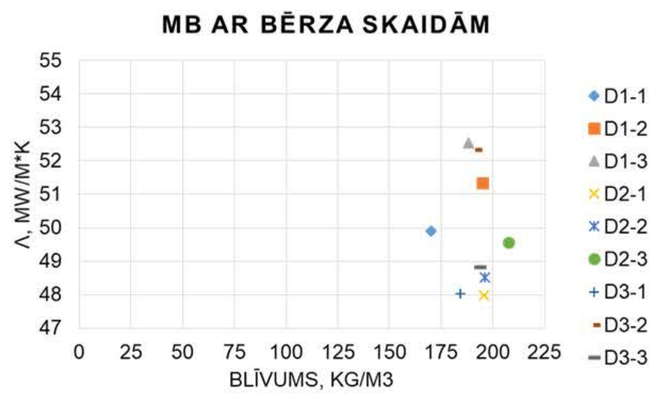


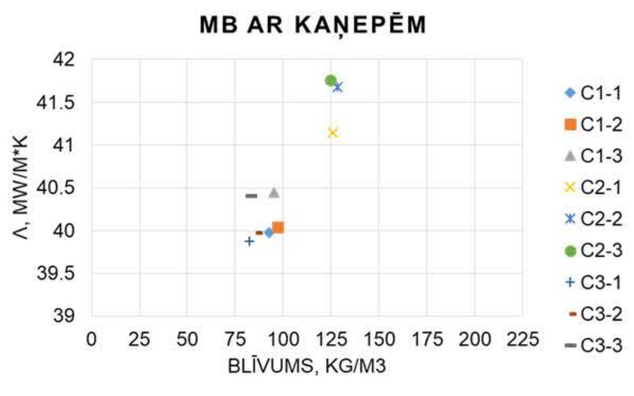

## Rezultāti un diskusija

### MEHĀNISKĀS ĪPAŠĪBAS

| MB variants | Blīvums | Spiede | | Liece | |
|---|---|---|---|---|---|
| | g/ cm³ | $\sigma_{10}$ (MPa) | E (MPa) | σfM (MPa) | E (MPa) |
| Skaidas 1 | 0.20 | 0.23 | 2.91 | 0.25 | 14.66 |
| Skaidas 2 | 0.22 | 0.18 | 2.20 | 0.17 | 8.78 |
| Skaidas 3 | 0.18 | 0.03 | 0.30 | 0.01 | 0.21 |
| Kaņ 1 | 0.10 | 0.16 | 2.41 | 0.11 | 5.55 |
| Kaņ 2 | 0.13 | 0.20 | 2.91 | 0.15 | 5.11 |
| Kaņ 3 | 0.11 | 0.19 | 2.94 | 0.10 | 4.41 |
| EPS (putu polistirols) | 0.01-0.05 | 0.07-0.7 | | 0.15-0.35 | |

### SILTUMVADITSPĒJA, λ




References: Stikla vate - blīvums 25 kg/m³, λ **39 mW/m*K**
Ekovate (celulozes šķiedra) - blīvums 60 kg/m³, λ **39 mW/*K**
Kokšķiedru plātnes - λ **50 mW/m*K**
EPS (putu polistirols) - λ **32 līdz 38 mW/m*K**

### DEGAMĪBA – konusa kalorimetrija

| MB variants | Max silt. izdalīšanās (p-HRR), kW/m² | Laiks, s |
|---|---|---|
| Skaidas 1 | 177.7 | 26 |
| Skaidas 2 | 172.3 | 30 |
| Skaidas 3 | 233.3 | 25 |
| Kaņ 1 | 140.9 | 19 |
| Kaņ 2 | 192.8 | 23 |
| Kaņ 3 | 152.3 | 19 |
| EPS | 200-300 | - |

### BIODEGRADĀCIJA AR KOMPOSTĒŠANAS METODI


100% biodegradācija 12 nedēļu laikā

## Secinājumi

1. MB pēc fizikālām, mehāniskām, termālām un degamības īpašībām ir **konkurētspējīgi** ar **sintētiskiem putu materiāliem** un komerciāliem **kompozītmateriāliem.**

2. MB izveidi raksturo **zems enerģijas patēriņš** un **minimāla $CO_2$ emisija**, kas ir būtiski saistībā ar klimata pārmaiņām un siltumnīcefekta gāzu emisiju samazināšanu.

## Kontaktinformācija

LV KĶI, Celulozes laboratorija, Dr. Ilze Irbe, ilze.irbe@kki.lv; tālr. 26410287

LATVIJAS VALSTS KOKSNES ĶĪMIJAS INSTITŪTS

Finansējums: ERAF projekts Nr.1.1.1.1/20/A/113

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# Thermochemical conversion of biomass into valuable products – from chemicals to nanostructured carbon materials

**Aivars Žūriņš, Gaļina Dobele, Kristīne Meile*, Ance Pļavniece, Aleksandrs Voļperts**

Latvian State Institute of Wood Chemistry

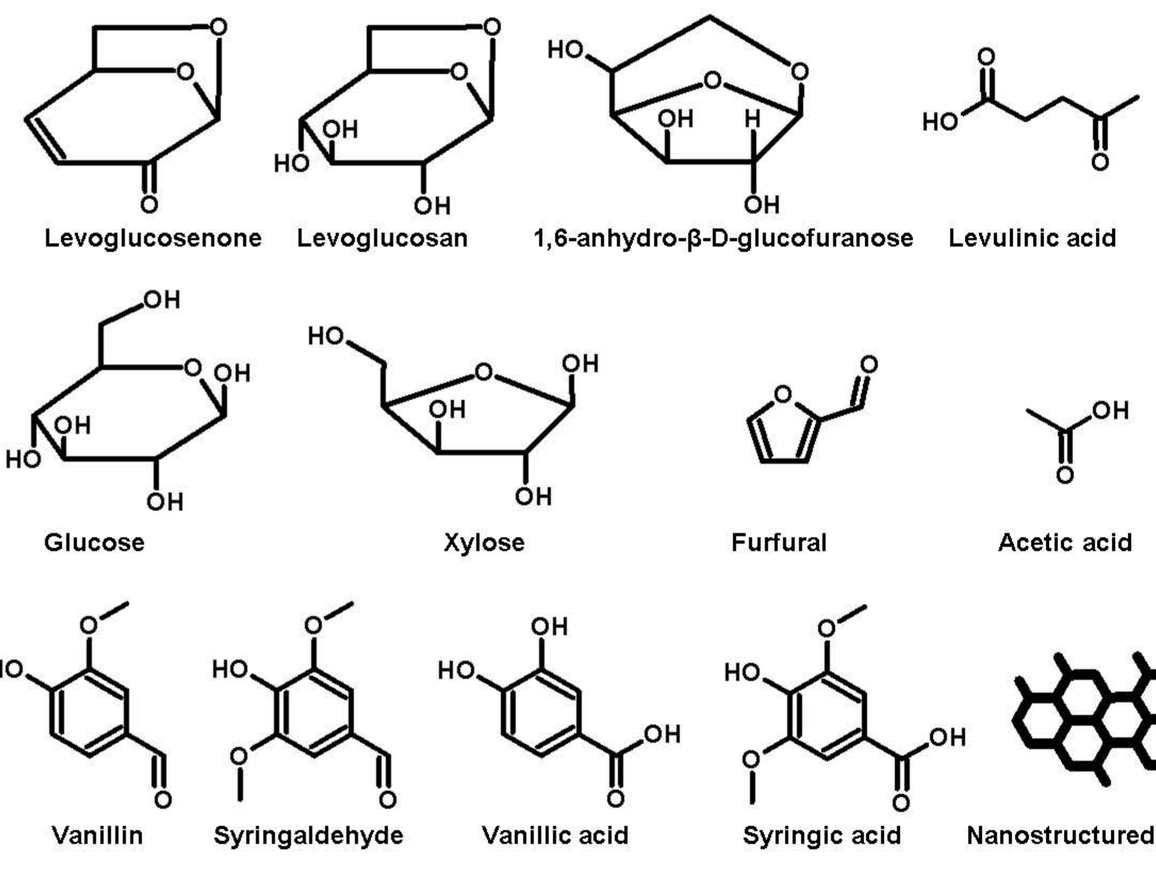
## Introduction

Successful implementation of a bioeconomy relies on the principles of biorefinery, when a single feedstock is a source of a vast array of products. Pyrolysis or the thermochemical conversion of biomass is a process with a long history, but nowadays various pyrolysis types have been developed, which provide valuable products, and they are up-scalable and practically applicable in a biorefinery.

## Research Objective

At the Latvian State Institute of Wood Chemistry, fast pyrolysis is aimed at the conversion of biomass, for example, birch wood, into liquid products, that contain such necessary chemicals as levoglucosenone, levulinic acid, levoglucosan etc. The use of biomass-based chemicals in the chemical industry would enable the replacement of the currently widely used fossil resources. On the other hand, slow pyrolysis or carbonization provides a higher yield of bio-char. Bio-char has different potential applications. It can be the basis of solid catalysts, adsorbents, soil enhancers, it can be used as a filler in various materials. Currently a topical research direction is about the use of bio-char based products in electrochemical applications.

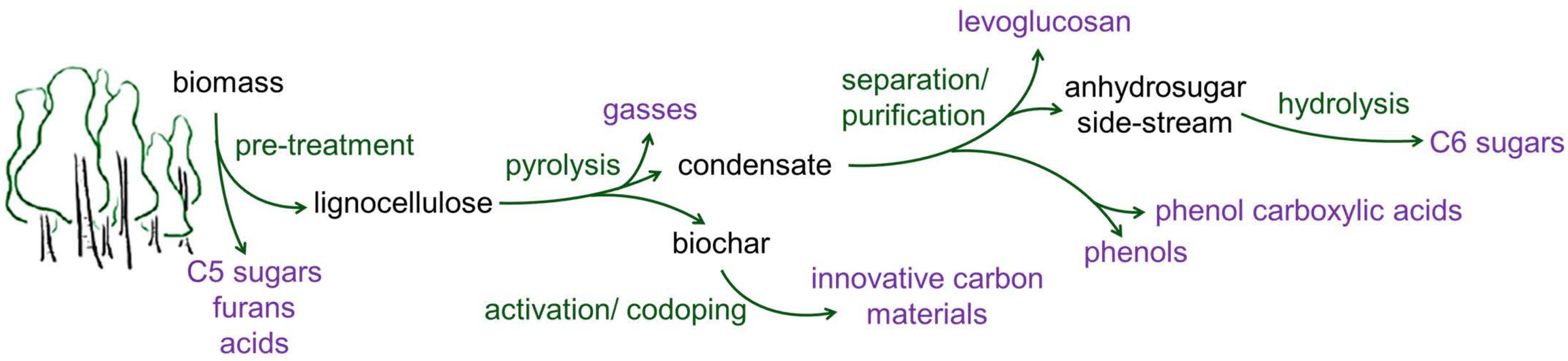
## Results & Discussion





**Fast pyrolysis equipment at LSIWC**: 1-steam generator; 2- water preparation unit; 3-control panel; 4- steam superheater (6 kW), 5- superheater (2 kW), 6-feeding bin with stirrer; 7- thermoreactor; 8- char cyclone; 9-condenser

**Some of the products obtainable from lignocellulosic biomass in a pyrolysis-based biorefinery**




**Birch wood-based biorefinery scheme with a vast array of products**: mainly focusing on various platform chemicals and innovative carbon materials

## Conclusions

The proposed biorefinery approach to the thermochemical processing of the locally available birch wood or other biomass ensures a number of valuable products. This scientific direction is multi-disciplinary, and it is a basis for cooperation with other institutions and entrepreneurs to promote renewable resource use in the chemical and electrochemical industry.

## Contact Information

* Kristīne Meile kristine.meile@kki.lv
www.kki.lv

LATVIAN STATE INSTITUTE OF WOOD CHEMISTRY

World Congress of Latvian Scientists

# Processing of available annual plants to alternative thermal insulation materials

Andris Berzins, Ramunas Tupciauskas, Gunars Pavlovics, Martins Andzs, Inese Filipova

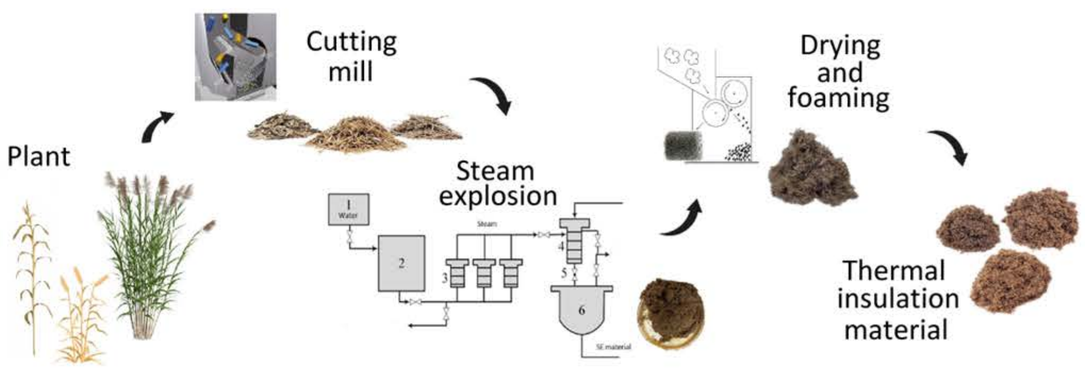
Latvian State Institute of Wood Chemistry

## Introduction

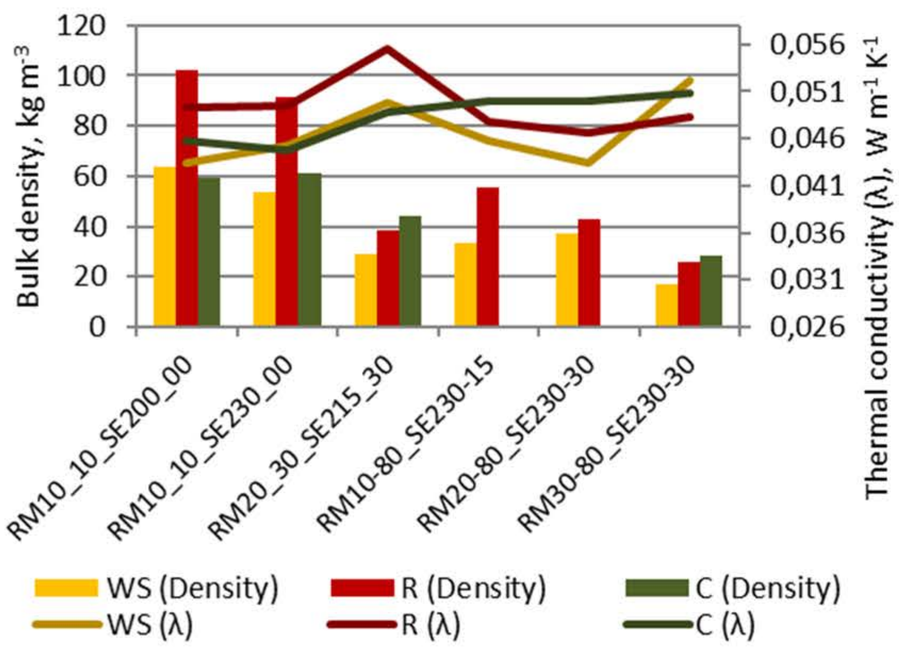
According to the EU climate policy, Latvia are committed to reduce greenhouse gas emissions. One of the important ways to implement the policy is to reduce the energy consumption required particularly for building maintenance that make up to 50% of the total amount of industrially emitted CO2. Therefore, the thermal insulation of buildings is a key to achieve the goal. Since the widely used mineral thermal insulation materials are very energy-intensive, it is crucial to develop environmentally friendly thermal insulation materials obtained from renewable resources with low production costs. Because of deforestation and a high demand of wood the second potential and annually available in Latvia is a lignocellulosic biomass like wheat straw, corn stalks and reeds.

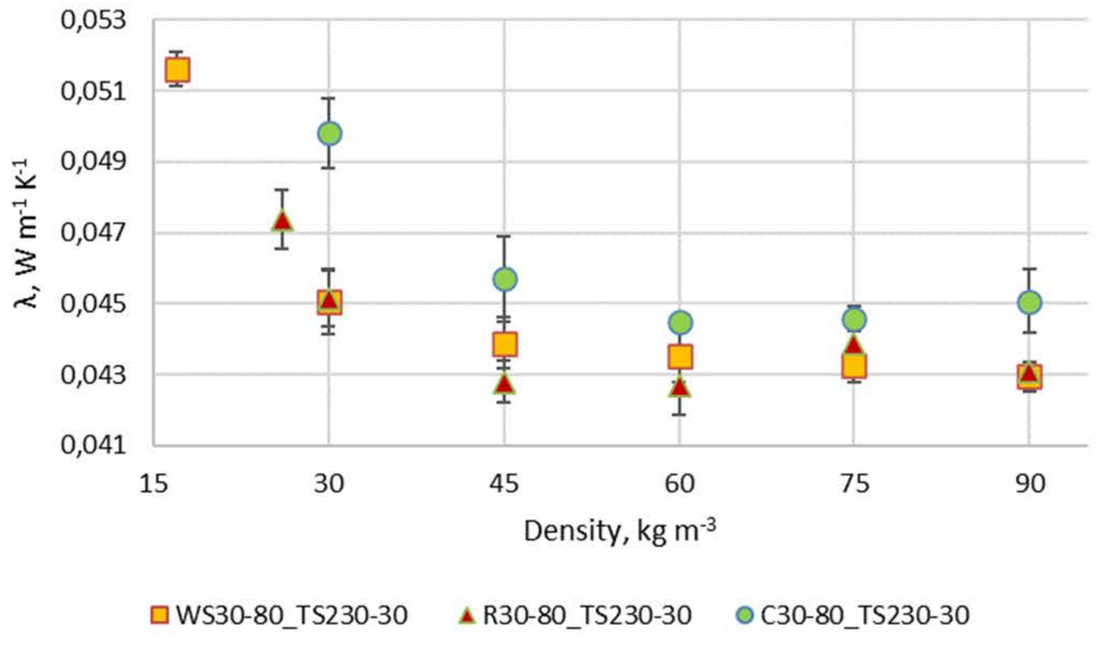
## Research Objective

The aim of the study was a development and optimization of lignocellulosic thermal insulation materials by steam explosion (SE) processing to get loose-fill fiber mass with improved properties. The study evaluates the influence of varying factors such as raw material moisture (10–80 %) and fraction size (10–30 mm), steam pressure (16–30 bar), temperature (200–230 °C) and processing time (0–60 s).




## Results & Discussion

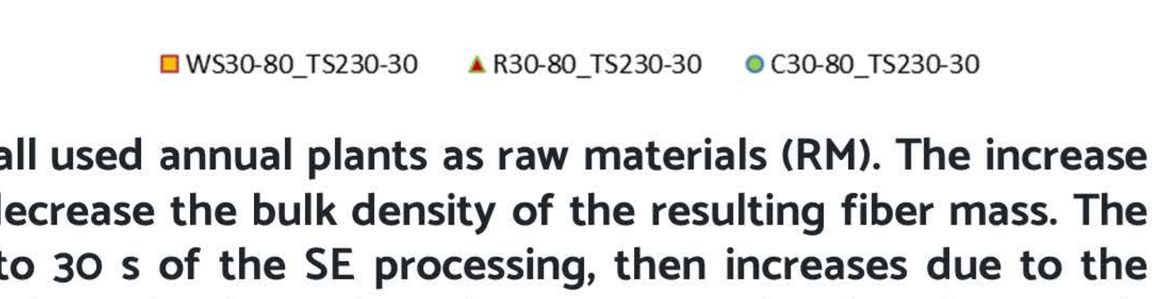



SE pretreatment results to efficient defibration of all used annual plants as raw materials (RM). The increase of RM fraction and moisture, and steam pressure decrease the bulk density of the resulting fiber mass. The resulting bulk density tends to decrease only up to 30 s of the SE processing, then increases due to the significant reduction of particle size and higher mass loss. The thermal conductivity (λ) of developed materials depends mostly on bulk density achieving the best values (0.042–0.045 W (m K)$^{-1}$) at density range between 40 and 60 kg m$^{-3}$. The developed thermal insulation materials demonstrate properties competing with conventional thermal insulation materials indicating that all used annual plants are suitable for application in thermal insulation of building construction.

## Conclusions

Lignocellulosic biomass of wheat straw, water reed and corn stalk treated by steam explosion under the conditions of 230 °C for 30 s and mechanically foamed by rotating wires system achieves significantly decreased bulk density (17–28 kg m$^{-3}$), with thermal conductivity in range of 0.042–0.045 W (m K)$^{-1}$ and contains mainly of cellulose (40–46%) that makes it suitable for thermal insulation applications.




## Contact Information

E-mail: andris.berzins@kki.lv; Phone: +371 26880964

Latvia University of Life Sciences and Technologies
FLPP FUNDAMENTAL AND APPLIED RESEARCH PROJECTS
LATVIAN STATE INSTITUTE OF WOOD CHEMISTRY

Pasaules latviešu zinātnieku kongress

**Agnese Gailīte,**
**Dainis Edgars Ruņģis**

Latvijas Valsts mežzinātnes institūts "Silava"

# Latvijas augu ģenētisko resursu saglabāšana un izpēte

## Kāpēc ir svarīgi saglabāt ģenētiskos resursus?

Bioloģiskā un ģenētiskā daudzveidība samazinās gan savvaļas ekosistēmās, gan lauksaimniecībā, un to saglabāšana ir svarīga un nepieciešama ilgtspējīgai, videi draudzīgai attīstībai. Ap 7000 augu sugu tiek izmantotas lauksaimniecībā, bet tikai 30 tiek uzskatītas par "pasaules barotājām". 50% no augiem iegūtās enerģijas pasaulē nodrošina kvieši, rīsi un kukurūza, vēl 25% - sorgo, prosa, kartupeļi, soja, cukurbietes, cukurniedres. Arī sugu iekšienē samazinās ģenētiskā daudzveidība, jo komerciāli izmanto tikai nedaudz šķirņu. Ģenētisko resursu (ĢR) saglabāšana un ilgtspējīga izmantošana ir nepieciešama, jo:

- tiem ir vērtīgas īpašības, kuras var izmantot lauksaimniecībā un selekcijā gan šobrīd, gan nākotnē;
- nodrošina ilgtspējīgu lauksaimniecību, tie ir daudzveidīgi, un pielāgojušies vietējiem klimatiskajiem un augšanas apstākļiem;
- tos saglabājot tiek nodrošināta piekļuve vietēji nozīmīgām sugām, piemēram, liniem, kaņepēm, pelēkajiem zirņiem.

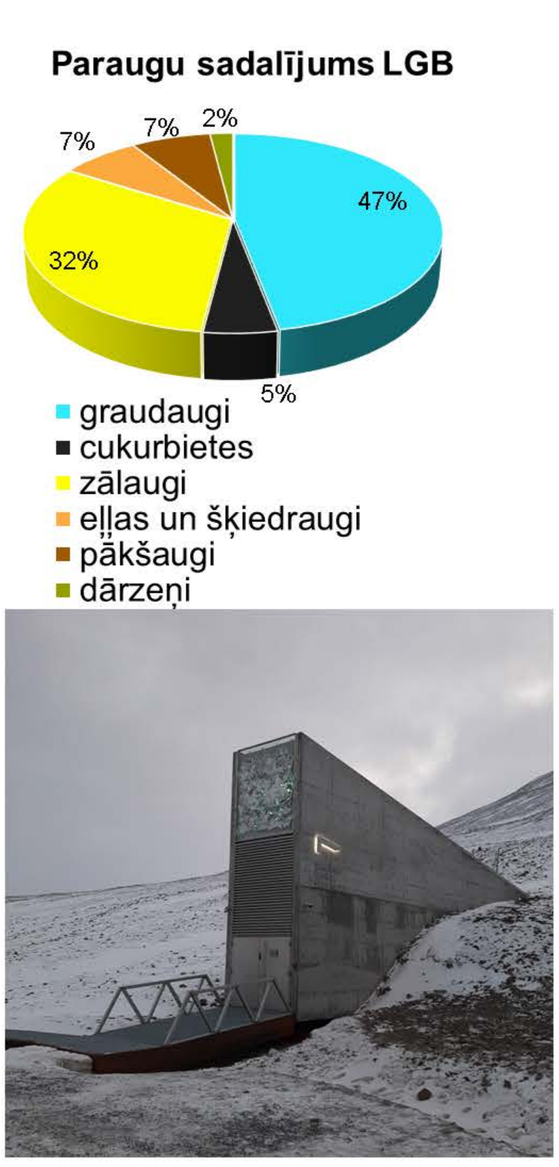
## Ģenētiskie resursi

Augu ģenētiskie resursi ir augu ģenētiskais materiāls, kuru šobrīd vai nākotnē iespējams izmantot pārtikā vai lauksaimniecībā un tiem ir liela loma ģenētiskās daudzveidības saglabāšanā, kā arī zinātnes un selekcijas uzdevumu risināšanā. Ģenētiskos resursus saglabā *ex situ* (gēnu (sēklu) bankās, lauka kolekcijās, *in vitro*) un *in situ* (dabā, aizsargājamajās teritorijās). Ģenētisko resursu centrs ir viena no LVMI "Silava" struktūrvienībām un koordinē lauksaimniecībā un pārtikā izmantojamo augu saglabāšanu; tajā ietilpst Latvijas Kultūraugu gēnu banka (LGB), kurā glabā ar sēklām pavairojamos Latvijas augu ģenētiskos resursus.

## Augu ģenētisko resursu kolekcijas Latvijā

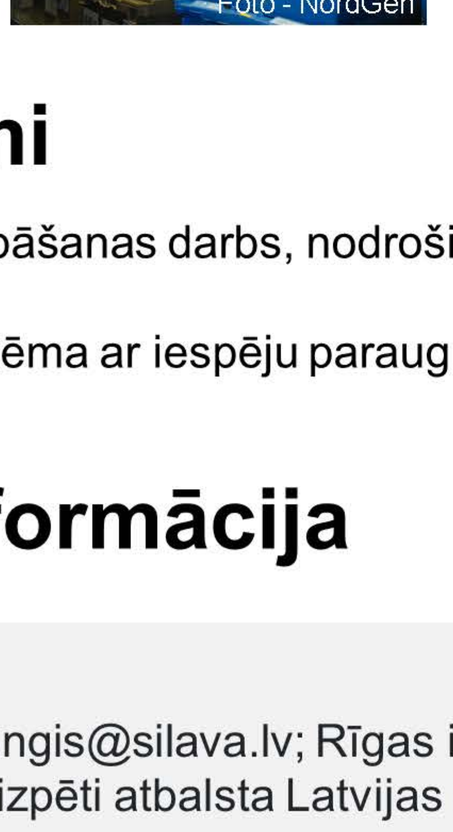
### Sēklu kolekcija

Sēklu kolekcijā saldētavās pie -18 °C glabā Latvijas izcelsmes šķirnes, vietējās šķirnes (*landraces*), selekcijas līnijas un citu vērtīgu selekcijas materiālu, savvaļā ievāktus paraugus (kopā vairāk kā 2000 paraugu no 43 ģintīm 68 sugām). Paraugi tiek aprakstīti pēc deskriptoriem un tiem veic molekulāri ģenētisko analīzi.






Drošības kolekcija atrodas Dānijā un kopš 2021. g. arī Svalbāras globālajā sēklu glabātuvē.




### Lauka kolekcijas

Lauka kolekcijas atrodas:

- Dārzkopības institūtā (augļu koki un ogulāji, dārzeņi),
- Latvijas Biozinātņu un tehnoloģiju universitātē (ārstniecības un aromātiskie augi),
- AREI Priekuļu pētniecības centrā (kartupeļi)

GENBIS

GRIN-Global Nordic Baltic Genebanks Information System (GENBIS)

datu bāze: www.nordic-baltic-genebanks.org

**ĢR *in situ* saglabāšana** – kultūraugu savvaļas radinieki (*Crop Wild Relatives -CWR*)

- Nozīmīga loma ģenētiskās daudzveidības saglabāšanā ar savām dabiskajā vidē saglabātajām adaptīvajām īpašībām, ko ietekmē abiotiskie, biotiskie un vides faktori;
- Galvenie CWR Latvijā – zālaugi, ārstniecības un aromātiskie augi, savvaļas ogas un augļi;
- Tiek strādāts pie prioritāro sugu saraksta pabeigšanas, *in situ* iespējamo saglabājamo vietu atrašanas un izpētes.



## Secinājumi

Jāturpina ģenētisko resursu saglabāšanas darbs, nodrošinot ģenētiskās daudzveidības saglabāšanu ilgtermiņā;
Jāizveido *in situ* saglabāšanas sistēma ar iespēju paraugus saglabāt arī *ex situ* kolekcijās.

## Kontaktinformācija

www.genres.lv; www.silava.lv
agnese.gailite@silava.lv; dainis.rungis@silava.lv; Rīgas iela 111, Salaspils, Salaspils nov., LV-2169
Ģenētisko resursu uzturēšanu un izpēti atbalsta Latvijas Republikas Zemkopības ministrija.

Pasaules latviešu zinātnieku kongress

# Viedās lauksaimniecības risinājumu izstrāde un ieviešana Latvijas augļkopības nozares konkurētspējas celšanai

**Gunārs Lācis, Edīte Kaufmane, Sarmīte Strautiņa**

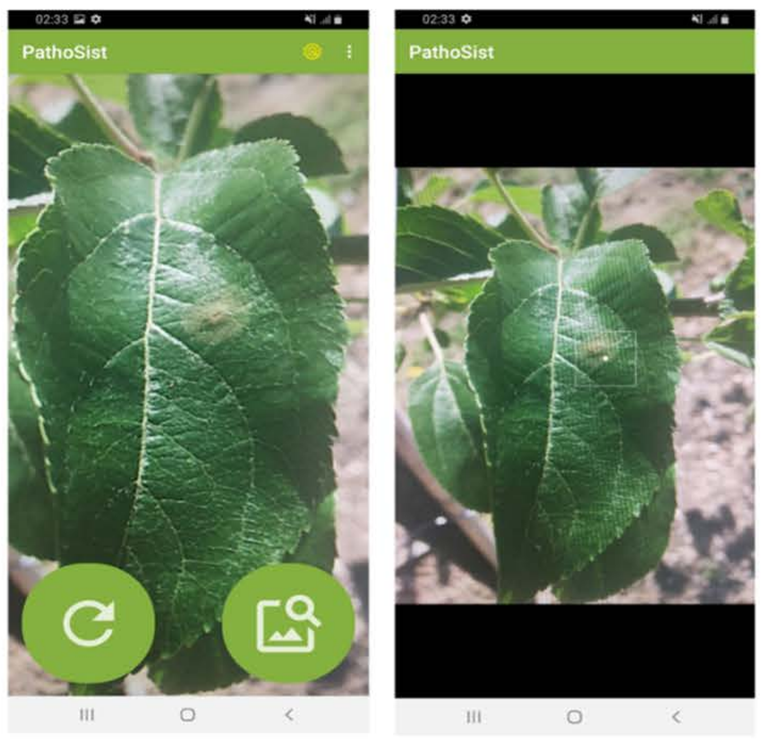
Dārzkopības institūts

## Ievads

Augļkopība ir pakļauta virknei izaicinājumu: klimata izmaiņas, jauni slimību ierosinātāji un kaitēkļi, sabiedrības pieprasījums pēc mazākas pesticīdu lietošanas, vienlaikus nodrošinot ekonomiski izdevīgu ražošanu. Tie ietekmē visus etapus – sākot no jaunu šķirņu radīšanas līdz agrotehnisko lēmumu pieņemšanai labākai un kvalitatīvākai ražai. Šādu, bieži pretrunīgu uzdevumu risināšana prasa zināšanu ietilpīgus viedās augļkopības instrumentus, dažādu informācijas avotu izmantošanu. Selekcija ir ilgstošs un darbietilpīgs process, kas saistīts ar liela apjoma augu materiāla izvērtēšanu. Aprakstot vizuāli, vienmēr pastāv arī subjektīvais faktors. Procesa paātrināšanai un precizēšanai, arvien plašāk izmanto precīzās tehnoloģijas. Apvienojot iepriekš uzkrātās zināšanas selekcijā ar modernām vērtēšanas un mašīnmācīšanas metodēm, iespējams palielināt selekcijas procesa efektivitāti, saīsinot tam nepieciešamo laiku.

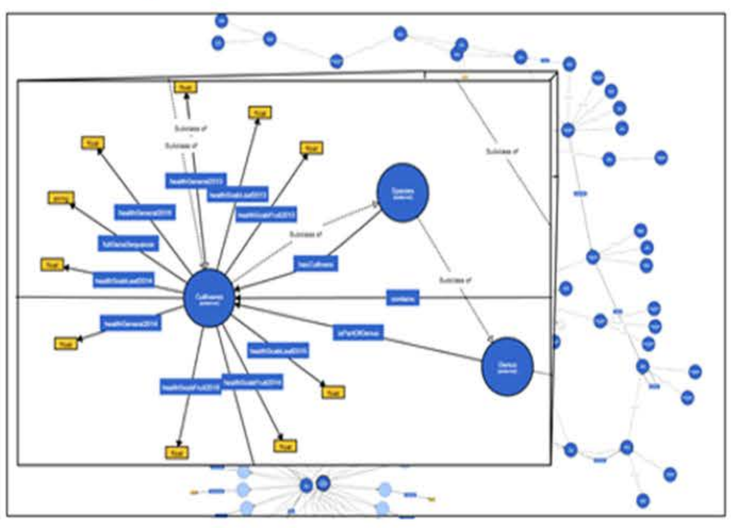
## Pētījuma mērķis

- izstrādāt attēlu atpazīšanas un mākslīgā intelekta rīkus ābeļu kraupja agrīnai identifikācijai un novērtēšanai,
- veikt datu semantisko analīzi un izstrādāt lēmumu pieņemšanas sistēmu viedajiem ābeļu un bumbieru dārziem,
- izstrādāt metodoloģiju un rīkus augsti efektīvai un precīzai neinvazīvai aveņu un krūmcidoniju ražas komponentu fenotipēšanai.




**1. att.** Mobilā lietotne kraupja atpazīšanai agrīnajā stadijā

## Rezultāti un diskusija



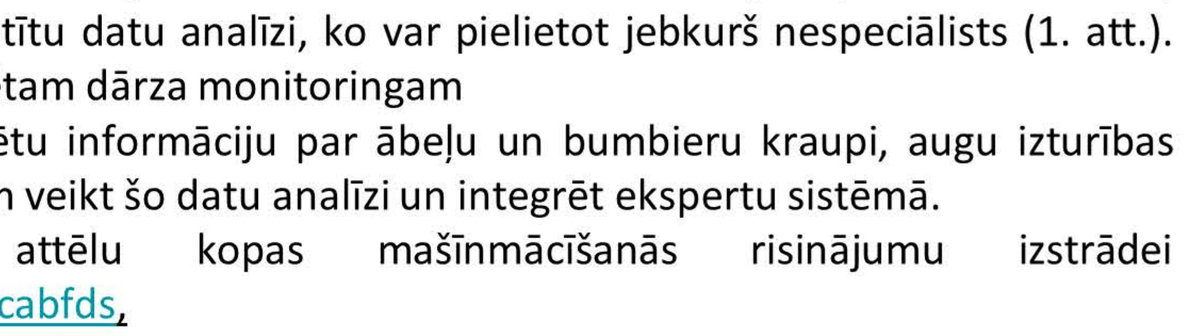
**2. att.** Ābolu un bumbieru kraupja ontoloģija

**3. att.** Attēlu izmantošana krūmcidoniju augļu fenotipēšanā - krūmcidoniju fotografēšana ar 3D kameru

- Izveidota mobilā tālruņa aplikācija ābeļu kraupja agrīnai atpazīšanai un slimības attīstības pakāpes novērtēšanai, izmantojot RGB attēlošanu un uz mašīnmācīšanos balstītu datu analīzi, ko var pielietot jebkurš nespeciālists (1. att.). Izstrādātais rīks tiks integrēts dronu sistēmā automatizētam dārza monitoringam
- Izstrādāta semantiskā ontoloģija (2. att.), lai strukturētu informāciju par ābeļu un bumbieru kraupi, augu izturības gēniem un vides datiem. Tā ļāva mākslīgajam intelektam veikt šo datu analīzi un integrēt ekspertu sistēmā.
- Zinātniskiem nolūkiem izveidotas anotētas attēlu kopas mašīnmācīšanās risinājumu izstrādei (https://www.kaggle.com/projectlzp201910094/applescabfds, https://www.kaggle.com/projectlzp201910094/applescablds).
- Pamatojoties uz RGB un 3D attēlveidošanu (3. att.), izstrādāts DNN Yolo5 algoritma modelis aveņu un krūmcidoniju augļu identifikācijai, ražas elementu fenotipēšanai, precizējot un vienkāršojot selekcijas procesu.
- Krūmcidonijām un avenēm izstrādāti mašīnmācīšanās algoritmi neinvazīvai fenotipēšanai, veikta attēlveidošanas metožu un datu analīze (4. att.).

## Secinājumi

- Automatizēta un agrīna slimību identifikācija uzlabo augu aizsardzības pasākumu efektivitāti augļudārzos un samazina pesticīdu lietošanu
- Viedo dārzu rīki sniedz atbalstu audzētāju lēmumu pieņemšanai, izmantojot visu iegūto zināšanu kopumu
- Viedie risinājumi palielina selekcijas procesa efektivitāti, saīsinot tam nepieciešamo laiku un mazinot darbaspēka patēriņu



**4. att.** Krūmcidoniju un aveņu attēlu detektēšanas rezultāti, kas iegūti ar apmācītu YOLOVv5 detektoru

## Kontaktinformācija

Graudu iela 1, Dobele, Dobeles novads, LV-3701
e-pasts: gunars.lacis@lbtu.lv

**Finansējums:** lzp-2019/1-0094
lzp-2020/1-0353
lzp-2021/1-0134

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# Long-term effect of organic soil drainage on soil carbon stock and greenhouse gas emissions in old-growth Scots pine forests

**Valters Samariks, Laura Ķēniņa, Āris Jansons**

Latvian State Forest Research Institute "Silava"

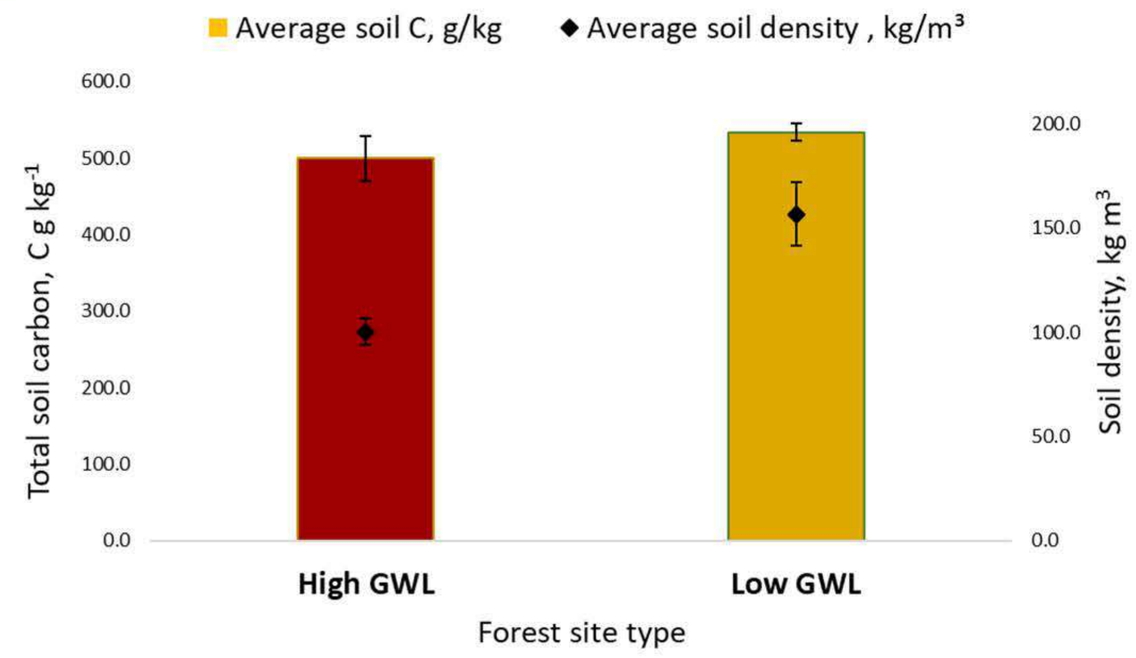
## Introduction

Forest trees and soils are the largest carbon pools in the forest ecosystems. Carbon storage capacity in forests is dependent on soil and site type, tree species composition, management practices and occurrence of natural disturbances. Therefore, forest management practices (especially drainage) are crucial to improve carbon storage in these pools and to mitigate climate change, thereby achieving the European Union's climate neutrality goals. Recent studies have focused on various aspects of forest carbon storage and greenhouse gas (GHG) emissions from mineral soils. However, information regarding the long-term effects of drainage on soil GHG fluxes from old-growth forests on organic soils is currently lacking.

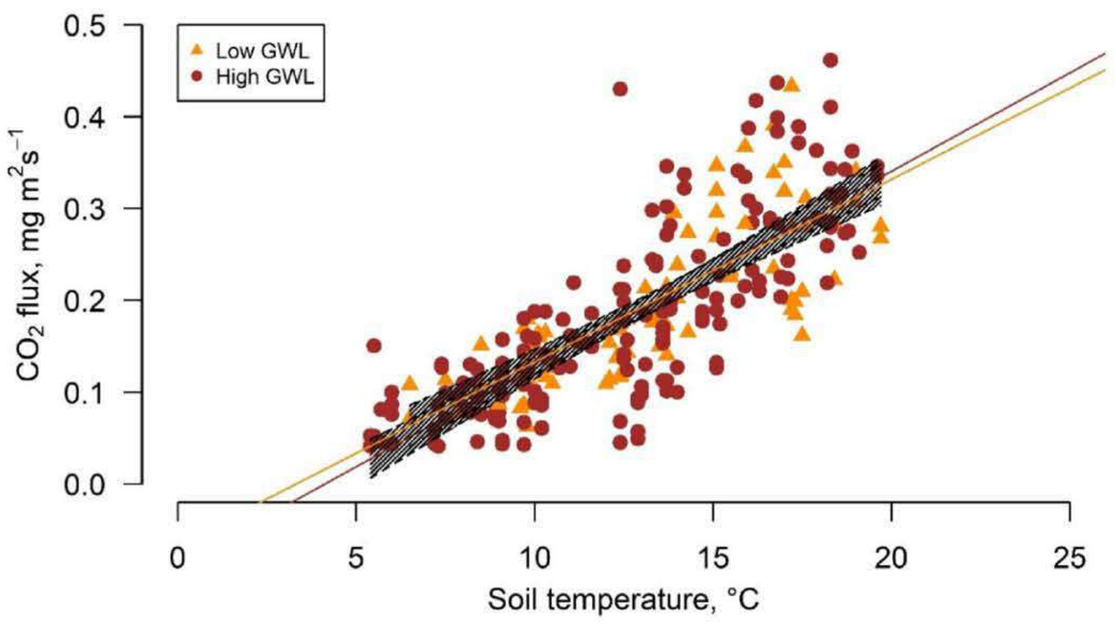
## Research Objective

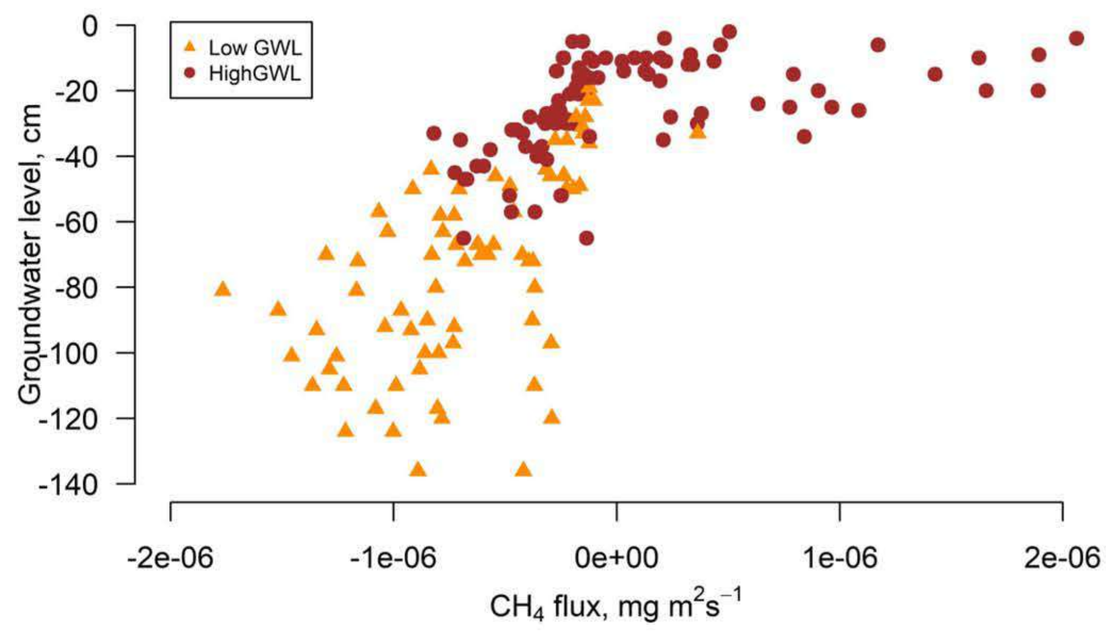
The aim of the study is to evaluate differences of soil carbon stock and the dynamics of carbon dioxide ($CO_2$) and methane ($CH_4$) fluxes in hemiboreal old-growth (130-180 years) Scots pine stands on organic soils with contrasting groundwater levels.

## Results & Discussion




Long-term effect of drainage resulted in slightly higher soil carbon stock in drained sites compared to not drained sites, 534 ± 11.4 C g $kg^{-1}$, and 499 ± 29.2 C g $kg^{-1}$, however differences were insignificant. Moreover, significant differences were observed in average soil density in drained and not drained sites, 156.6 ± 15.1 kg $m^3$ and 100 ± 6.4 kg $m^3$, respectively.




The season's average $CO_2$ flux in low and high GWL class sites were 0.18 ± 0.018 mg $m^2$ $s^{-1}$ (average ± 95% confidence interval) and 0.17 ± 0.015 mg $m^2$ $s^{-1}$, respectively. Furthermore, a close significant relationship was observed between the total $CO_2$ flux and soil temperature ($R^2$ = *0.60*). The annual (measurement season) average $CH_4$ flux in low GWL class was -6.1e-07 ± 9.43e-08 mg $m^2$ $s^{-1}$, but in high GWL class 1.67e-07 ± 1.5e-07 mg $m^2$ $s^{-1}$, and the difference was statistically significant ($p$ < *0.001*). The dynamics of $CH_4$ emissions are largely driven by groundwater fluctuations.

## Conclusions

- Soil is a relatively stable carbon pool with minor fluctuations. In the long term, the establishment of drainage systems in peat soils contributes to an increase in the amount of carbon.
- CO2 emissions are seasonal and closely related to soil temperature, however differences between drained and undrained sites are tiny.
- Drainage systems and their effects on groundwater levels can ensure CH4 uptake throughout the growing season, thus positively contributing to climate change mitigation (climate neutrality).

## Contact Information

Valters Samariks
valters.samariks@silava.lv

NATIONAL DEVELOPMENT PLAN 2020 | EUROPEAN UNION European Regional Development Fund
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European Regional Development Fund project "Development of a decision support tool integrating information from old-growth semi-natural forest for more comprehensive estimates of carbon balance" No. 1.1.1.1/19/A/130

SILAVA

World Congress of Latvian Scientists

# Agronomic Assessment of Flax Advanced Breeding Lines as Potential New Varieties

**Inga Morozova[1], Isaak Rashal[2], Veneranda Stramkale[1]**

[1]Institute of Agricultural Resources and Economics
[2]Institute of Biology, University of Latvia

## Introduction

Flax is a green resource for the planet and biodiversity. A European agroresources of exemplary sobriety, flax is eco-friendly, multipurpose crop and grown without waste, or GMOs and with very few input. The fibres are intended for textile, decoration and composite materials (bicycles, skateboards, surfboards, etc.). The seeds are used for resowing or for the production of oil, biosourced solvents and the shives, the woody part of the plant, are used in various field: energy, constructions, gardening, animal litter, plastic processing, etc.

Since 1992, researchers in Latvia, has actively engaged in research on flax fibre, oil and genetic resources, as well as repatriation, propagation, research, preservation and maintenance of a flax collection. The aim of the Latvian flax breeding study was creating most promising lines for fibre flax breeding in the sustainable agro-ecosystems.

## Research Objective

Currently, 18 promising fibre flax lines and standard variety 'Vilani' were evaluated for agronomically important traits. All studied genotypes were created by hybridisation with old varieties of the Latvian origin suitable for growing in the Latvian conditions which were repatriated from gene banks abroad (from Germany, Russia, Swedish).


**Figure 1. Some products from** biocomposite materials of flax

## Results & Discussion

More than 10 years are required to provide a genetically fixed variety and for its proper multiplication.

The 50% of flax lines have highest technical plant height in comparison with the standard variety 'ST Vilani'. (Fig. 2.). The flax line 'N1-1' showed highest technical plant height and stem yield during both years in comparison with the standard variety.

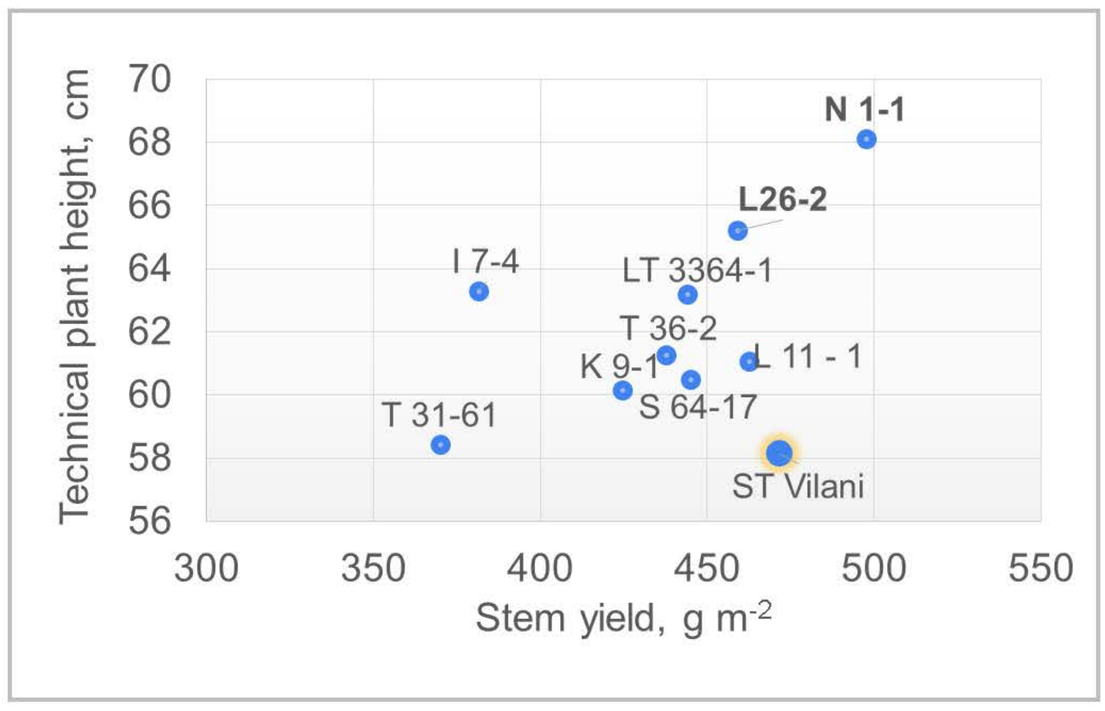



**Figure 2. Average tehnical plant height to stem yield of flax lines from 2021 to 2022**

## Conclusions

In Latvian climatic condition identified most perspective the flax lines 'N1-1', 'L26-1' with medium length vegetation period, highest of the stem yield and significant ($p \leq 0.05$) higher plant technical height in comparison with the standard variety 'ST Vilani' at field experiment from 2021 to 2022.

**Figure 3. Flax line 'N 1-1' in the field trails**

**Figure 4. Flax line 'L26-1' in the field trails**

## Contact Information

Zinātnes Str. 2, Priekuļi, Priekuļi parish, Cēsis municipality, Latvia, inga.morozova@arei.lv

Institute of Agricultural Resources and Economics

World Congress of Latvian Scientists

# Agronomic Assessment of Flax Advanced Breeding Lines as Potential New Varieties

**Inga Morozova[1], Isaak Rashal[2], Veneranda Stramkale[1]**

[1]Institute of Agricultural Resources and Economics
[2]Institute of Biology, University of Latvia

## Introduction

Flax is a green resource for the planet and biodiversity. A European agroresources of exemplary sobriety, flax is eco-friendly, multipurpose crop and grown without waste, or GMOs and with very few input. The fibres are intended for textile, decoration and composite materials (bicycles, skateboards, surfboards, etc.). The seeds are used for resowing or for the production of oil, biosourced solvents and the shives, the woody part of the plant, are used in various field: energy, constructions, gardening, animal litter, plastic processing, etc.

Since 1992, researchers in Latvia, has actively engaged in research on flax fibre, oil and genetic resources, as well as repatriation, propagation, research, preservation and maintenance of a flax collection. The aim of the Latvian flax breeding study was creating most promising lines for fibre flax breeding in the sustainable agro-ecosystems.

## Research Objective

Currently, 18 promising fibre flax lines and standard variety 'Vilani' were evaluated for agronomically important traits. All studied genotypes were created by hybridisation with old varieties of the Latvian origin suitable for growing in the Latvian conditions which were repatriated from gene banks abroad (from Germany, Russia, Swedish).


**Figure 1. Some products from** biocomposite materials of flax

## Results & Discussion

More than 10 years are required to provide a genetically fixed variety and for its proper multiplication.

The 50% of flax lines have highest technical plant height in comparison with the standard variety 'ST Vilani'. (Fig. 2.). The flax line 'N1-1' showed highest technical plant height and stem yield during both years in comparison with the standard variety.

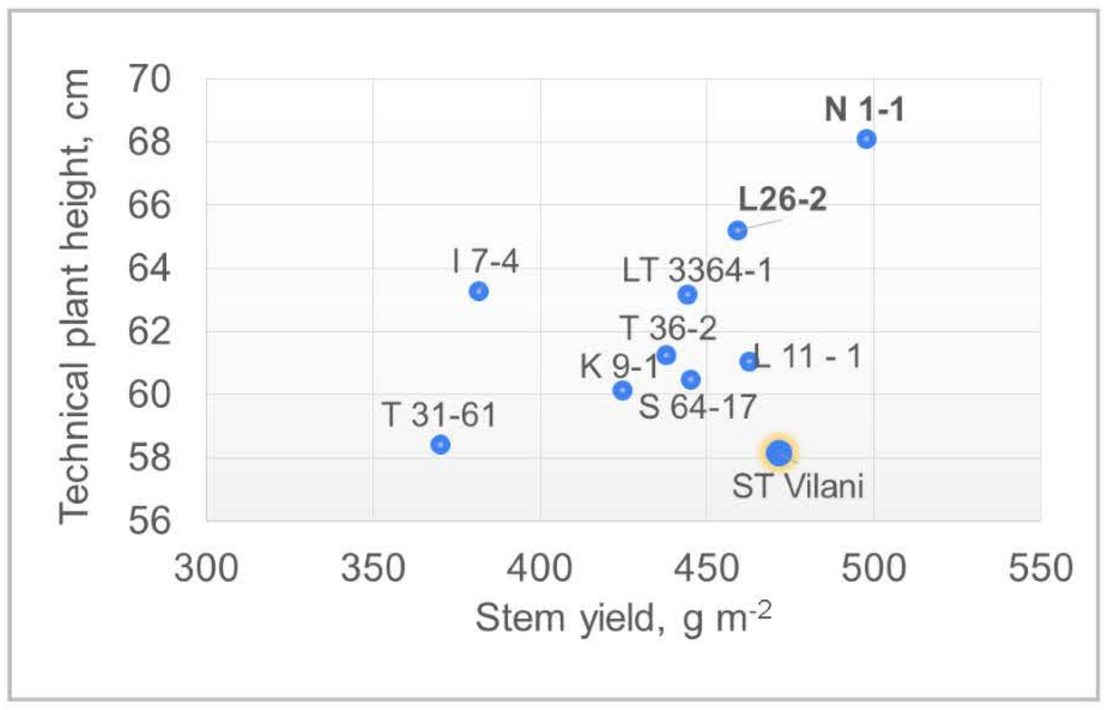



**Figure 2. Average tehnical plant height to stem yield of flax lines from 2021 to 2022**

## Conclusions

In Latvian climatic condition identified most perspective the flax lines 'N1-1', 'L26-1' with medium length vegetation period, highest of the stem yield and significant ($p \leq 0.05$) higher plant technical height in comparison with the standard variety 'ST Vilani' at field experiment from 2021 to 2022.

Figure 3. Flax line 'N 1-1' in the field trails

Figure 4. Flax line 'L26-1' in the field trails

## Contact Information

Zinātnes Str. 2, Priekuļi, Priekuļi parish, Cēsis municipality, Latvia, inga.morozova@arei.lv

Institute of Agricultural Resources and Economics

Pasaules latviešu zinātnieku kongress

**E. Kaufmane, S. Strautiņa, L. Ikase, G. Lācis, I.Grāvīte, D.Feldmane**

Dārzkopības institūts

# Latvijas augļaugu selekcijas jaunākie sasniegumi un izaicinājumi: no klasiskās krustošanas līdz biotehnoloģisko metožu pielietojumam

## Ievads

Augļaugu selekcija Latvijā veikta kopš 1950to gadu beigām. Radītas vairāk nekā 70 augļaugu šķirnes, t.sk. pirmās krūmcidoniju kā augļauga šķirnes ES un pasaulē. DI ir augļaugu selekcijas centrs Latvijā, tur izveidotās šķirnes reģistrētas arī Beļģijā, Zviedrijā, Lietuvā, Igaunijā; licences līgumi noslēgti ar vairāku Eiropas valstu kokaudzētavām. Latvijas VAAD reģistrā ir 40 Latvijā selekcionētas augļaugu šķirnes, iesniegtas reģistrācijai vēl 18. Līdz šim valsts finansiāli atbalstījusi ābeļu, krūmcidoniju, aveņu un upeņu selekciju. Ierobežotos apjomos strādāts arī aprikožu, plūmju, saldo ķiršu un bumbieru selekcijā.

**Ābele 'Lora'**

## Pētījuma mērķis

Iegūt un izdalīt Latvijas un Ziemeļeiropas apstākļiem piemērotas šķirnes, kurās apvienotas sekojošās īpašības:, augsta augļu kvalitāte, dažāds lietošanas laiks un veids, uzlabots bioķīmiskais sastāvs; augsts agroekoloģiskais plastiskums, labi un regulāri ražojošs, viegli kopjams koks vai krūms; noturīga kompleksa izturība pret nozīmīgajām slimībām un kaitēkļiem.

**Krūmcidonija 'Jānis'**

**Plūme 'Zane'**

## Rezultāti un diskusija

**Upene 'Karina'**

**Avene 'Alise'**

**Saldais ķirsis 'Ināra'**

Lai strauju klimata izmaiņu dēļ selekcionētu ekoloģiski plastiskas šķirnes ar augstu pielāgošanas spēju audzēšanas apstākļiem un rezistenci pret jauniem patogēniem vai esošo patogēnu populācijām, nepieciešamas precīzas zināšanas par attiecīgo pazīmju iedzimtību. Lai izprastu augu rezistences mehānismus, Dārzkopības institūtā veikta tādu pazīmju izpēte kā ābeļu izturība pret kraupi; bumbieru izturība pret bumbieru-kadiķu rūsu; upeņu izturība pret pumpurērcēm; aveņu RBDV vīrusu. Lai saīsinātu selekcijas procesu, kas augļaugiem aizņem 20-25 gadus, un uzlabotu tā efektivitāti, institūtā veiksmīgi tiek izmantoti molekulārie marķieri. Turpinās arī tradicionālā selekcija, veicot krustojumus un hibrīdu izvērtēšanu siltumnīcā un lauka apstākļos. Salcietības izvērtēšanai papildus tiek veikta saldēšana laboratorijas apstākļos. Ziedu bioloģijas izpēte tiek veikta ar mērķi noteikt pašauglību vai piemērotākos apputeksnētājus. Turpinās selekcija agronomisko īpašību un augļu kvalitātes uzlabošanai.

## Secinājumi

- Latvijā iespējams selekcionēt konkurētspējīgas augļu koku un ogulāju šķirnes, kuru galvenais audzēšanas areāls būs Ziemeļeiropa.
- Pielietojot modernās selekcijas metodes kā rezistences gēnu piramidēšana noturīgai slimībizturībai un homozigotu rezistences gēnu nesēju identifikācija, pielietojot molekulāros marķierus, iespējams būtiski saīsināt jaunu šķirņu izveides laiku un iegūt noturīgāku rezultātu.

**Aprikoze 'Boriss'**

## Kontaktinformācija

edite.kaufmane@lbtu.lv; www.darzkopibasinstituts.lv

*Augļu koku un ogulāju selekcija atbalstīta no Zemkopības ministrijas finansētas programmas*

DĀRZKOPĪBAS INSTITŪTS

World Congress of Latvian Scientists

# Climate change mitigation potential of agroforestry systems in agricultural land with mineral and organic soils in Latvia

Andis Bārdulis, Dana Purviņa, Aldis Butlers, Arta Bārdule,
Sandra Šalkovska, Kristaps Makovskis, Andis Lazdiņš, Dagnija Lazdiņa

Latvian State Forest Research Institute "Silava"

## Introduction

« Tree introduction in agricultural land by establishing agroforestry systems can significantly contribute to the reduction of greenhouse gas (GHG) emissions and increase of carbon dioxide ($CO_2$) removals. An increasing number of studies provides description of environmental, climate change mitigation, and economic benefits of agroforestry systems – an ancient type of land management implemented historically also in the Baltic Sea region (e.g. shelterbelts, windbreaks, hedges, wood pasture). Nevertheless, in Latvia there is a lack of definitions of agroforestry systems in national legislation, a lack of information for land owners and policy makers as well as general support systems.

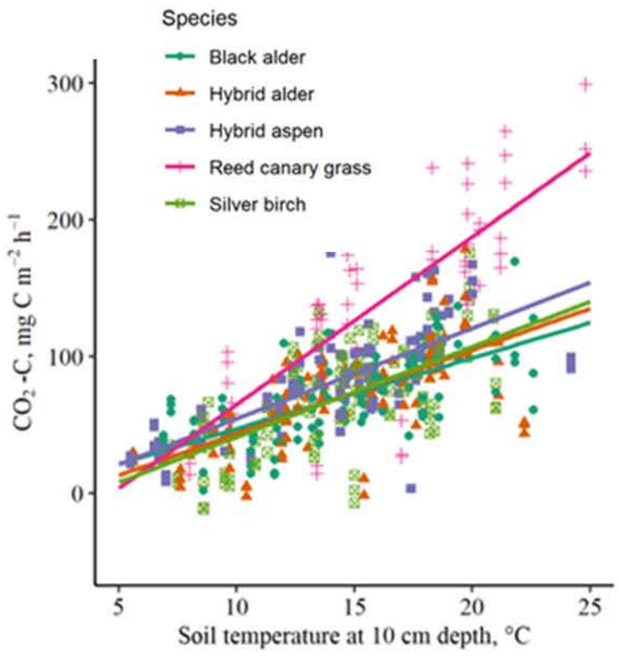
The general aim of this study was to contribute to the implementation of national and European Union GHG reduction targets by improving the ability to evaluate the climate change mitigation potential of agroforestry systems established in cropland and grassland.

## Research Objective

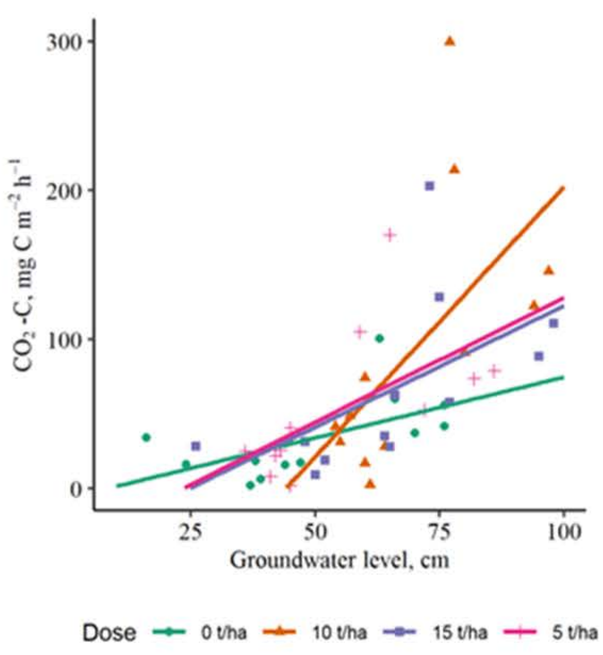
« The main objectives of the study are to elaborate:

- Parametric models for accounting of GHG emissions and $CO_2$ removals in selected agroforestry systems (agrisilvicultural systems) established in agricultural areas with mineral and organic soils;
- Updated growth & yield model for calculation of carbon stock changes in living biomass;
- Updated EPIM tool for National GHG inventory for calculation of GHG fluxes and carbon stock changes in agroforestry systems;
- Tool for system analysis of productivity, cost and GHG footprint of mechanized management of different agroforestry systems;
- Recommendations for climate change mitigation targeted management of agroforestry systems.

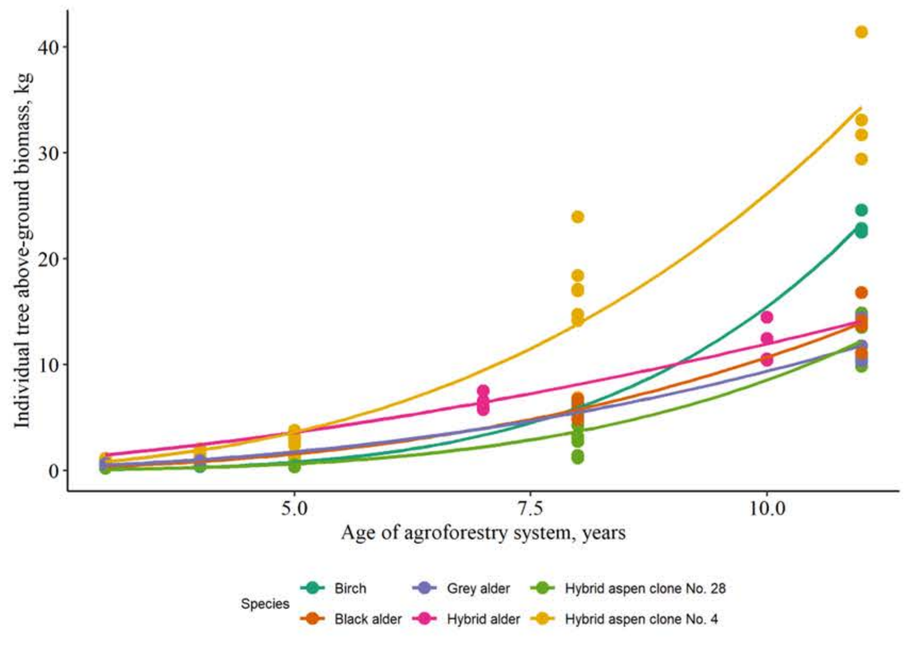
## Results & Discussion




« Soil-to-atmosphere $CO_2$ fluxes (sum of heterotrophic and autotrophic respiration) depending on soil temperature in deciduous tree based agroforestry systems with mineral soil.




« Soil-to-atmosphere $CO_2$ fluxes (sum of heterotrophic and autotrophic respiration) depending on groundwater level and dose of wood ash fertilizer in juvenile Scots pine based agroforestry systems with organic soil.




« Comparison of growth of different tree species (dry above-ground biomass of individual trees) in agroforestry systems with mineral soil (agricultural land).


- Bārdulis A., Ivanovs J., Bārdule A., Lazdiņa D., Purviņa D., Butlers A., Lazdiņš A. 2022. Assessment of agricultural areas suitable for agroforestry in Latvia. Land, 11(10), 1873; https://doi.org/10.3390/land11101873
- Bardulis A., Purviņa D., Makovskis K., Bardule A., Lazdiņa D. 2023. Soil-to-atmosphere GHG fluxes in hemiboreal deciduous tree and willow coppice based agroforestry systems with mineral soil. Land, 12, 715; https://doi.org/10.3390/land12030715
- Bardulis A., Purvina D., Bardule A., Lazdins A. 2023. Potential role of tree introduction in agricultural land to reduce greenhouse gas emissions. In: Proceedings of the 22nd International Scientific Conference "Engineering for Rural Development", Jelgava, Latvia, 24-26 May 2023. Jelgava: LULST, p. 196-203; https://doi.org/10.22616/ERDev.2023.22.TF038


## Conclusions

« Establishment of agroforestry systems (tree introduction in agricultural land) can contribute significantly to reaching climate change mitigation aims set for Latvia (specificallyf or the Land Use, Land-Use Change and Forestry sector).

« The total area of low-value agricultural land parcels in Latvia where agroforestry could provide a solution for more effective land management was estimated to be 351.5 kha (including 306.6 kha of area without sub-surface drainage systems) with total potential to sequester 966.6 kt C $yr^{-1}$.

## Contact Information

Andis Bārdulis, Dagnija Lazdiņa
Latvian State Forest Research Institute "Silava"
andis.bardulis@silava.lv, dagnija.lazdina@silava.lv

This study was funded by the ERDF's post-doctoral research project 'Evaluation of climate change mitigation potential of agroforestry systems with mineral and organic soils' [*Klimatu izmaiņu mazināšanas potenciāla izpēte agro-mežsaimniecības sistēmās ar organiskām augsnēm un minerālaugsnēm*] (No. 1.1.1.2/VIAA/4/20/684).

SILAVA

PostDoc Latvia

NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020

EIROPAS SAVIENĪBA
Eiropas Reģionālās attīstības fonds

IEGULDĪJUMS TAVĀ NĀKOTNĒ

Pasaules latviešu zinātnieku kongress

# Jauni risinājumi Eiropas zaļā kursa ietvaros Latvijas augšņu klasifikācijā un kartēšanā

O. Nikodemus, A. Kārkliņš, I. Kukuļs, R. Kasparinskis, I. Vinogradovs, A. Avotiņš, B. Dirnēna, K. Afanasjeva, A. Anufrijevs

**Latvijas Universitāte, Latvijas Biozinātņu un Tehnoloģiju universitāte**

## Ievads

Klimata pārmaiņu mazināšanai un vienlaicīgi pārtikas produktu ražošanas kāpināšanai nepieciešama kvalitatīva un starptautiski harmonizēta augsnes informācija. Līdz šim Latvijā pielietotās augšņu izpētes metodes, rezultātu interpretācija, augšņu grupēšana un augsnes informācijas uzkrāšana neatbilst standartiem, kādus mūsdienās lieto Eiropas Savienībā un ārpus tās lauksaimniecības resursu, ražošanas potenciāla un efektivitātes, kā arī vides risku novērtēšanai. Tas nozīmē, ka līdzšinējā informācija par Latvijas LIZ augsnēm ir novecojusi ne tikai metodikas neatbilstības dēļ, bet arī tāpēc, ka daudzas augsnes īpašības ir būtiski mainījušās.

## Pētījuma mērķis

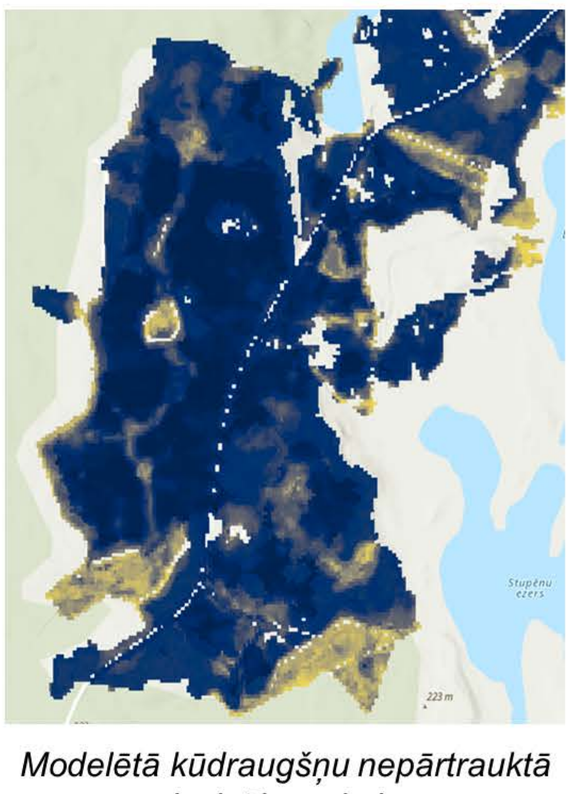
Projekta "Ilgtspējīgas augsnes resursu pārvaldības uzlabošana lauksaimniecībā" (E2SOILAGRI) ietvaros ir paredzēts izveidot un praksē aprobēt atjaunotu Latvijas augšņu inventarizācijas un klasifikācijas sistēmu, kas nodrošinātu sasaisti starp vēsturisko informācijas kopumu un pašreiz starptautiski lietoto Pasaules augšņu klasifikācijas sistēmu (WRB 2022), kā arī dotu iespēju inventarizēt tā saukto organisko augšņu izplatību, kas nepieciešama SEG (siltumnīcu efektu veicinošo gāzu) emisiju aprēķināšanai no lauksaimniecībā izmantojamām.

### Informācijas ieguves, interpretācijas shēma

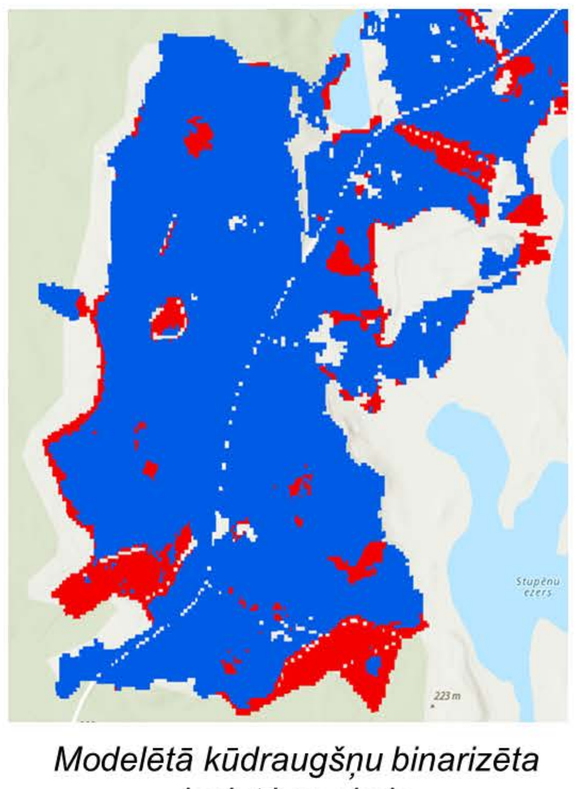

## Rezultāti un diskusija

**1. sniedz objektīvu informāciju par augsni;**
**2. nodrošina nacionālās uz starptautiskās vajadzības;**
**3. harmoniski apvieno iepriekš uzkrāto informāciju ar jauniegūto.**

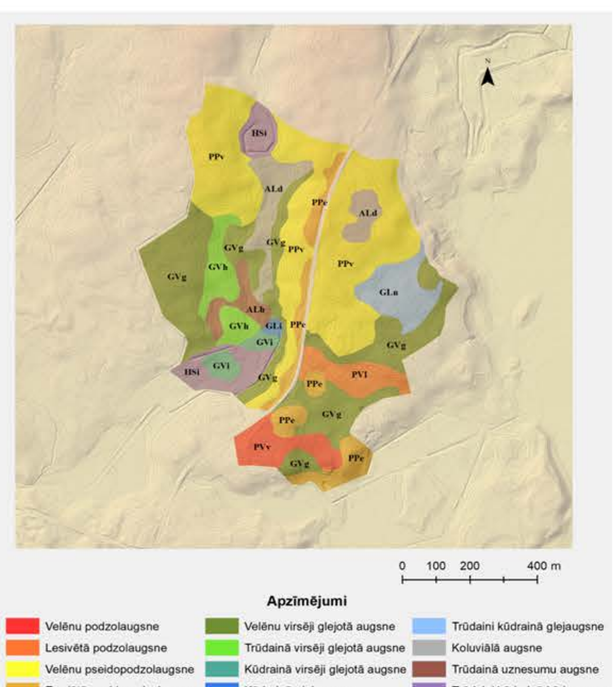
Karšu precizitātes uzlabošanai, tika izmantota digitālā augsnes kartēšana, kas balstīta uz tālizpētes datiem, izmantojot ekoģeogrāfisko mainīgo kopu statistisko analīzi un mašīnmācīšanos. Ekoģeogrāfisko mainīgo izveidē tika izmantoti spektrālie Sentinel-2 dati un to indeksi (NDVI, NDWI, EVI, SAVI u.c.) Sentinel-1 SAR dati un LIDAR datu produkti.



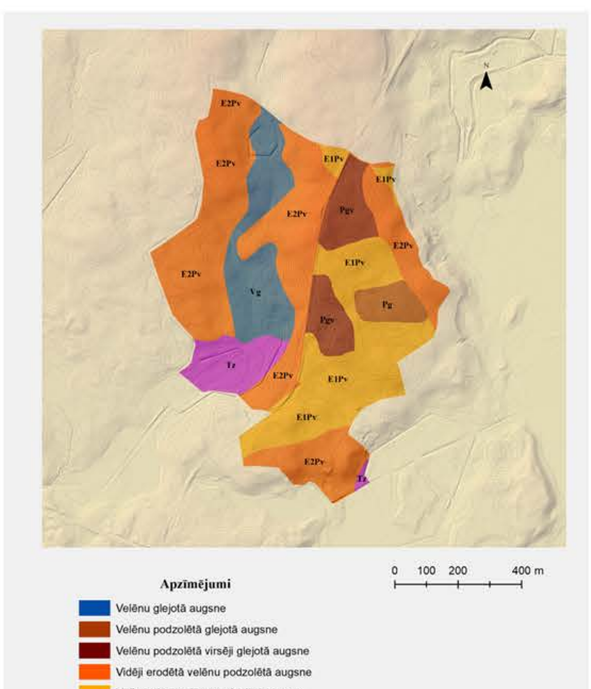
*Modelētā kūdraugšņu nepārtrauktā izplatības skala*



*Modelētā kūdraugšņu binarizēta izplatības skala*




*Jaunā sastādītā augsnes karte*




*Vēsturiskā augšņu karte*

Izmantojot jauno Latvijas augsnes klasifikāciju un kartēšanas metodoloģiskos risinājumus mēs iegūstam precīzāku informāciju par augsnes taksonu telpisko izplatību, to īpašībām, augsnes degradāciju, kuru ir iespējams izmantot zemes izmantošanas politikas izstrādāšanā, lauksaimniecības zemju apsaimniekošanā un starptautiskā datu apmaiņā. Attēlos augsnes kartes fragmenti no Vidzemes augstienes.

## Secinājumi

Projekta rezultāti dod iespēju veikt Latvijas lauksaimniecības zemju augšņu kartēšanu, kas nodrošinātu starptautiskās un valsts institūcijas ar kvalitatīvu informāciju par Latvijas augsnēm un to lomu SEG emitēšanā, kā arī nodrošinās zemes apsaimniekotājus ar aktualizētu informāciju, kas nepieciešama zemes ilgtspējīgai apsaimniekošanai.

## Kontaktinformācija

**Oļģerts Nikodemus**
E-pasts: olgerts.nikodemus@lu.lv

LATVIJAS UNIVERSITĀTE
Latvijas Biozinātnu un tehnoloģiju universitāte
Norway grants

World Congress of Latvian Scientists

# 3D Printed Foamed Geopolymer for Building Technology Applications

**Liga Radina, Andina Sprince, Leonids Pakrastins, Rihards Gailitis, Gita Sakale**

Riga Technical University
Faculty of Civil Engineering
Institute of Structural Engineering

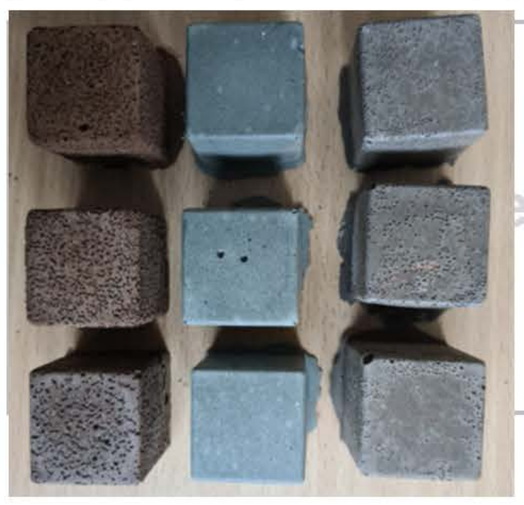
ES RTD/2022/8ES

## Introduction

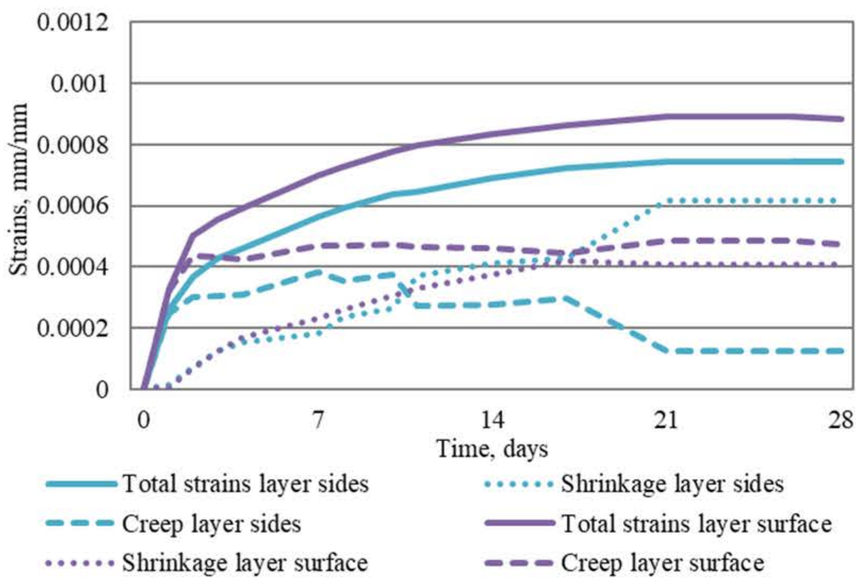
Additive manufacturing is a rapidly developing industrial sector and potentially disruptive technology. It can provide new horizons in the construction sector, especially in terms of geometrical flexibility, reduction of labor costs, improvement of efficiency and safety, construction in harsh environments, and sustainability. This research is an answer to new challenges such as resource-saving and energy efficiency, and sustainability compared to subtractive technologies. The main challenge is designing zero-waste technology for 3D printing and using waste products, such as clay bricks, aerated concrete, etc., as raw materials. The research is focused on developing foamed ceramic materials for additive manufacturing – 3D printing technology, especially geopolymer and hybrid geopolymer composites with customized properties for additive manufacturing used as insolation. The expected result of the project is to design a new class of materials with high thermal properties and, at the same time, non-inflammable materials (heat-resistant materials and thermal barriers).

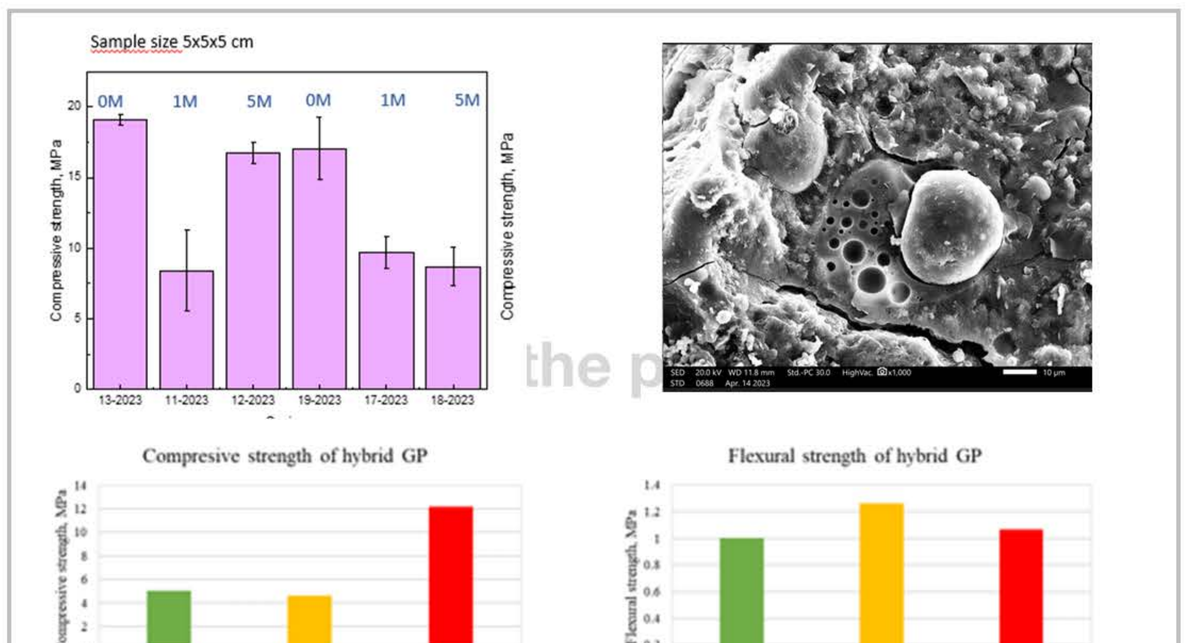
## Research Objective

The main objective is the development of foamed ceramic materials for additive manufacturing – 3D printing technology. It will focus on GPs, HGPs composites dedicated to the building and construction material industry, and other special applications, especially as an insulator.



## Results & Discussion




As part of the research, cement composites and geopolymers were developed, the production of which used various waste products such as clay bricks, fly ash, burnt oil shale ash, autoclaved aerated concrete, etc. The samples were tested in long-term compression, tension and three-point bending, determining creep deformations, as well as parallel determined drying shrinkage deformations, compressive strength, water absorption, XRD, XRF, SEM tests of the samples, optimal curing conditions and alkali molarity, were performed. Please see publications for detailed information on other experimental tests and their results (Scopus ID: 55359789500; 57211205458).

## Conclusions

- Printed specimens that have had load applied in the same way as the layers are shown to show 28.3% fewer creep strains.
- Printed specimens are more prone to creep, as printed specimens' specific creep value is 32.8% higher on average than cast specimens.
- Increasing alkali solution molarity increases compressive strength values but, at the same time, decreases the setting time of mixed.
- The successful use of construction and demolition waste in geopolymer and cement composites was experimentally confirmed, reaching a high strength of up to 80 MPa.
- The use of clay brick waste together with ground granulated blast furnace slag allows the use of ambient curing temperature, obtaining samples with sufficiently high strength but a longer setting time.
- Shrinkage strains are the same for printed and cast specimens.

## Contact Information

Researcher M.sc.ing. **Liga Radina**
liga.radina@rtu.lv

World Congress of Latvian Scientists

Andrejs Krasnikovs

S.Upnere, A.Mačanovskis, K.R.Kannathasan, O.Kononova,
U. H. Vavaliya *Riga Technical University, Latvia*
I.Nováková, E. Gjerløw *Arctic University of Norway, Norway*
R.Mõtlep, V.Gulik *University of Tartu, Estonia*
M.Vaisnoras, A.Kaliatka, J.Česnienė *Lithuanian Energy Institute, Lithuania*

# New "Baltic green" fiberconcrete as a solution for radiation shielding and hazardous waste management

B10

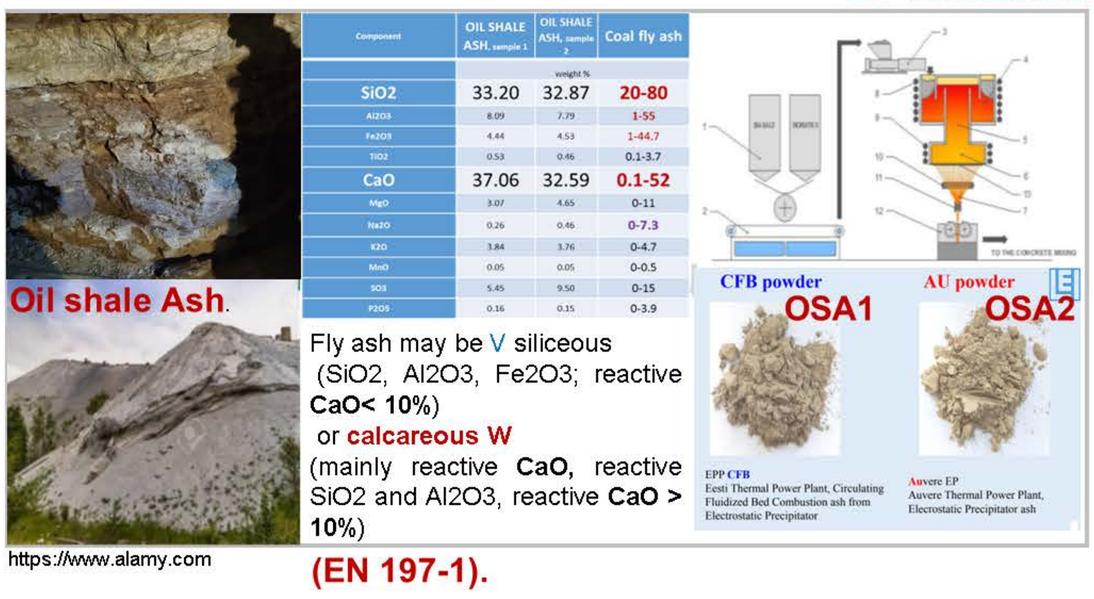
## Introduction

Long time Estonian oil shale burning for obtaining energy, generated millions tons of ashes collected at landfills. How effective **OIL SHALE ASH** (OSA) is possible to use as the admixture, partially **replacing cement** in the concrete and fiberconcrete? Chemical, granulometric and mechanical properties investigation are realizing by team from ***Latvia, Estonia, Lithuania and Norway***. Was obtained, replacing cement by OSA (1%-5%) concrete strength is increasing then till 35% strength properties are stable or slightly decreasing. Schwenk Eco-cement was used. At the same time rapidly decrease concrete workability. Obtained concretes were used in combination with short basalt and **BASALT-BORON fibers** creating specialized fiberconcretes aimed to isolate hazardous waste in the Baltic and Nordic countries, including ***radioactive waste*** (directly related to demountable nuclear power stations and radioactive waste coming from medical equipment) to toxic substances from industry. In the framework of realized experimental program hundreds of samples were fabricated and tested. Created numerical models covered fracture process simulation in such composites as well as radioactive radiation shielding process by novel materials.

## Research Objective

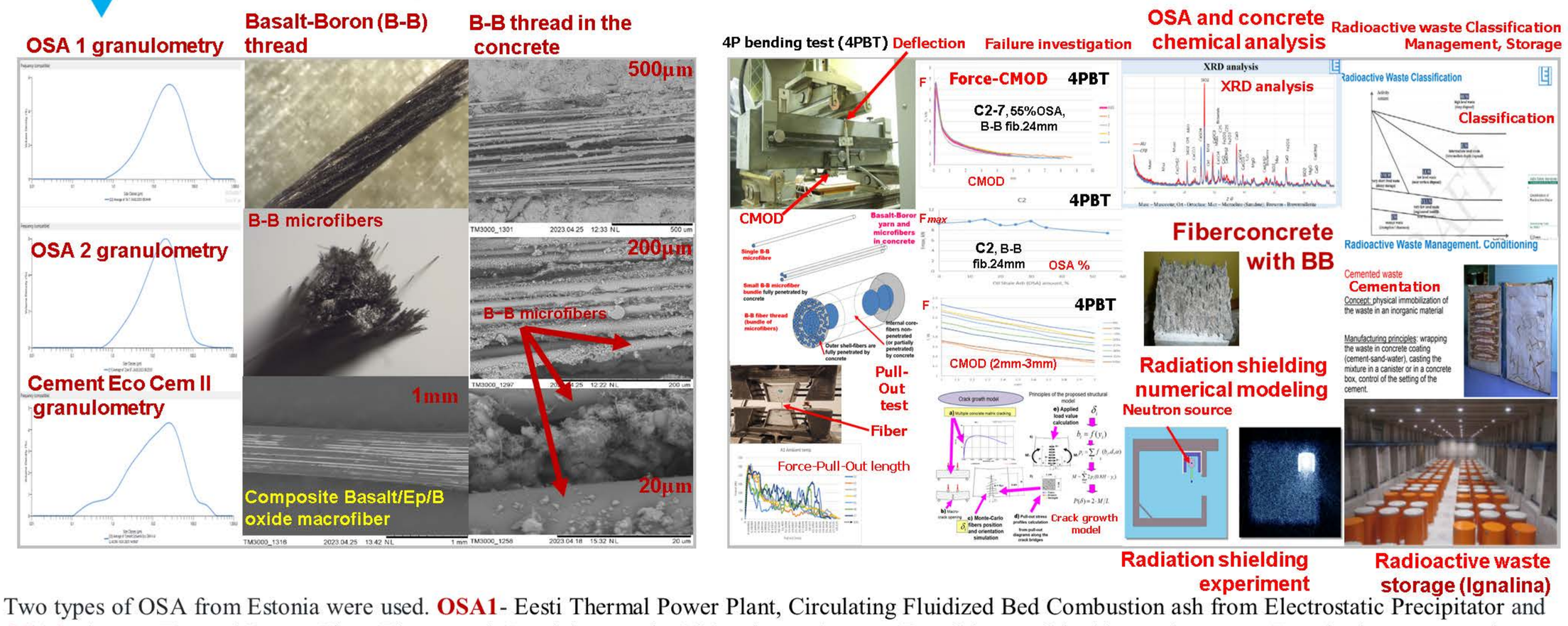
- Promoting the circular economy, to use **oil shale ash** (OSA) - an industrial waste product generated in energy production in Estonia as an additive to cement in **«Baltic green»** concrete production.
- Improving the mechanical properties of concrete to use **short fibers.**
- Increasing the ability of fiberconcrete to shield neutrons to use short Basalt – Boron (**BB**) and composite fibers (with **boron oxide**).
- To justify that fiberconcrete with BB fibers protects against **radioactive radiation**.

**BB fabrication**.




(EN 197-1).

## Results & Discussion




Two types of OSA from Estonia were used. **OSA1**- Eesti Thermal Power Plant, Circulating Fluidized Bed Combustion ash from Electrostatic Precipitator and **OSA2**- Auvere Thermal Power Plant, Electrostatic Precipitator ash. OSA mine at Auvere (Estonia) was visited by project team. Four basic concrete mixes - low, middle, middle and high strength concretes were elaborated. In every mix cement was replaced by OSA1 and OSA2 in concentrations **0%, 10%, 15%, 20%, 25%, 30%, 35%, 55%.** Short Basalt-Boron 6mm and 24mm long as well as composite 24mm long fibers were added in three concentrations. **Non – commercial fibers** were produced in Ukraine and delivered to Riga. More than **1400 samples** were fabricated and tested. Samples were tested after maturing 28 and 90 days. Mixes rheology was measured using Abrams cone. Compressive and bending (FPBT) strength of fiberconcretes were experimentally obtained. Chemical analysis of fabricated fiberconcretes was done using SEM, EDS, EDX, XRD, XRD-Rietveld refinement analysis, TG analysis. fibers Boundary fiber-matrix was investigated. Leaching tests were performed. Neutron shielding modeling was done using software based on Monte-Carlo approach. Detailed radioactive waste analysis was done. Project participants visited Ignalina NPP in Lithuania. Neutron shielding experiments will be performed and recommendations will be elaborated.

## Conclusions

- **New innovative «Baltic green» fiberconcrete is fabricated. The use of basalt-boron fibers and composite basalt-epoxy-boron oxide acid fibers is increasing material's ability to shield neutron radiation.**
- **The addition of oil shale ash increases the density of the concrete, forming the barrier for migration and leaching of hazardous materials (incl. radioactive waste).**

## Contact Information

**A. Krasnikovs** *Dr.sc., Professor, Riga Technical University, Academician, Latvian Academy of Sciences.* ***Andrejs.Krasnikovs@rtu.lv***

Acknowledgment

The work is carried out within the project Innovation in concrete design for hazardous waste management applications (ICONDE), EEA-RESEARCH-165, financially supported by the European Economic Area (EEA) Grants of Iceland, Liechtenstein and Norway.

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Andrejs Krasnikovs

S.Upnere, A.Mačanovskis, K.R.Kannathasan, O.Kononova,
U. H. Vavaliya *Riga Technical University, Latvia*
I.Nováková, E. Gjerløw *Arctic University of Norway, Norway*
R.Mõtlep, V.Gulik *University of Tartu, Estonia*
M.Vaisnoras, A.Kaliatka, J.Česnienė *Lithuanian Energy Institute, Lithuania*

# New "Baltic green" fiberconcrete as a solution for radiation shielding and hazardous waste management

B10

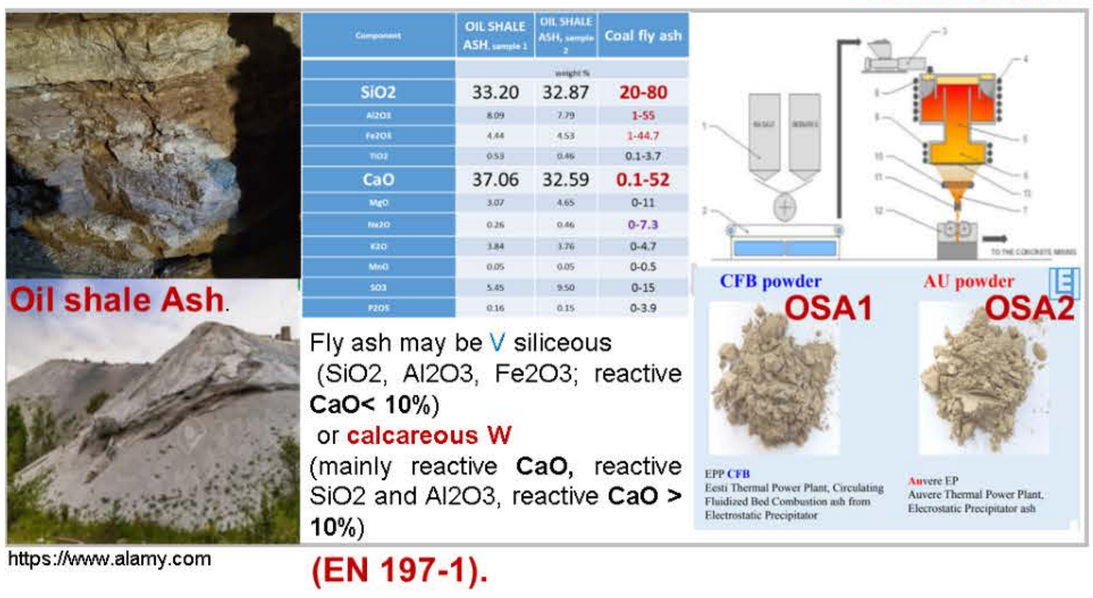
## Introduction

Long time Estonian oil shale burning for obtaining energy, generated millions tons of ashes collected at landfills. How effective **OIL SHALE ASH** (OSA) is possible to use as the admixture, partially **replacing cement** in the concrete and fiberconcrete? Chemical, granulometric and mechanical properties investigation are realizing by team from ***Latvia, Estonia, Lithuania and Norway***. Was obtained, replacing cement by OSA (1%-5%) concrete strength is increasing then till 35% strength properties are stable or slightly decreasing. Schwenk Eco-cement was used. At the same time rapidly decrease concrete workability. Obtained concretes were used in combination with short basalt and **BASALT-BORON fibers** creating specialized fiberconcretes aimed to isolate hazardous waste in the Baltic and Nordic countries, including ***radioactive waste*** (directly related to demountable nuclear power stations and radioactive waste coming from medical equipment) to toxic substances from industry. In the framework of realized experimental program hundreds of samples were fabricated and tested. Created numerical models covered fracture process simulation in such composites as well as radioactive radiation shielding process by novel materials.

## Research Objective

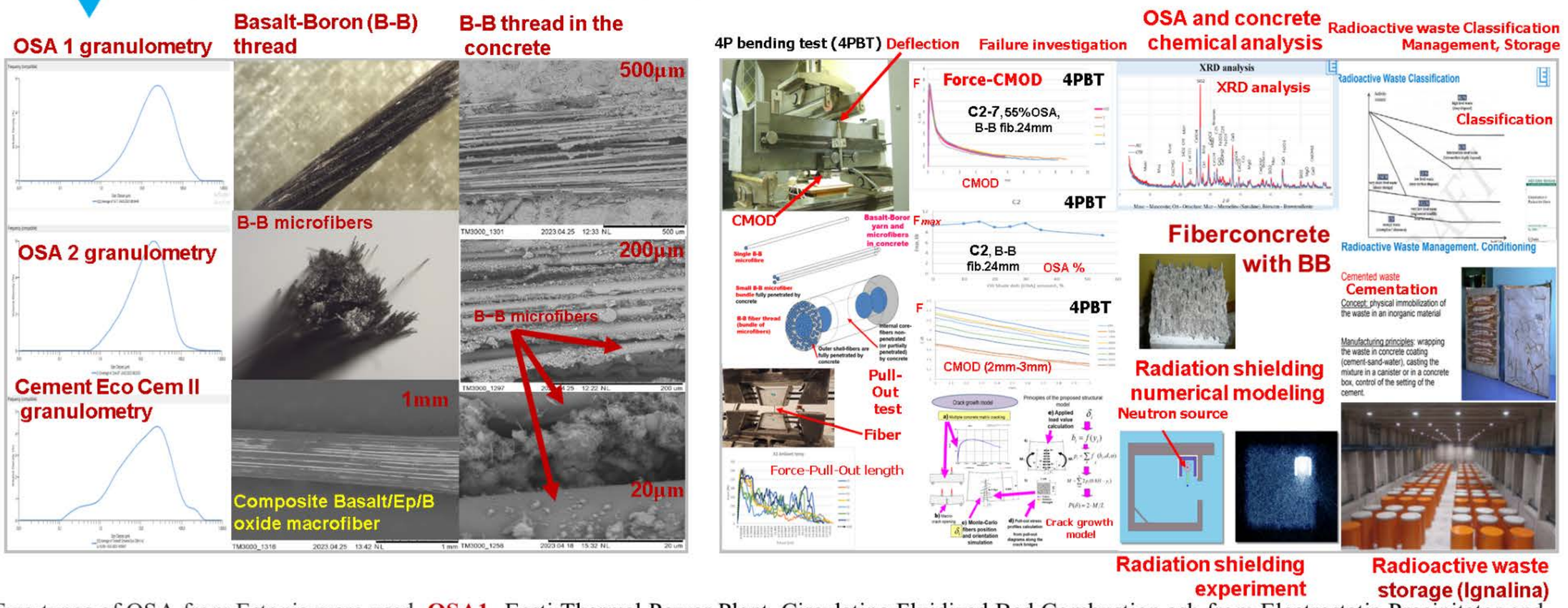
- Promoting the circular economy, to use **oil shale ash** (OSA) - an industrial waste product generated in energy production in Estonia as an additive to cement in **«Baltic green»** concrete production.
- Improving the mechanical properties of concrete to use **short fibers.**
- Increasing the ability of fiberconcrete to shield neutrons to use short Basalt – Boron (**BB**) and composite fibers (with **boron oxide**).
- To justify that fiberconcrete with BB fibers protects against **radioactive radiation**.

**BB fabrication**.




(EN 197-1).

## Results & Discussion

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## Conclusions

- **New innovative «Baltic green» fiberconcrete is fabricated. The use of basalt-boron fibers and composite basalt-epoxy-boron oxide acid fibers is increasing material's ability to shield neutron radiation.**
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Pasaules latviešu zinātnieku kongress

# Viedās tehnoloģijas dārzkopībā

**Līga Lepse, Edgars Rubauskis**

Dārzkopības institūts

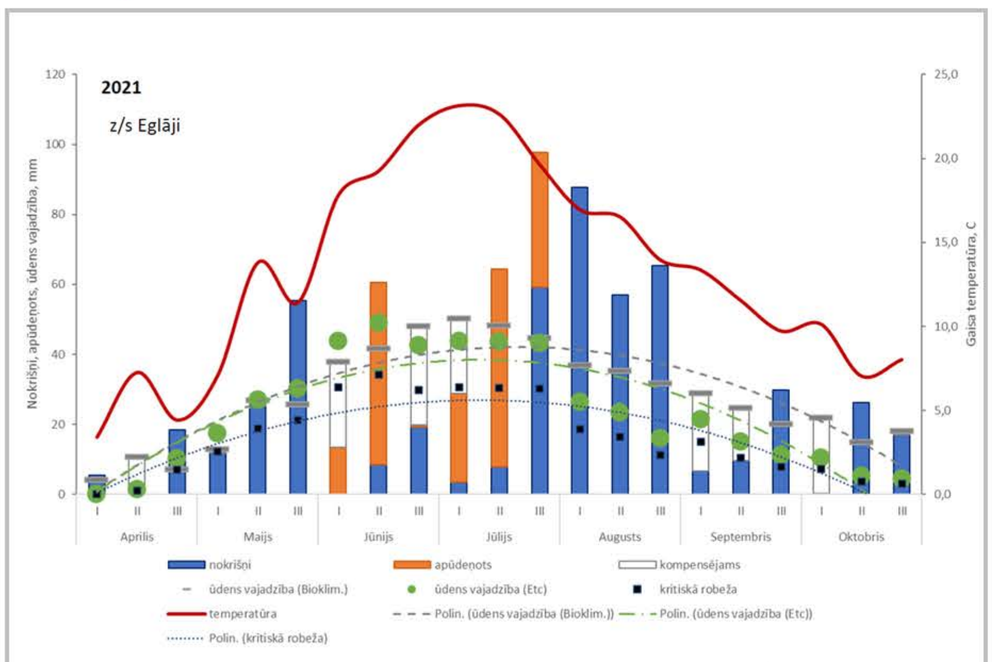
## Ievads

Viedās tehnoloģijas un digitālie risinājumi ieņem arvien nozīmīgāku vietu modernajā dārzkopībā. Tā kā dārzkopība ir resursu ietilpīga nozare, viedo rīku un tehnoloģiju lietošana nozīmīgi palielina tās rentabilitāti. Izmantojot datos balstītu informāciju, tiek mazināta augu aizsardzības līdzekļu un augu mēslojuma lietojuma negatīvā ietekme uz vidi. Meteoroloģisko datu un sensoru sniegtās iespējas aizvien biežāk izmanto lēmuma atbalstu sistēmās, sasniedzot mērķtiecīgākus rezultātus kaitīgo organismu ierobežošanā. Arī ātra un precīza meteoroloģisko datu apstrāde un interpretācija, lietotājam draudzīgā formā un savietojumā ar attiecīgām ierīcēm, nodrošina iespēju veikt efektīvāku aizsardzību pret salnām vai krusu. Datos balstīta informācija sniedz objektīvu priekšstatu arī par apūdeņošanas vajadzību.

## Pētījuma mērķis

Lai ieviestu digitālos rīkus praktiskajā dārzkopībā un pielāgotu to iespējas Latvijas agrotehnoloģiskajiem apstākļiem, Dārzkopības institūtā sadarbībā ar vairākām zemnieku saimniecībām tiek īstenoti divi «Horizon 2020» finansēti projekti - Smart agriculture for innovative vegetable crop protection (SMARTPROTECT) un Agricultural Interoperability and Analysis System (ATLAS).

## Rezultāti un diskusija




Dārza apūdeņošanas nepieciešamības aprēķins, balstoties uz reālo meteoroloģisko datu analīzi

Viedais slazds kāpostu laukā un algoritma apstrādāts slazda attēls, atpazīstot kāpostu cekulkodes (*Plutella xylostella)* imago

Viedie kaitīgo kukaiņu slazdi, kas ir viens no šobrīd efektīvākajiem un salīdzinoši vieglāk ieviešamajiem risinājumiem, sniedz ātru un precīzu informāciju par nepieciešamību veikt augu aizsardzības līdzekļu smidzinājumu, kas nozīmīgi samazina augu aizsardzības līdzekļu lietojumu un palielina to efektivitāti, tādējādi mazinot kaitīgo ietekmi uz vidi un patērētājiem, kā arī mazinot audzēšanas izmaksas.
Automātiskajās meteostacijās iegūtos datos un piemērotos modeļos balstīta informācija sniedz objektīvu priekšstatu arī par apūdeņošanas vajadzību dārzaugu stādījumos. Pamatota un laikus veikta apūdeņošana nodrošina augstu ražības potenciālu, veicinot resursu t.sk. ūdens efektīvu un lietderīgu izmantošanu.

## Secinājumi

Projektu rezultātā ieviesti un demonstrēti vairāki viedie risinājumi praktiskajā dārzkopībā, kā arī sadarbībā ar konsorcija partneriem strādāts pie algoritmu precizēšanas, platformu izveides, kas nodrošinātu atsevišķu sistēmu, rīku, prognozēšanas ierīču savietojamību un darbību.

Burkānu mušas (*Psilla rosae*) slazds, algoritma izstrādes etaps SMARTPROTECT projekta ietvaros

## Kontaktinformācija

Līga Lepse: liga.lepse@llu.lv; Edgars Rubauskis: edgars.rubauskis@llu.lv

World Congress of Latvian Scientists

# Wood coatings for healthcare facilities

**Dace Cīrule [1], Errj Sansonetti [1], Bruno Andersons [1], Māris Valdmanis [2]**

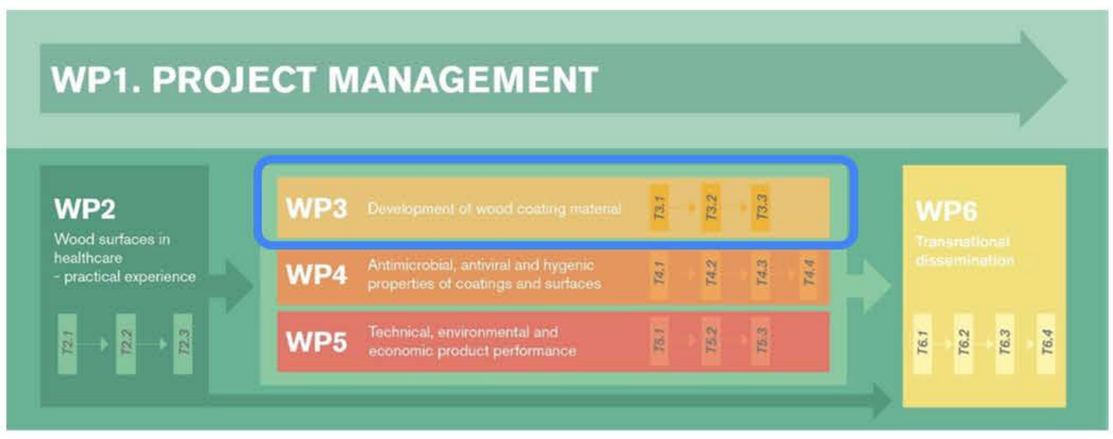
[1]Latvian State Institute of Wood Chemistry, [2]Ltd "Iecavnieks & Co"

## Introduction

More intensive use of wood as a substitute for non-renewable resources and materials can support society on its way to a climate-neutral economy. A number of studies examining various interior materials have demonstrated that wood has a positive effect on the indoor environment by mitigating humidity fluctuations and promoting people's well-being through pleasant visual and tactile impressions. The present study is a part of the WOODforHEALTH project carried out by an international consortium within the framework of Horizon 2020 under ERA-NET Cofound ForestValue joint call. The study is focused on promoting safe and expanded use of wood products in healthcare facilities by designing wood coating formulations with high antimicrobial performance to meet the hygiene requirements.

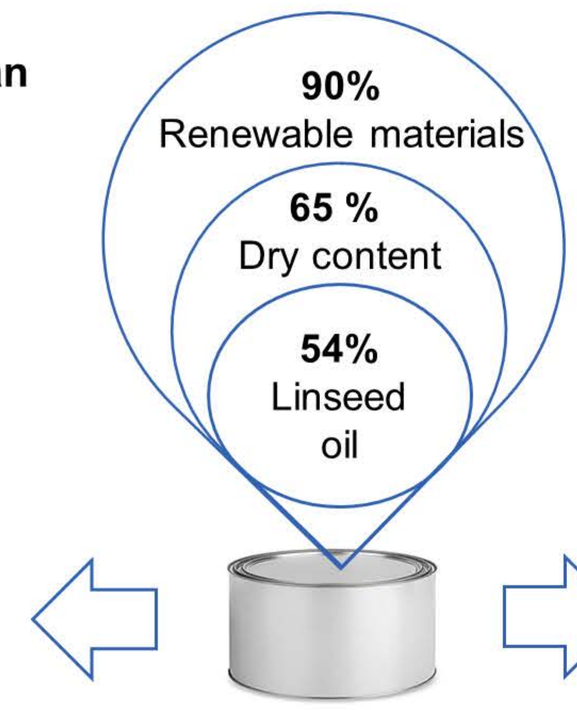
## Research Objective

The aim of the study is to develop non-film-forming wood coatings that are based on linseed oil with targeted additives and meet the safe-by-design principle. The coatings should provide the wood primarily with a high anti-microbial effect, but also give the surface aesthetic stability and protect it from photo-discoloration. The adjustment of the coatings to the requirements of industrial production and industrial application is ensured by close cooperation with an industrial partner "Iecavnieks & Co".



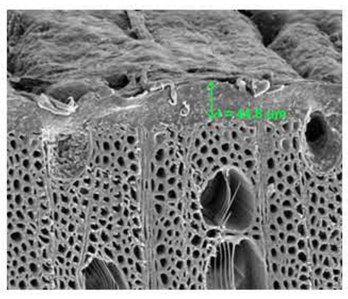

## Results & Discussion

**Stable in can emulsion**




**Fast drying**

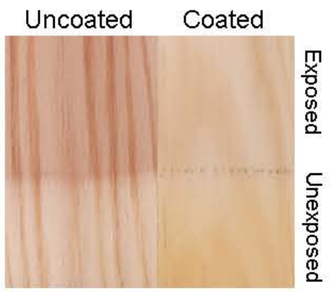

**Non-film forming coating**



**Color stability**

Exposure to LED

**Maintained texture, hydrophobic surface**




The base formulation developed is a water-in-oil emulsion based on thermally pre-treated linseed oil, which provides the wood surface with high hydrophobicity while maintaining its natural appearance. The formulation consists of 90% renewable raw materials with a dry content of 65.4%. The viscosity is tailored to the requirements of industrial application for non-film forming (thickness up to 50 µm) coatings. The composition of the drying agents is adjusted to ensure touch-dry surface in up to 24 hours after application of the coating. The functional additives for meeting standards of anti-microbial activity and photo-stability are tested to select the optimal composition.

## Conclusions

The coating base formulation developed in the first phase of the study meets the performance requirements set for the composition that will serve as a basis for supplementation with targeted additives. The additives included in the coating formulations in the next phase of the study are selected based on a preliminary assessment of the antibacterial performance of the potential active agents.

LATVIAN STATE INSTITUTE OF WOOD CHEMISTRY

Iecavnieks

ForestValue

Latvian Council of Science

Project WOODforHEALTH is supported under the umbrella of ERA-NET Cofund ForestValue by Ministry of the Environment of Finland, Latvian Council of Science, German Federal Ministry of Education and Research, the Research Council of Norway and Vinnova Sweden's Innovation Agency. ForestValue has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 773324.

## Contact Information

Dace Cīrule: dace.cirule@kki.lv (www.kki.lv)

More information about the WOODforHEALTH project:
www.woodforhealth.eu
https://www.facebook.com/woodforhealth.eu
https://www.linkedin.com/company/wood-for-health-project/

Wood for Health

World Congress of Latvian Scientists

# Antibacterial and antioxidant activities of extracts of plants growing in Latvia and their potential use in veterinary medicine.

**Renāte Šukele (Teterovska ), Dace Bandere, Rudīte Koka, Ingus Skadiņš, Līga Lauberte, Līga Kovaļčuka**

Department of Pharmaceuticals of Red Cross Medical College of Rīga Stradiņš University, Riga, Latvia; Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Rīga Stradiņš University, Riga, Latvia
Department of Biology and Microbiology, Rīga Stradiņš University, Riga, Latvia; Laboratory of Finished Dosage Forms, Rīga Stradiņš University, Riga, Latvia
Baltic Biomaterials Centre of Excellence, Headquarters at Riga Technical University, Riga, Latvia; Clinical Institute, Faculty of Veterinary Medicine, Latvia University of Life Sciences and Technologies, Jelgava, Latvia

## Introduction

Bovine mastitis is most common and costly disease of dairy farming, that requires antibiotics use. The use of antibiotics in animal farming is a major contributor to antimicrobial resistance, and it is expected to grow by 8% between by 2030. Research shows that good husbandry practices and alternative treatment such as herbal medicine could be used instead. Plant secondary metabolites such as phenolic compounds have shown antibacterial and antioxidant activities, which contribute to battle infections.

*Quercus robur* bark (QB) *Calluna vulgaris* herb (CH)

*Tanacetum vulgare* flower (TF) and leaf (TL)

**Figure No 1. Plants used in study.**

## Research Objective

The aim of our projects is to develop and put into practice new, innovative phytopreparations, which contain plant extracts typical of Latvian flora, which have anti-parasitic, antibacterial and antioxidant activity in vitro.
This part of the project focused on antibacterial potential of plant extracts against bacteria that induce bovine mastitis.

## Research Methods

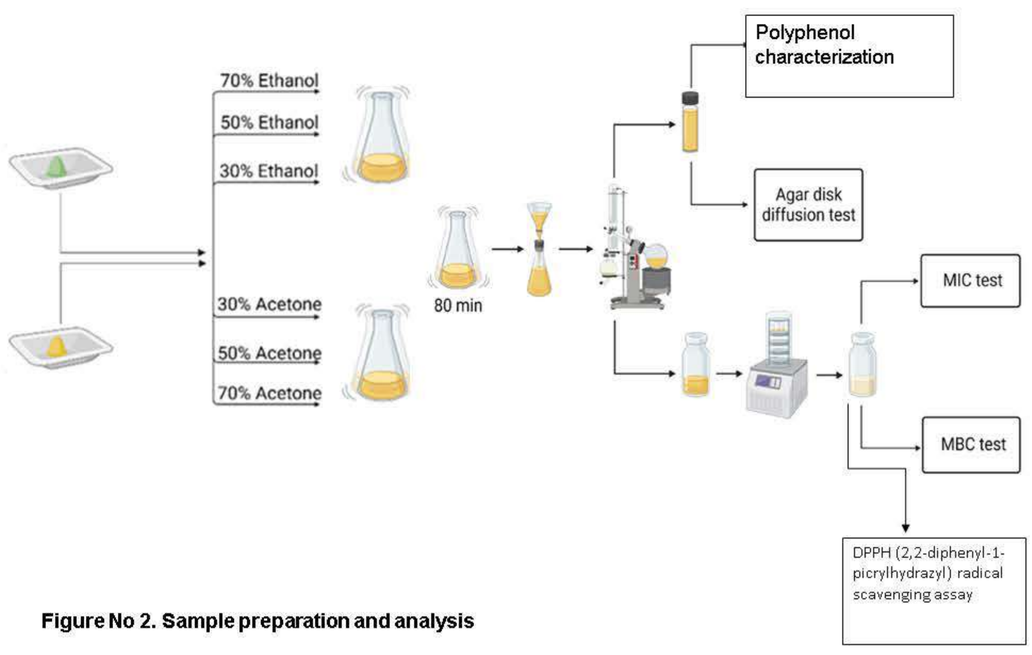



**Figure No 2. Sample preparation and analysis**

## Results & Discussion

| Plant Sample | TPC (mg GAE / g of lyophilised extract wt), ±SD | TFC (mg QE / g of lyophilised extract wt), ±SD | $IC_{50}$ value of DPPH radical scavenging activity (μg/ml), ±SD |
|---|---|---|---|
| Ascorbic acid | - | - | 43.92 ± 1.15 |
| Ethanol extracts | | | |
| *Calluna vulgaris* herb | 294.88 ± 14.20 | 51.13 ± 0.29 | 127.06 ± 1.07 |
| *Quercus robur* bark | 301.39 ± 10.17 | 5.11 ± 0.32 | 96.16 ± 1.03 |
| *Tanacetum vulgare* flower | 154.11 ± 7.95 | 25.12 ± 2.53 | 193.64 ± 1.10 |
| *Tanacetum vulgare* leaf | 158.48 ± 15.57 | 46.15 ± 0.29 | 185.35 ± 1.12 |
| Acetone extracts | | | |
| *Calluna vulgaris* herb | 285.61 ± 5.41 | 55.08 ± 2.23 | 104.71 ± 1.07 |
| *Quercus robur* bark | 316.02 ± 21.54 | 6.20 ± 0.22 | 83.95 ± 1.04 |
| *Tanacetum vulgare* flower | 155.38 ± 3.17 | 29.69 ±0.02 | 181.97 ± 1.07 |
| *Tanacetum vulgare* leaf | 225.99 ± 3.69 | 52.75 ± 2.37 | 146.55 ± 1.05 |

**Table 1. Antioxidant activity (by** DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay) **of plant samples, Total phenolic (TPC) and Total flavonoid (TFC) content. Samples prepared with 50% ethanol or 50% acetone ratio 1:10**

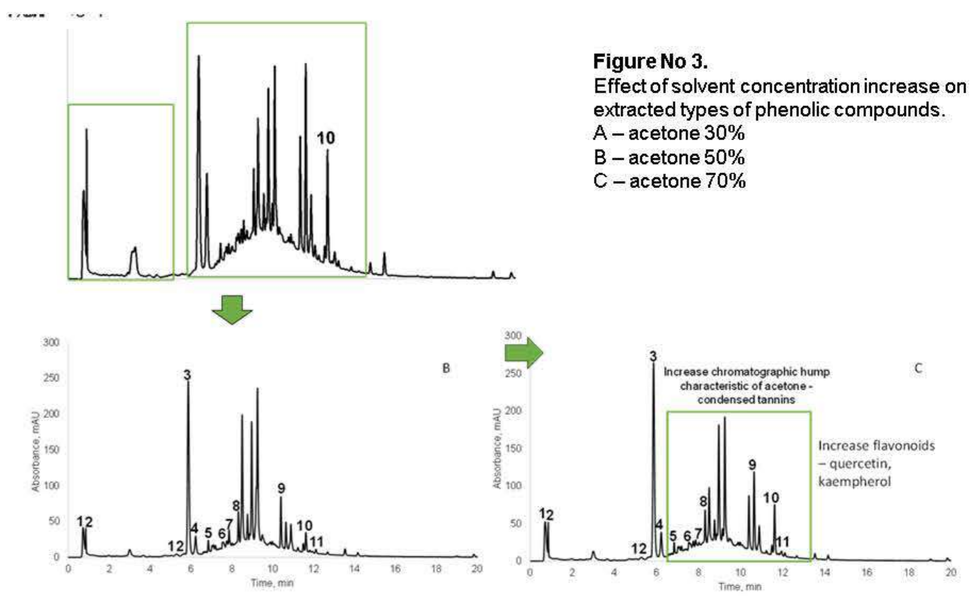



**Figure No 3.**
Effect of solvent concentration increase on extracted types of phenolic compounds.
A – acetone 30%
B – acetone 50%
C – acetone 70%

**Minimal inhibitory concentration (MIC) and Minimal bactericidal concentration (MBC) of extracts by Broth microdilution method, mg/mL**

| | *Q. robur* bark Ethanol extract | | *Q. robur* bark Acetone extract | | *C.vulgaris* herb Ethanol extract | | *T. vulgare* flower Ethanol extract | | *T. vulgare* leaf Ethanol extract | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MIC | MBC | MIC | MBC | MIC | MBC | MIC | MBC | MIC | MBC |
| *E.coli ATCC* | 6.16 | 6.1 | 5.99 | 5.99 | 18.27 | 18.27 | 53.9 | 53.9 | - | - |
| *E. Coli V252* | 12.34 | 12.34 | 11.98 | 26.96 | 18.27 | 18.27 | 53.9 | 107.8 | - | - |
| *E.Coli V4* | 12.34 | 12.34 | 11.98 | 11.98 | 18.27 | 18.27 | 53.9 | 107.8 | - | - |
| *S.aureus ATCC* | 3.08 | 3.08 | 1.49 | 2.99 | 1.14 | 4.56 | 3.4 | 6.8 | 7.8 | 15.7 |
| *S.aureus V256* | 1.54 | 3.08 | 0.78 | 1.49 | 1.14 | 2.28 | 3.4 | 3.4 | 15.7 | 125.9 |
| *Strep. V171* | 24.68 | 24.68 | 23.96 | 23.96 | 18.27 | 36.53 | 53.9 | 53.9 | 31.4 | 62.9 |
| *Strep. V243* | 24.68 | 49.4 | 47.92 | 35.93 | 36.50 | 73.06 | - | - | 62.9 | 125.9 |
| *Serratia V251* | - | - | 47.92 | 47.92 | 73.06 | 73.06 | - | - | 125.9 | 125.9 |

Table 2. Antibacterial activity of plant samples

Bovine mastitis pathogens and reference cultures: *Escherichia coli (ID. V-2019-4), E. coli (ID. V-2019-252), E. coli (ATCC 25922), Streptococcus agalactiae (ID. V-2019-171), S. uberis (ID. V-2019-243), Serratia liquefaciens (ID. V-2019-251), Staphylococcus au-reus (ID. V-2019-256), S. aureus (ATCC 25923).*

- All six types of extracts for each plant were screened by the agar disc diffusion test for antibacterial activity. The best samples were selected for MIC and MBC determination.
- All *Q. robur* bark acetone extracts had antibacterial activity, but ethanol extract did not affect *Serratia liquefaciens*. The 30% ethanol extract of *Q. robur b*ark measured the highest bacterial inhibition zones, whereas 70% acetone extracts - the broadest spectrum (all tested bacteria). The lowest MIC/MBC was observed against *S. aureus*.
- Lower concentration extracts of *C. vulgaris* were effective against all tested bacteria. The 30% ethanol extract of *C. vulgaris* herb had the broadest spectrum, although it had better activity against Gram-positive bacteria.
- MIC and MBC values of the 70% ethanol extract of *Tanacetum vulgare* flower were lower than for the 70% ethanol extract of *T. vulgare* leaf.
- All analyzed plants are good source of phenolic compounds. These compounds contribute to antibacterial and antioxidant activity, which can be helpful in healing process.
- Antioxidant activity of 50% extracts: TF ethanol< TL ethanol< TF acetone< TL acetone< CH extracts< QB extracts.
- Various factors could affect the antibacterial effectivity of extract like the type of solvent, concertation, extraction process, and plant material. Solvent polarity and the plant part used could affect extracted phenolic compound amounts and effects.
- Type of bacterial wall (Gram positive or Gram negative) also affects activity since most of the extracts had better effects against Gram positive bacteria.

## Conclusions

Tested extracts can potentially be used in the development of antibacterial phytopreparations, which would contribute to a more ecologically friendly medicine and reduce resistant pathogens contamination in the environment.

## Contact Information

**Renāte Teterovska renate.teterovska@rcmc.lv**

Vadošais partneris: Latvijas Lauksaimniecības universitāte
Sadarbības partneri: SIA „Veterinārmedicīnas izglītības centrs", Rīgas Stradiņa universitāte, SIA „Mikaitas", Biedrība „Latvijas Aitu audzētāju asociācija"

„ĀRSTNIECĪBAS AUGU EKSTRAKTU SATUROŠA PRETPARAZITĀRĀ FITOLĪDZEKĻA IZSTRĀDE"

18-00-A01620-000028

Atbalsta Zemkopības ministrija un Lauku atbalsta dienests

**Acknowledgements**

**„ĀRSTNIECĪBAS AUGU EKSTRAKTU SATUROŠA PRETPARAZITĀRĀ FITOLĪDZEKĻA IZSTRĀDE" 18-00-A01620-000028**

**We are very grateful to PhD Pharm. Inga Sīle for experimental and laboratory support and prof. Dr.med.vet. Anda Valdovska for supplying Bovine Mastitis pathogens**

World Congress of Latvian Scientists

# Construction Waste Management Issues in the Context of Sustainability

**Sandra Gusta, Mareks Pavars, Kaspars Grabens**

Latvia University of Life Sciences and Technologies

## Introduction

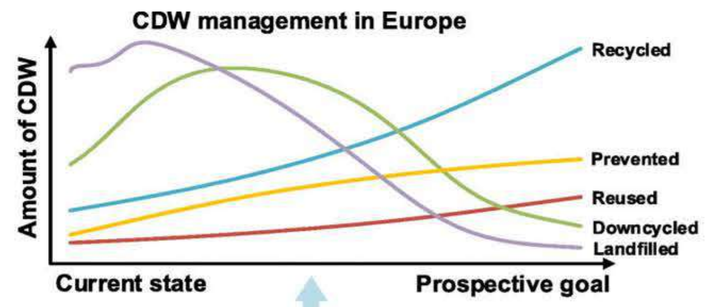
Increasing attention is being paid to waste management problems in the EU as global warming becomes more and more important.

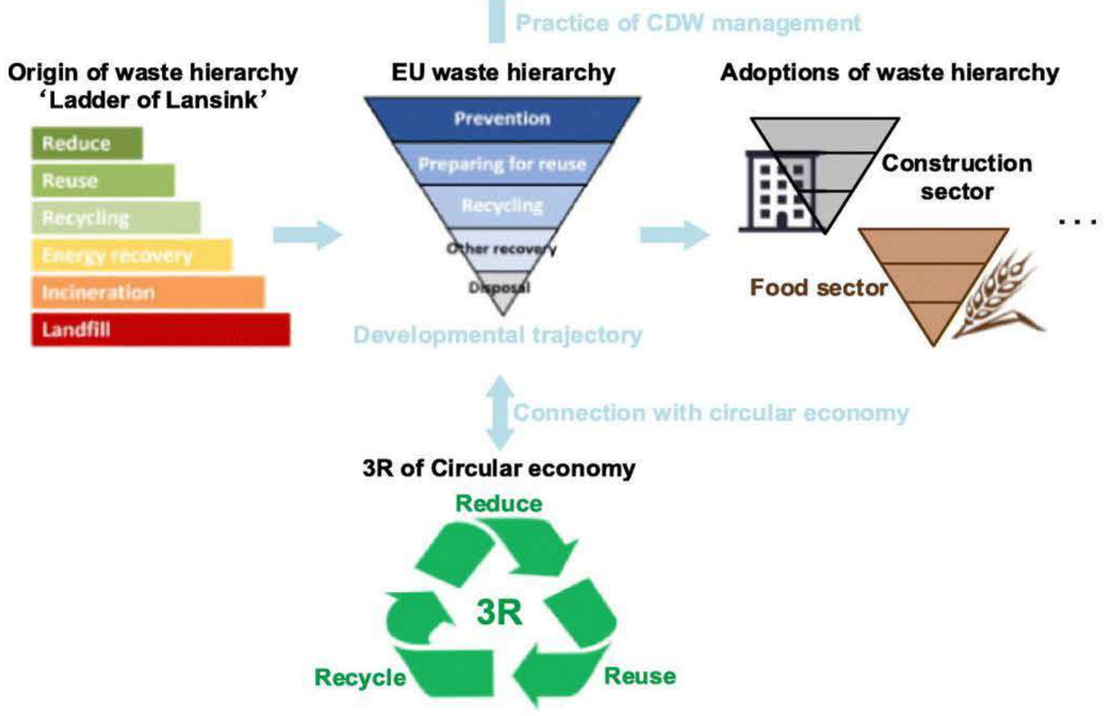
According to the principles of the circular economy, construction waste can be sorted, buried, and recycled, extending its life cycle. The circular economy emphasizes the importance of the principles of reuse and recycling rather than the extraction of natural resources. This means that previously used materials must be recovered and reused in different ways, thus protecting natural resources from overuse. In turn, this requires the development of innovative technologies that allow the recovery of valuable materials.

Today, the sustainability approach has intensified the need for companies and their supply chains to rethink their investments in three important values - environmental, social, and economic value.

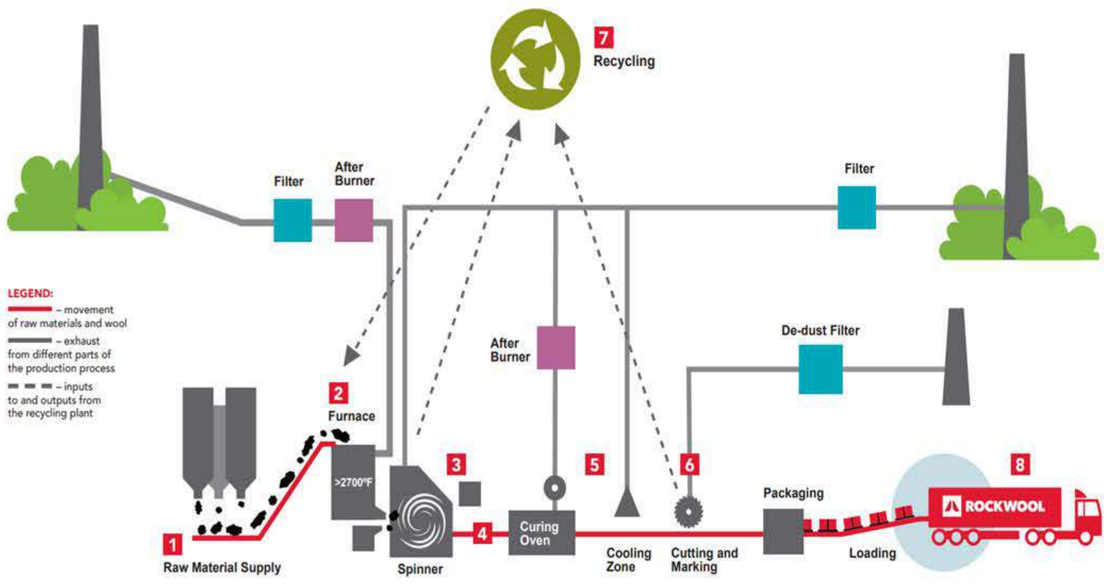
## Research Objective

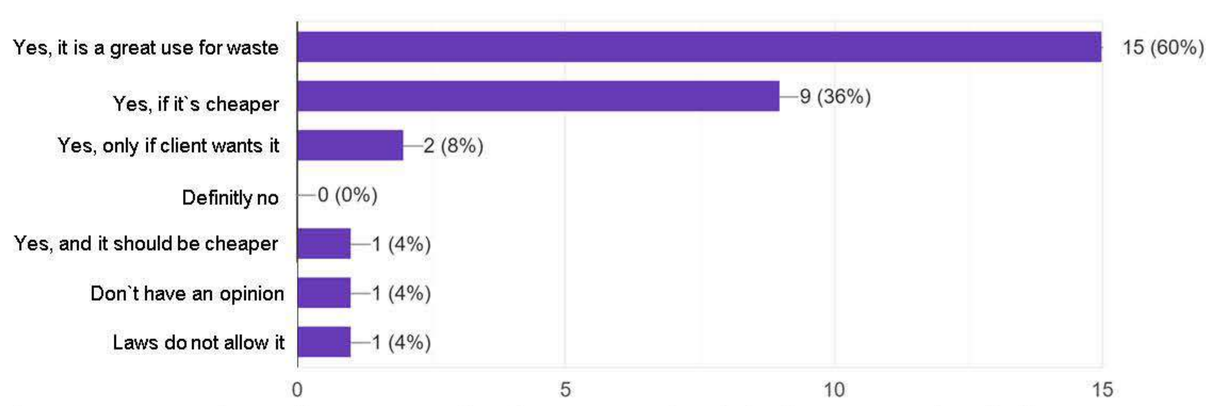
«Identify possible construction waste recycling processes and their final products, find out the attitude of industry participants regarding the sorting of construction waste and the use of recycled materials in construction by conducting a sociological survey, and take a closer look at the production process of recycled construction material and its characteristics.




## Results & Discussion



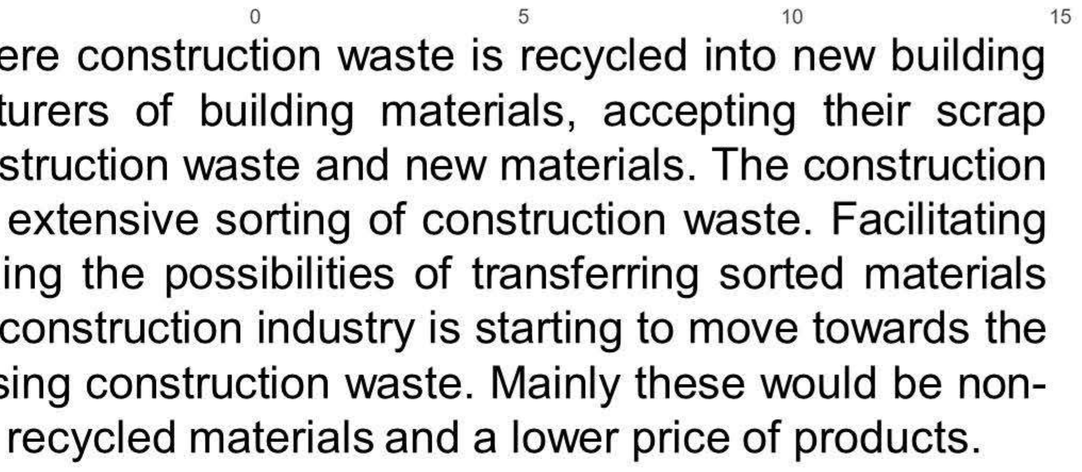

«There are several successful examples in the world where construction waste is recycled into new building materials. This is done both by the existing manufacturers of building materials, accepting their scrap materials, and by manufacturers who recycle various construction waste and new materials. The construction industry of Latvia is ready to start moving towards more extensive sorting of construction waste. Facilitating faster progress towards sorting can be done by expanding the possibilities of transferring sorted materials and making them more economically viable. The Latvian construction industry is starting to move towards the use of construction materials that have been produced using construction waste. Mainly these would be non-bearing positions. This could be driven by a wider offer of recycled materials and a lower price of products.

## Conclusions

«Based on the survey, the Latvian construction industry is mostly ready for using recycled materials in new construction projects.

Adjusted laws and standards would help use materials from construction waste more widely.

The construction industry is not ready to use recycled materials for bearing constructions such as beams, columns, and others as they are essential for the overall strength and longevity of buildings.




## Contact Information

sandra.gusta@lbtu, pavars.mareks@gmail.com, kasparss.grabens@gmail.com

Latvia University of Life Sciences and Technologies

Pasaules latviešu zinātnieku kongress

# Rozmarīna (*Rosmarinus officinalis* L.) fizikāli ķīmisko rādītāju novērtējumsbiodegradējamā iepakojumā uzglabāšanas laikā

**Ingrīda Augšpole**, Irina Sivicka, Sandra Muižniece Brasava

Latvijas Biozinātņu un tehnoloģiju universitāte, Lielā iela 2, Jelgava, Latvja

## Ievads

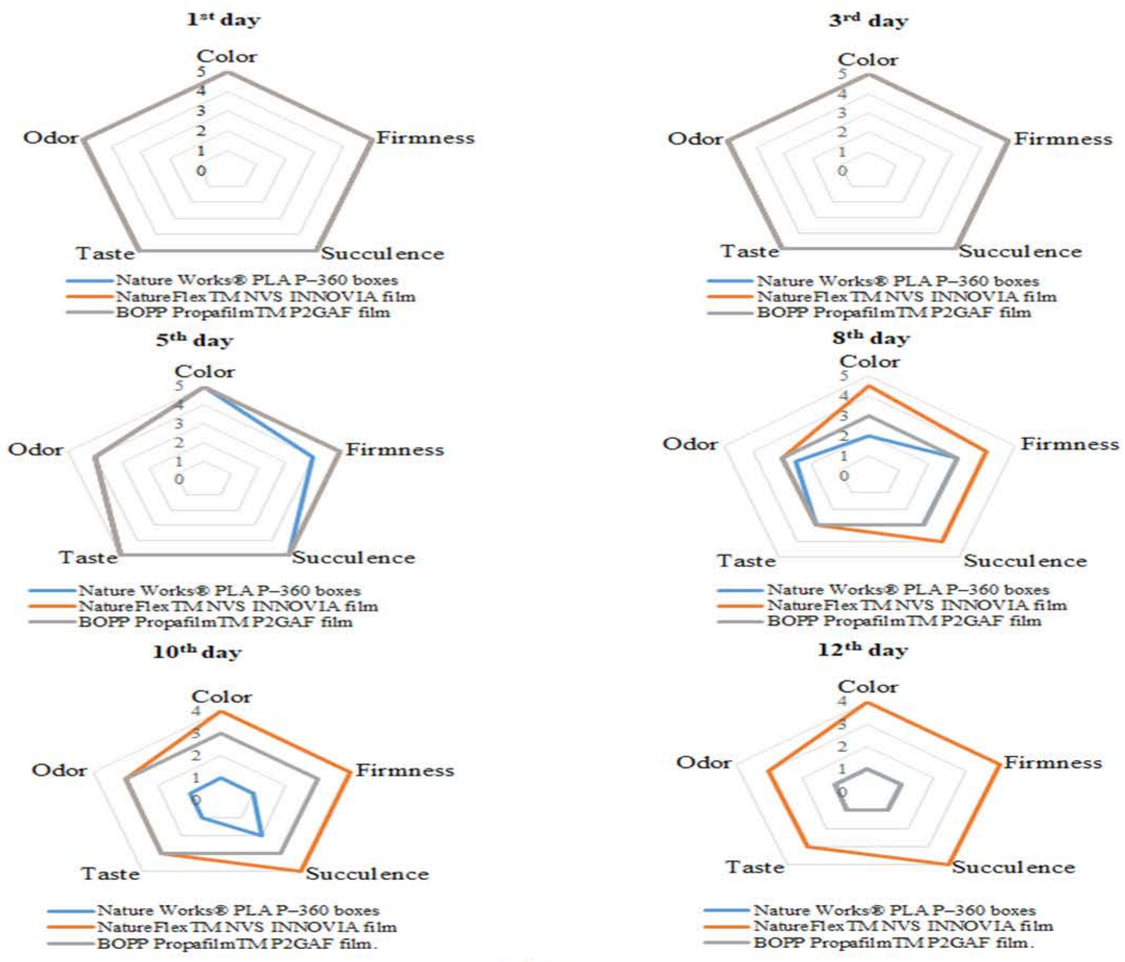
Svaigi griezti garšaugi Latvijas tirgū ir pieprasīti, jo tos ir ērti iegādāties pārtikas tirdzniecības centros kā ātri pieejamus produktus, piemēram, veselīgu svaigu ātro uzkodu, ko var ēst, atrodoties ceļā. Pārtikas iepakojumam ir liela nozīme mūsdienu pārtikas rūpniecībā, jo tas palīdz uzglabāt svaigu augu kvalitāti un nodrošina to drošību uzglabāšanas laikā.

## Pētījuma mērķis

Novērtēt svaiga rozmarīna kvalitātes izmaiņas, kas bija iepakots un uzglabāts bioloģiski noārdāmās plēves iepakojumos. Rozmarīns bija iepakots vairākos materiālos: divos bioloģiski noārdāmajos iepakojuma materiālos *NatureFlex™ NVS INNOVIA* plēvē, *Nature Works® PLA P–360* kārbiņās ar hermētiski noslēgtu *PLA* vāciņu un "elpojošā" konvenciālā *BOPP Propafilm™ P2GAF* plēvē.

## Metodes

Paraugus analizēja pirms iepakošanas pirmajā dienā un 3., 5., 8., 10., 12. uzglabāšanas dienā, trīs atkārtojumos 5±1°C temperatūrā, nosakot skābekļa un ogļskābās gāzes koncentrāciju iepakojuma brīvajā telpā, masas zudumus iepakojumā, šķīstošās sausnas saturu (°Brix) un augu organoleptiskās īpašības.

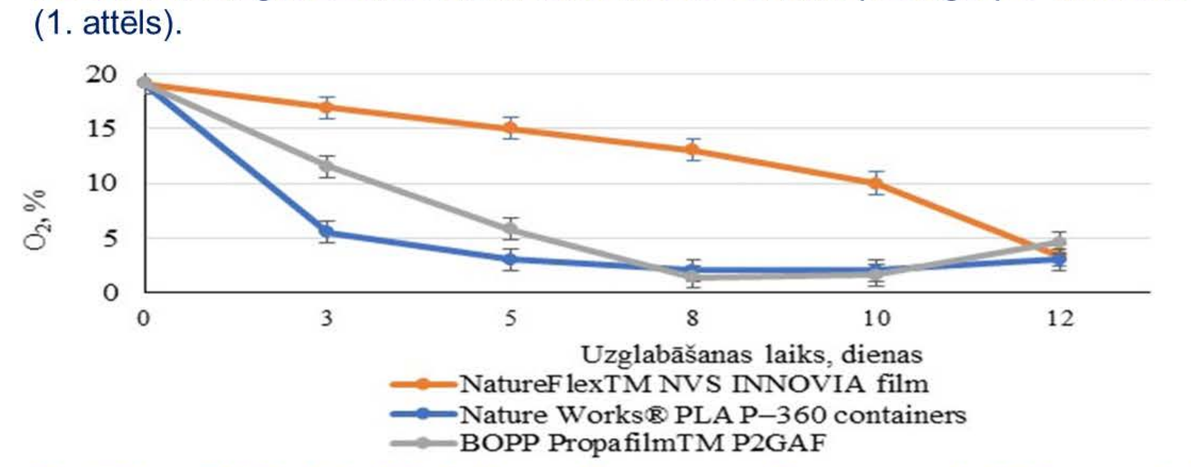



**4.attēls. Rozmarīna sensorās kvalitātes izmaiņas dažādos iepakojumos uzglabāšanas laikā, ballēs**

## Rezultāti un diskusija

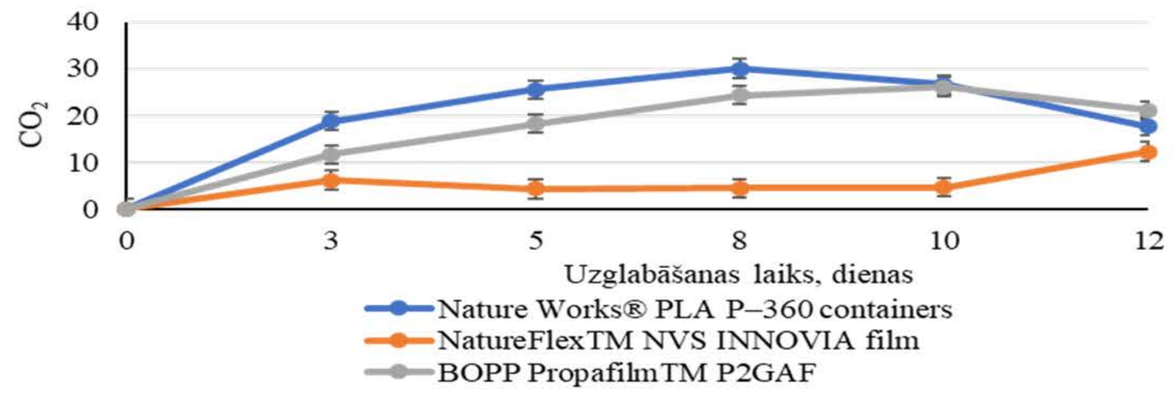

**1.attēls. Rozmarīna masas zudumi uzglabāšanas laikā**

Bioloģiski noārdāmajos *Nature Works® PLA P–360* konteineros masas zudumi būtiski pieauga līdz 2.77±0.1% jau 12 uzglabāšanas dienu laikā, bioloģiski noārdāmas plēves *NatureFlex™ NVS INNOVIA* nepārsniedza 0.99±0.1%. Savukārt iepakojumā ar "elpojošu" konvenciālo plēvi *BOPP Propafilm™* P2GAF, 12 uzglabāšanas dienu laikā masas zudumi pieauga par 0.09±0.1% (1. attēls).




**2.attēls. Skābekļa ($O_2$) dinamika rozmarīnam uzglabāšanas laikā**

Ļoti pozitīvi rezultāti tika novēroti, veicot $O_2$ satura analīzi iepakojuma iekšpusē ar svaigi grieztu rozmarīnu bioloģiski noārdāmajā iepakojuma materiāla *Nature Works® PLA P–360* konteineros ar hermētiski noslēgtiem *PLA* vāciņiem. $O_2$ saturs uzglabāšanas laikā samazinās no 19.1% līdz 3.0% (2. attēls).




**3.attēls. Ogļskābās gāzes ($CO_2$) dinamika rozmarīnam uzglabāšanas laikā**

$CO_2$ pieaugums noslēgtā celulozes bāzes bioloģiski noārdāmajā plēves *NatureFlex™ NVS INNOVIA* rozmarīna iepakojumā nebija augsts – ne vairāk kā 4.2–4.6%, un šī koncentrācija saglabājās nemainīga 5., 8. un 10. uzglabāšanas dienā. Uzglabāšanas beigās $CO_2$ līmenis palielinās līdz 12.2%.

Rozmarīna paraugiem, kas bija iepakoti dažāda veida materiālos, būtiskas atšķirības šķīstošās sausnas satura (°Brix) vērtībās 12 dienu uzglabāšanas laikā netika konstatētas ($p>0.05$).

Sensorās analīzes rezultāti uzglabāšanas laikā parādīti 4. attēlā.

Visiem iepakojuma materiāliem kvalitātes zudumi sākās 5. uzglabāšanas dienā. Bioloģiski noārdāmajā iepakojuma materiāla *Nature Works® PLA P–360* konteineros ar hermētiski noslēgtiem *PLA* vāciņiem tika novēroti cietības un smaržas zudumi, savukārt iepakojumā ar "elpojošu" konvenciālo plēvi *BOPP Propafilm™ P2GAF* un celulozes bāzes bioloģiski noārdāmajā plēves *NatureFlex™ NVS INNOVIA* iepakojumā tika novēroti pirmie cietības zudumi. Iepakojumā ar "elpojošu" konvenciālo plēvi *BOPP Propafilm™ P2GAF* plēvēm un bioloģiski noārdāmajā iepakojuma materiāla *Nature Works® PLA P–360* konteineros ar hermētiski noslēgtiem *PLA* vāciņiem 8. uzglabāšanas dienā tika novēroti būtiski visu sensoro parametru zudumi.

15. uzglabāšanas dienā tika sniegts vērtējums tikai celulozes bāzes bioloģiski noārdāmajā plēves *NatureFlex™ NVS INNOVIA* rozmarīna iepakojumā – smarža un garša novērtēta ar 3, bet pārējie rādītāji – ap 4.

Var secināt, ka *NatureFlex™ NVS INNOVIA* plēves iepakojumu var izmantot svaiga rozmarīna uzglabāšanai līdz 15 dienām. Šis iepakojuma materiāls saglabā visus optimālos rozmarīna sensoros rādītājus.

## Secinājumi

1. Pētījuma rezultāti liecina, ka izpētītā celulozes bāzes bioloģiski noārdāmā *NatureFlex™ NVS INNOVIA* plēve ir piemērota svaigi griezta rozmarīna uzglabāšanai iepakojumā, saglabājot tā kvalitāti.
2. Iepakojuma materiāls *NatureFlex™ NVS INNOVIA* saglabā visus optimālos rozmarīna sensoros rādītājus.
3. Svaigi griezta rozmarīna iepakojuma gadījumā, rezultāti apstiprināja iespēju izmantot bioloģiski noārdāmās iepakojuma plēves kā veiksmīgu alternatīvu parastajiem polimēriem.
4. Bioloģiski noārdāmās iepakojuma plēves var palīdzēt samazināt vides piesārņojumu.

**Kontaktinformācija:** **ingrida.augspole@lbtu.lv**

Latvijas Biozinātņu un tehnoloģiju universitāte

World Congress of Latvian Scientists

# Modified sheep wool based composite materials for air filters

**Karlis Shvirksts**, **Vilnis Peipins, Antons Podjava, Liga Avotina, Arturs Zarins, Mara Grube, Gunta Kizane**

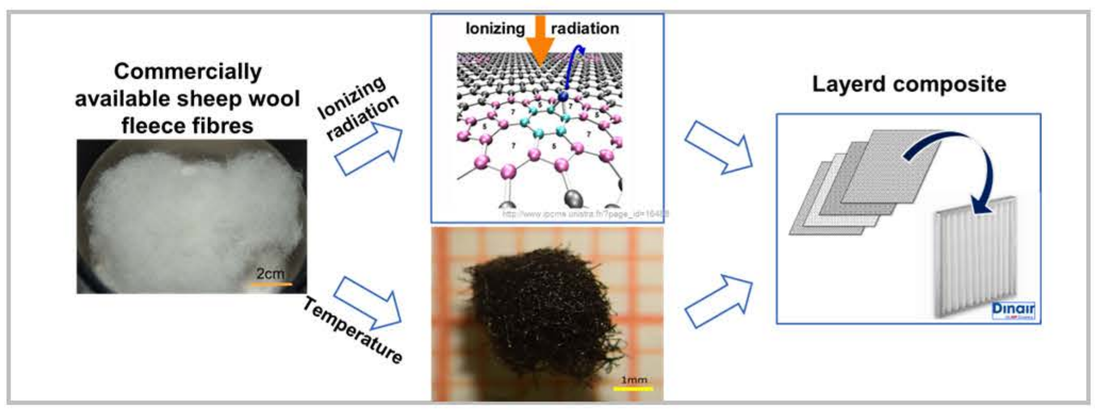
Institute of Microbiology and biotechnology, University of Latvia
Institute of Chemical physics, University of Latvia
«Dinair Filton» Ltd.

## Introduction

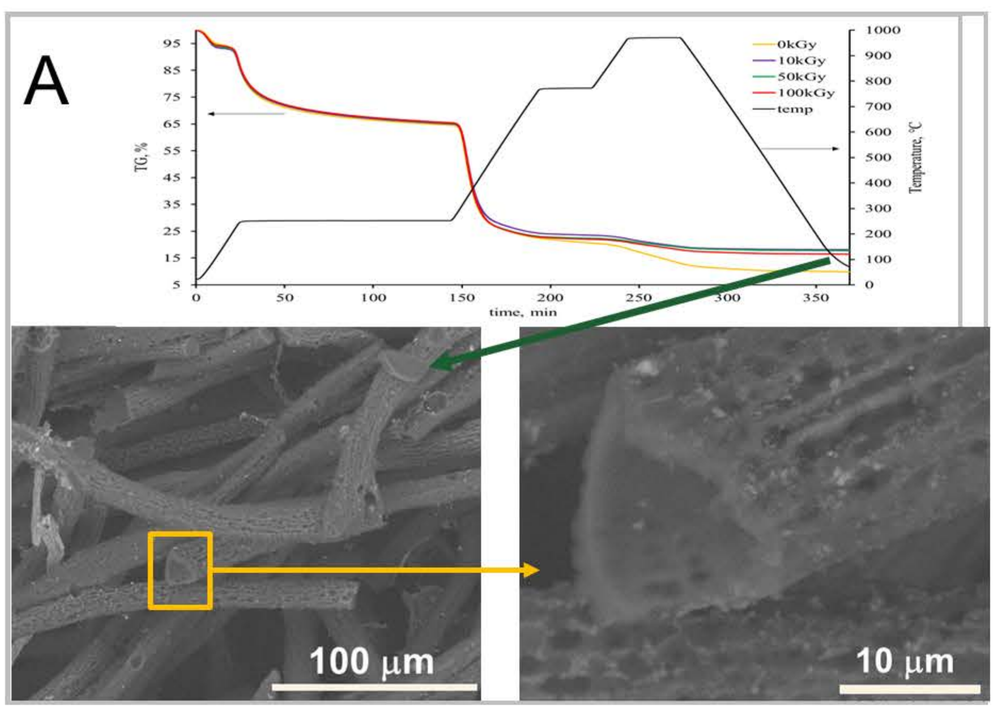
Due to low market demand and price in Latvia sheep wool is mostly considered as waste. It could be used as a natural, renewable and biodegradable bio-sorbent to ensure better public health, instead of being deposited at landfills. It is well known from the literature that electron radiation exposure increases the capacity of the wool sorption for heavy metals and is also expected to alter sheep wool's ability to connect with polar gaseous substances. Thermal treatment, by turning wool into carbon nanotubes, increases its sorption capacity for non-polar compounds (acid gases). The biological reinforcement of composite materials has several advantages: low density, biodegradability, profitability, partial recyclability and wider availability.

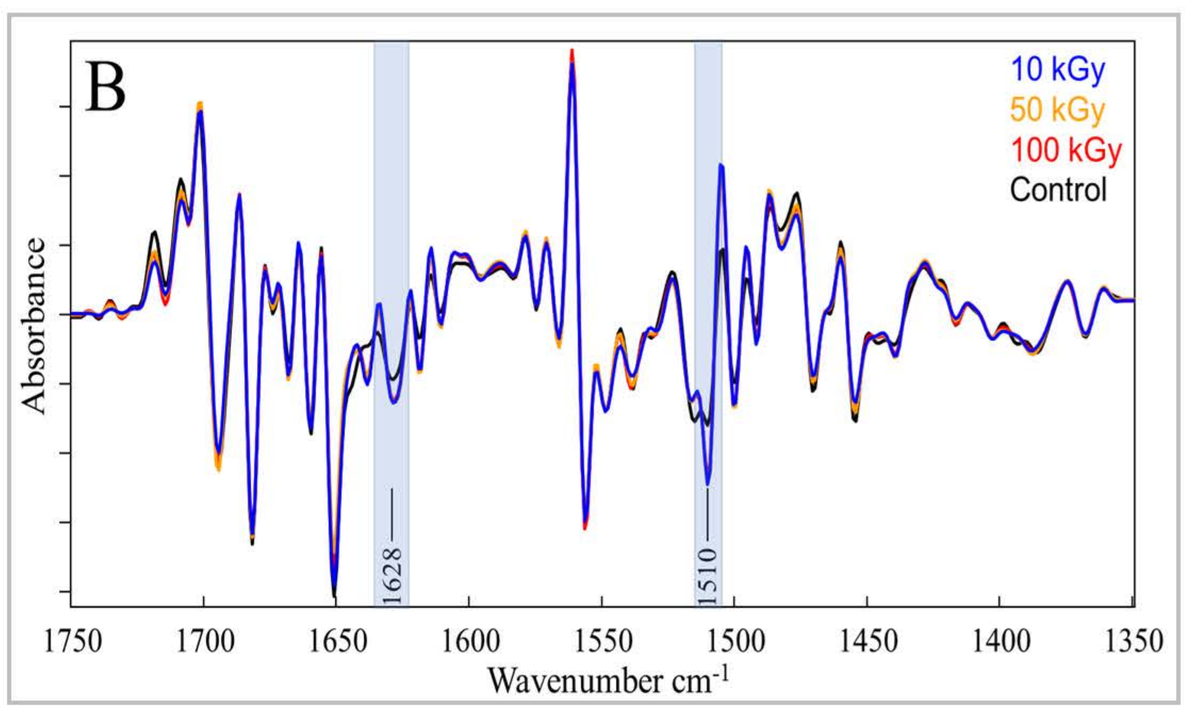
## Research Objective

To develop new and innovative composite materials for active part of air filters, consisting of radiation and heat-modified sheep wool grown in the Republic of Latvia and which will have improved sorption capacity for polar and non-polar gaseous compounds. Using local biodegradable materials for commercial air filters will reduce landfill waste and improve overall air quality while also increasing the commercialization and export potential of the local industry.




## Results & Discussion

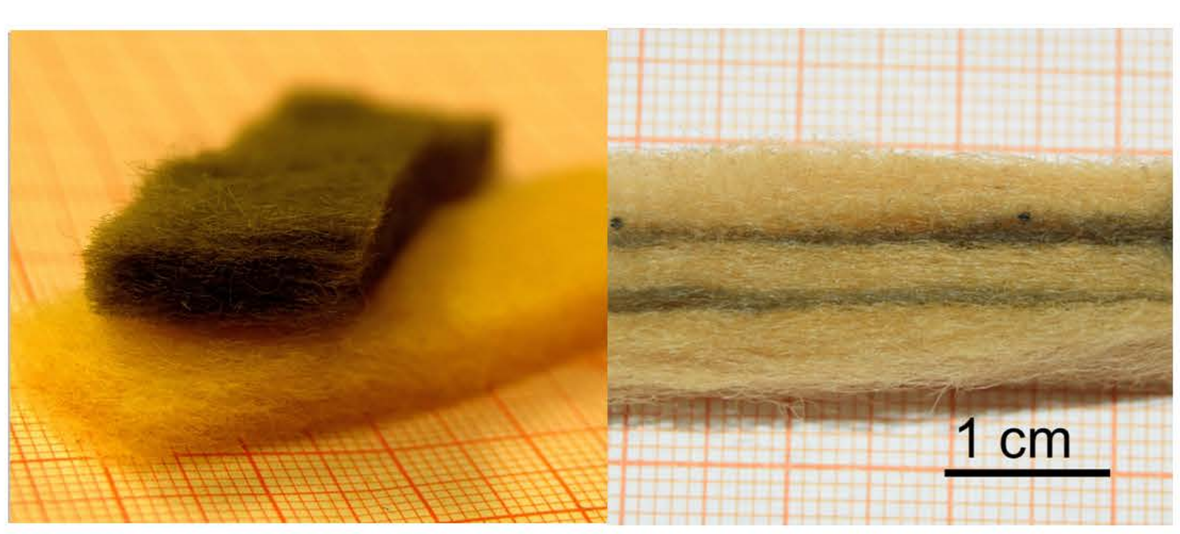



- Gradual heating in an inert atmosphere and in the presence of regulated water vapor within ~ 6 hours (360 min) allows the obtaining of activated carbon tubes with a significantly increased active surface area (Figure A)
- A slight increase in absorption band intensity at 1628 $cm^{-1}$ and 1510 $cm^{-1}$ attributable to β sheet structures of keratin was observed across all spectrum of irradiated samples. After storage for 12 months, the increase in irradiated samples was even higher, but the control sample did not change (Figure B).

## Conclusions

As a result of thermal modification, the resulting activated carbon tubes provide increased sorption of non-polar compounds.
Radiation induced continuous effect of α-helical structure transformation into more stable β-sheets. The higher content of β-sheets in irradiated samples makes them more viable as starting material for novel bio-based materials useful in industrial formulations and composites.




## Contact Information

Acknowledgement: This study is supported by ERDF project "Development of novel and innovative composite materials with enhanced sorption properties from renewable biological natural resources available in the Republic of Latvia for commercial air purification filtration systems", 1.1.1.1/20/A/155.

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# Green transition of working life for ageing populations in the Nordic-Baltic region

Ieva Reine1,2, Agnese Reine2, Aija Bukova-Žideļūna2, Andrejs Ivanovs2, Anna Nyberg1, Antanas Kairys3, Courtney M. Queen2,4, Halldór S. Guðmundsson5, Helgi Guðmundsson5, Ilze Koroļeva2, Kolbeinn Hólmar Stefánsson5, Liili Abuladze6, Luule Sakkeus6, Madara Miķelsone2, Olga Rajevska2, Olga Zamalijeva3, Raimonda Sadauskaite3, Signe Tomsone2, Tiina Tambaum6

1Uppsala University, Sweden, 2Rīga Stradiņš University, Latvia, 3Vilnius University, Lithuania, 4Texas Tech University Health Sciences Center, USA. 5University of Iceland, Iceland , 6 Tallinn University,

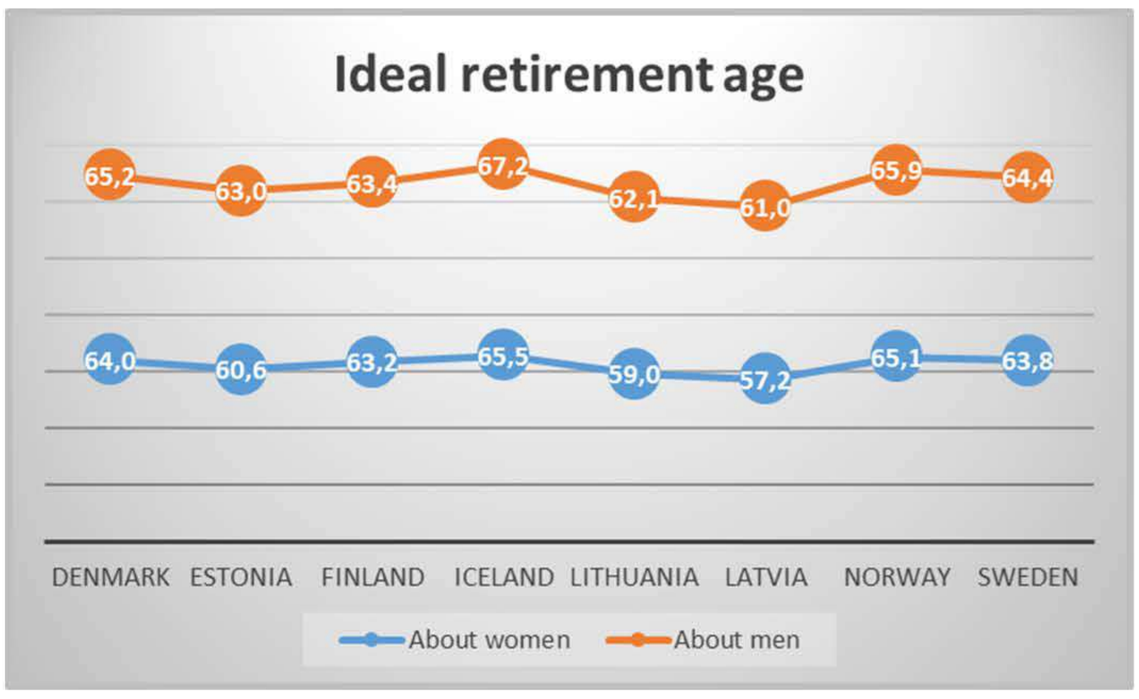
## Introduction

Income trajectories and legal aspects for population aged 50 and older and green transition of working life is crucial to create a better understanding of how the green transition will affect working life and how different actors in the labour market can contribute to a greener working life. Research is needed to better understand how to create healthy work environments that promote wellbeing and work-life balance in a time of hybrid working environments, flexible contracts/new employment forms and longer working life.

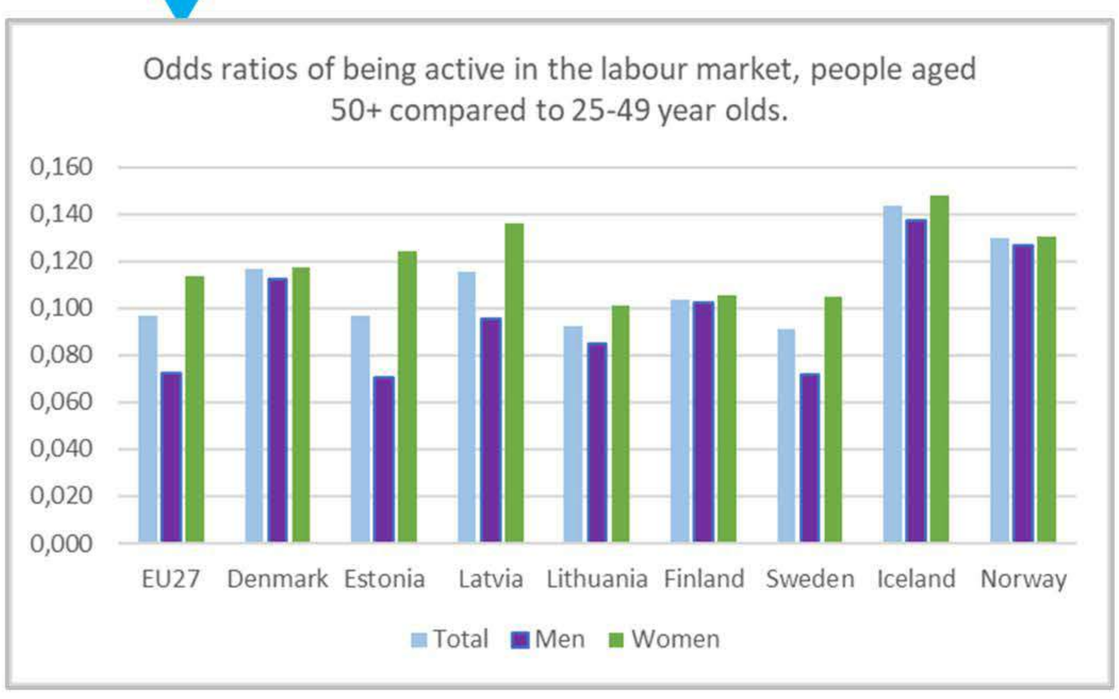
Our research includes the assessment of the institutional framework of the transition from work to retirement in the Baltic States and the Nordic countries, as well as the analysis of Survey of Health, Ageing and Retirement in Europe (SHARE) longitudinal survey data (the Baltic States and Sweden), along with other national and international statistical sources and databases, e.g. SLOSH (Sweden), HL20, VHI (Iceland).

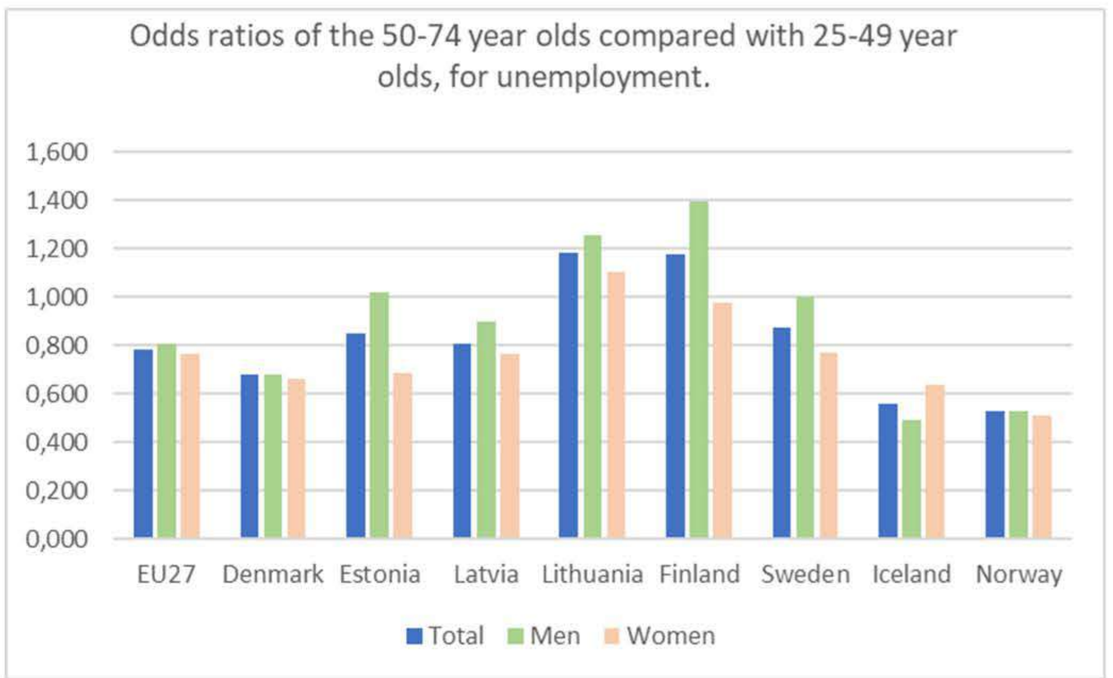
## Research Objective

Our collaborative project aims to generate knowledge and solutions for a sustainable and inclusive future working life in the Nordic-Baltic region. By analysing the distinct similarities and differences in welfare systems, working life, and culture across these countries, we seek to gain insights that contribute to positive change towards a sustainable and inclusive working environment.




## Results & Discussion




Preliminary analysis of SHARE data reveals a higher prevalence of the wish to retire as soon as possible among working-age adults in Latvia and Lithuania compared to Sweden and Estonia, indicating the complexity of extending working life through legislative regulation.

While the Baltic states may not have reached the same level of development as the Nordic countries in terms of their approaches to labour market challenges for ageing populations, they are increasingly aligning with Nordic values. We have examined the odds ratios of being active in the labour market for individuals aged 50 and above compared to those aged 25-49. A crude indicator shows, that Iceland stands out as a country that performs better in retaining older workers compared to the other countries in the study, while Sweden and Lithuania exhibit lower rates compared to the EU27 average. All countries generally fare better in retaining women than men, although differences tend to be minimal, except for Estonia, Latvia, and Sweden. The green transition in working life in the Nordic-Baltic region is crucial for aging populations as it creates employment opportunities, improves health and well-being, contributes to sustainable social security systems, and fosters intergenerational solidarity. By prioritizing sustainability and inclusivity, societies can build resilient and prosperous futures for all age groups.

## Conclusions

A green transition in working life for aging populations in the Nordic-Baltic region requires a multi-faceted approach that addresses the specific needs and contexts of each country. By prioritizing skills development, age-friendly workplaces, flexible work arrangements, and green entrepreneurship, the region can foster sustainable and inclusive working environments that promote the well-being and active participation of older workers. It is essential for governments, employers, educational institutions, and civil society organizations to collaborate and implement these proposals to drive the green transition and ensure a prosperous future for aging populations in the Nordic-Baltic region.

## Contact Information

Ieva Reine, ieva.reine@rsu.lv

Project proposal 139986: “Sustainable working-life for ageing populations in the Nordic-Baltic region”.

NordForsk

World Congress of Latvian Scientists

# Application of computer simulation for research into the perspective use of electric trucks

**Jurijs Tolujevs, Irina Jackiva**

Transport and Telecommunication Institute

## Introduction

Transport is one of the main sources of CO2 emissions in Europe, at that, road transport produces 77% of total transport emissions. Electric vehicles are an efficient mode of clean transport and their introduction into the EU economy is therefore one of the important measures aimed at implementing the European Green Deal. In recent years there has been a positive trend towards passenger cars in particular, but there is also the prospect of using electric trucks of various capacities. Since there are still many open questions in this area of electric vehicle applications, various research methods and, in particular, computer simulation techniques are being used to address them. In their presentation, the authors report on their experience of researching the use of electric trucks in regions equal to the size of Latvia.

## Research Objective

The objective of the study was to create a universal computer programme that could be used to simulate the use of any type of electric or diesel-powered truck in a given geographical area. The primary results of the simulation relate to a single day's operation of a fleet of electric trucks that performs transportation on given routes. The fleet includes medium capacity vehicles (see example in Figure 1) and the average distance between the route points is about 50 km.


Figure 1: eActros 300 from Mercedes-Benz

## Results & Discussion

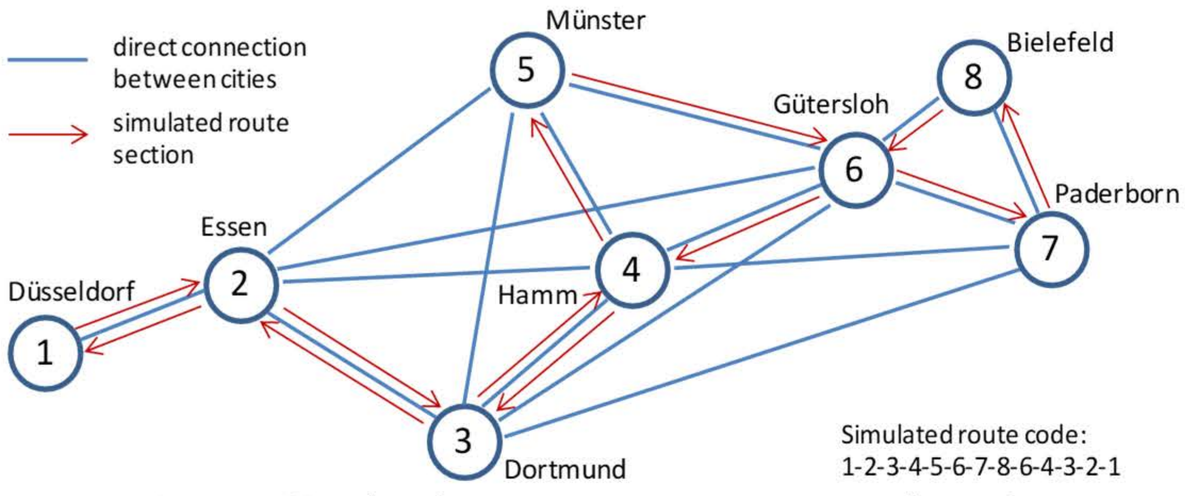



Figure 2: Simulated route on a transport network graph

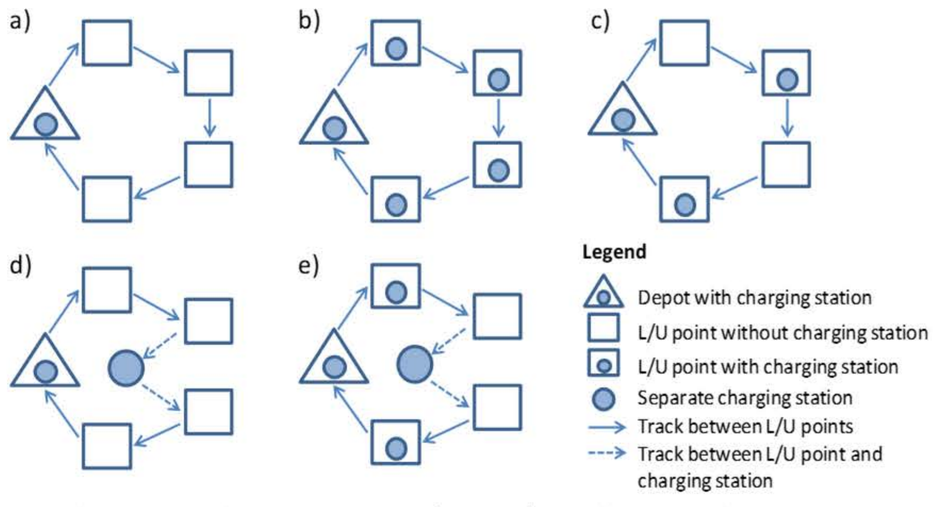



Figure 3: Five ways to place charging stations

The TraPodSim software has been developed, which core is a versatile multi-agent model implemented using the AnyLogic package. Using TraPodSim, a simulation model of the transportation process on the routes shown in Figure 2 was created. The first theoretical output of the project was the classification and analysis of the location of fast charging stations (Figure 3). Two main alternatives were investigated in experiments with the model: (b) there is a charging station at each L/U point and (d) the carrier itself equips one or more fast charging stations in the region where it will serve customers. In case (b) the vehicle does not waste time driving to the charging station and the charging process itself, because charging happens simultaneously with the loading/unloading processes. Three forms are used to present the results of the simulation: computer animation, vehicle traffic diagrams (Figure 4) and tables showing the amount of electricity or fuel consumed and the CO2 emissions.

## Conclusions

The TraPodSim software makes it possible to estimate all the physical usage indicators of the electric truck fleet and to compare them with those of a similar diesel truck fleet in terms of payload capacity. This data is the basis for two types of decisions: a) how many electric trucks a carrier should use in a particular region and b) where the unlimited access charging stations should be located.

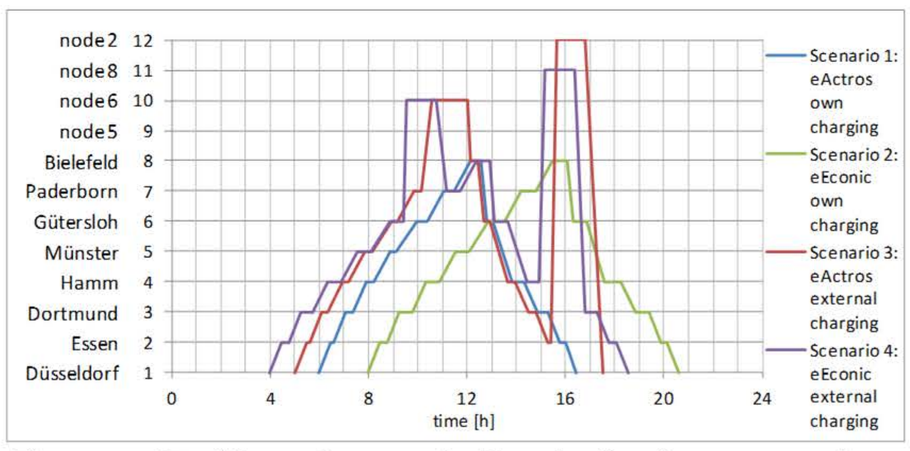



Figure 4: Traffic patterns of eTrucks for four scenarios

## Contact Information

Tolujevs.J@tsi.lv, Jackiva.I@tsi.lv

TSI TRANSPORTA UN SAKARU INSTITŪTS

World Congress of Latvian Scientists

# Evaluation of the European Green Deal Policy in the Context of Agricultural Support Payments in Latvia

**Irina Pilvere, Aleksejs Nipers, Aija Pilvere**

Latvia University of Life Sciences and Technologies

Latvia University of Life Sciences and Technologies

## Introduction

The European Commission (EC), based on the European Green Deal (2019) policy and the European Recovery Plan (2021), intends to invest 30% of the budget in climate-related programmes, projects and initiatives, which clearly demonstrates Europe's commitment to becoming the first climate-neutral region by 2050. The aim of the European Green Deal is to minimise the negative impact on the environment while maintaining the international competitiveness of the European Union (EU). Almost all the elements of the European Green Deal are directly or indirectly related to agriculture. However, two strategies will have the greatest impact on the agricultural sector: (1) Farm to Fork Strategy, that is, a system for creating fair, healthy and environmentally friendly food; (2) Biodiversity Strategy for 2030, which provides for the protection and restoration of ecosystems. CAP reforms after 2020 and the related Farm to Fork Strategy define five different directions for building farm resilience: (1) income resilience framework, (2) farmer supply chain resilience framework, (3) climate change resilience framework, (4) disease resilience framework and (5) ecological resilience framework. Agriculture and rural areas thus play a central role in the Green Deal policy, and the CAP is intended to be a key element in achieving the transition from sustainability to environmental compliance. CAP expenditure as a share of the total EU budget has been steadily decreasing over the past 30 years, but still amounts to almost EUR 60 billion per year. The CAP has been subject to reforms several times. This demonstrates that the CAP is evolving to meet new economic, societal and environmental needs. Given the different situation in the Member States, many of the desired changes can be more effectively supported at the national level. It offers stable support to farmers, helping to provide them with a standard of living that is in line with other countries, and defines the conditions that allow the agricultural sector to fulfil its important functions in society. By 2030, the EU must introduce regulatory and other instruments that not only reduce greenhouse gas emissions from agriculture, but also increase carbon sequestration, increase the sustainability of agricultural production, improve biodiversity in rural areas and help ensure quality food for the growing world population. The EU 2021-2027 CAP has great potential to contribute to sustainable development, but changes are needed to unlock this potential.

## Research Objective, Tasks and Hypotesis

Therefore, by analysing the significance and effect of CAP reforms in ensuring and developing the resilience of farms, the goal of the research was set – to determine the possible impact of the reform envisaged for 2023 on farms of various specialisations and sizes in Latvia by analysing the existing CAP support payment system in 2019. To achieve the goal, two research tasks were defined: (1) to evaluate the support pay-ments of the 2015 CAP reform in Latvia in 2019 and (2) to analyse the possible impact of the CAP support payment reform on farms of various specialisations and sizes in Latvia in 2023. A hypothesis was put forward for the research that in the application of the CAP reform which will be introduced from 2023, contradictions between sup-port to small farms, employment promotion, GHG reduction, and efficiency promotion in agriculture could arise.

## Materials and Methods

The research used the database of the RSS Integrated Administration and Control System on the actually received support payments for each farm in 2019. Limitation of the study – in 2021, when the study was conducted, newer data were not available. Thus, a database in Excel format containing information on 58 644 beneficiaries ($n_x$=58 644) (rows in a table) was received from the RSS. For each beneficiary, it was possible to analyse 210 variables arranged in columns ($n_y$=210). 1 954 farms that only received Natura 2000 support for forest areas were excluded from the total number of beneficiaries because they did not have agricultural land.

**Table 1.** Criteria for the selection of farms necessary for detailed analysis in the main specialisation groups

| Indicators/Specialisation groups | Arable crops | Dairy production | Cattle breeding | Vegetable cultivation |
|---|---|---|---|---|
| The number of selected farms in the group | 997 | 699 | 377 | 36 |
| Revenue from agriculture, EUR | > 0 | > 0 | > 0 | > 0 |
| Permanent grassland of the total area of the farm, % | < 5 | n.a.* | n.a.* | n.a.* |
| Relevance of arable crops to the total area of the farm | > 70% | < 0.7 ha per dairy cow | < 0.5 ha per livestock unit | < 10 ha |
| VCS** for vegetables, ha | =0 | =0 | =0 | > 3 ha |
| VCS for starch potatoes and seed potatoes, ha | =0 | =0 | =0 | =0 |
| Organic farm support, ha | =0 | =0 | =0 | =0 |
| VCS for dairy cows, number | =0 | > 10 | =0 | =0 |
| VCS for cattle, number | =0 | =0 | > 10 | =0 |
| VCS for goats, sheep, number | =0 | =0 | =0 | =0 |

* n.a. – not applicable; ** VCS – Voluntary Coupled Support.

## Results & Discussion

**Table 3.** Description of farms and main types of support in Latvia in 2019 (as of 20.05.2021)

| Indicators, unit of measurement | All beneficiaries | SAPS | | SFS | |
|---|---|---|---|---|---|
| | | beneficiaries | % to total | beneficiaries | % to total |
| Number of farms | 56 690 | 45 007 | 79 | 11 683 | 21 |
| incl. legal entities | 11 459 | 11 129 | 97 | 330 | 3 |
| incl. natural persons | 45 231 | 33 878 | 75 | 11 353 | 25 |
| Area applied for support, ha | 1 740 076 | 1 711 426 | 98 | 28 650 | 2 |
| Average area applied per farm (mean), ha | 31 | 38 | 123 | 2 | 6 |
| Support payments received in total, thousand EUR | 318 361 | 312 527 | 98 | 5 834 | 2 |
| Received support payments on average per farm (mean), EUR | 5 616 | 6 941 | 124 | 499 | 9 |
| Support payments received per ha, EUR | 183 | 183 | 100 | 204 | 111 |
| Allocated diesel fuel*, number of farms | 16 912 | 16 653 | 98 | 259 | 2 |
| Allocated diesel fuel*, thousand litres | 146 528 | 146 460 | 100 | 68 | 0 |
| Allocated diesel fuel* on average per farm (mean), litres | 8 664 | 8 795 | 102 | 263 | 3 |
| Allocated diesel fuel, ha | 1 465 428 | 1 464 721 | 100 | 707 | 0 |
| Allocated diesel fuel* on average per farm (mean), ha | 100 | 100 | 100 | 96 | 96 |
| Farms with income from agriculture, number | 16 542 | 16 290 | 98 | 252 | 2 |
| Total revenue from agriculture, thousand EUR | 955 285 | 954 504 | 100 | 781 | 0 |
| Average income from agriculture per farm (mean), EUR | 57 749 | 58 594 | 101 | 3 100 | 5 |
| Agricultural income of farms that received support (mean), EUR ha$^{-1}$ | 648 | 648 | 100 | 1 069 | 165 |

**Table2.** Criteria for determining the size of farms in different specialisation groups

| Indicators/Specialisation groups | Arable crops, ha | Dairy production Dairy cows, number | Cattle breeding number of cattle | Vegetable cultivation, ha |
|---|---|---|---|---|
| Small | < 50 | < 20 | < 20 | < 20 |
| Average small | 51-100 | 21-80 | 21-80* | 21-80 |
| Average large | 101-300 | 81-200 | 21-80** | 81-110 |
| Large | > 301 | > 201 | > 81 | > 111 |

**Table 4.** Indicators of specialised arable crop farms and support payments in Latvia in 2019 and the potential forecast for 2023.

| Indicators/Farm size | Small | Average small | Average large | Large | Average for a farm |
|---|---|---|---|---|---|
| Revenue from agriculture, thousand EUR | 2 | 15 | 120 | 392 | 90 |
| Income per ha of land, EUR | 90 | 209 | 675 | 659 | 641 |
| Declared managed area, ha | 23.9 | 73.7 | 178.2 | 595.6 | 140.8 |
| incl. wheat | 18.0 | 59.9 | 127.8 | 462.6 | 102.8 |
| rapeseed | - | - | 45.1 | 106.5 | 22.0 |
| barley | 4.1 | 1.2 | - | 1.0 | 2.9 |
| fallow land | 1.8 | 7.4 | 2.2 | 13.9 | 4.9 |
| broad beans | - | 5.0 | - | 5.7 | 3.2 |
| potatoes | - | 0.2 | - | - | 0.2 |
| fodder plants | - | - | 3.1 | - | 2.7 |
| vegetables | - | - | - | 1.0 | 0.1 |
| fruit trees | - | - | - | 4.9 | 0.1 |
| Support received in 2019, EUR | 3 288 | 13 989 | 23 388 | 79 095 | 20 122 |
| Received support per ha of land in 2019, EUR | 137 | 190 | 131 | 171 | 143 |
| Received support in 2019 against revenue per ha of land, % | 152 | 91 | 19 | 11 | 22 |
| Potential support in 2023, EUR | 4 263 | 16 393 | 28 105 | 96 118 | x |
| incl. base payments*, EUR | 3 136 | 11 436 | 24 497 | 82 419 | x |
| for additional activities**, EUR | 1 127 | 4 957 | 3 608 | 13 699 | x |
| Can be received for being located in a specific parish***, % | 0-22 | 0-16 | 0-23 | 0-23 | x |
| Potential support in 2023 vs support received in 2019, % | 130 | 117 | 120 | 122 | x |
| incl. base payments, % | 95 | 82 | 101 | 102 | x |
| for additional activities, % | 34 | 35 | 20 | 19 | x |

**Table 5.** Indicators of specialised dairy farms and support payments in Latvia in 2019 and the potential forecast for 2023.

| Indicators/Farm size | Small | Average small | Average large | Large | Average for a farm |
|---|---|---|---|---|---|
| Revenue from agriculture, thousand EUR | 18 | 106 | 333 | 1 398 | 165 |
| Income per ha of land, EUR | 440 | 1 910 | 1 083 | 2 004 | 1 245 |
| Number of dairy cows, pcs | 7 | 33 | 114 | 303 | 55 |
| Declared managed area, ha | 23.9 | 55.8 | 307.0 | 697.8 | 132.2 |
| incl. fodder plants sown on arable land | 10.7 | - | 221.0 | 124.5 | 57.5 |
| permanent grassland | 13.1 | 55.8 | - | 0.4 | 43.0 |
| wheat | - | - | 48.2 | 255.0 | 9.5 |
| barley | - | - | 13.2 | - | 6.1 |
| alfalfa | - | - | 24.4 | 59.2 | 2.0 |
| corn | - | - | - | 156.5 | 12.8 |
| rapeseed | - | - | - | 101.8 | 0.9 |
| miscellaneous | 0.1 | - | 0.2 | 0.4 | 0.4 |
| Support received in 2019, EUR | 6 784 | 17 845 | 70 552 | 157 920 | 29 963 |
| Received support per ha of land in 2019, EUR | 284 | 320 | 230 | 226 | 226 |
| Received support in 2019 against revenue per ha of land, % | 65 | 13 | 21 | 11 | 18 |
| Potential support in 2023, EUR | 10 335 | 27 943 | 90 825 | 219 913 | x |
| incl. base payments*, EUR | 10 335 | 27 943 | 84 465 | 191 217 | x |
| for additional activities**, EUR | 0 | 0 | 6 360 | 28 696 | x |
| Can be received for being located in a specific parish***, % | 0-18 | 0-9 | 0-13 | 0-13 | x |
| Potential support in 2023 vs support received in 2019, % | 152 | 150 | 129 | 139 | x |
| incl. base payments, % | 152 | 150 | 120 | 121 | x |
| for additional activities, % | 0 | 0 | 9 | 18 | x |

**Table 6.** Land use efficiency of specialised farm groups compared to the intensity of support in Latvia in 2019 and the potential forecast for 2023

| Indicators/Specialisation groups | Arable crops | Dairy production | Cattle breeding | Vegetable cultivation |
|---|---|---|---|---|
| Income per ha of land in 2019, EUR (median) | 420 | 835 | 210 | 2 465 |
| Support per ha in 2019, EUR (median) | 144 | 211 | 193 | 586 |
| Support (EUR) from agricultural income (EUR) in 2019 per ha, % (median) | 34 | 26 | 92 | 24 |
| GHG emissions in 2019, kg per EUR ha$^{-1}$ of revenue | 1.5 | 3 | 8 | 0.5 |
| Possible increase in support in 2023 compared to 2019, % (base) | 0 | 20-50* | 50 | 20 |
| Possible increase of support in 2023 compared to 2019, % (for additional activities) | 20-35 | 0-18 | 0-8 | 2-11 |
| Possible increase of support in 2023 compared to 2019, % (for being located in a given parish) | 22 | 13 | 15 | 5 |

In Latvia in 2019, 83% of the total number of farms received support; out of 57 thousand of the beneficiaries 79% participated in the SAPS, and only 20% of the total number of beneficiaries were legal entities. On average, one farm has received EUR 5 616 per year; besides, beneficiaries of the SAPS received 24% more. Only 30% of the total number of beneficiaries have requested to be allocated marked diesel fuel with a reduced excise tax rate, which shows the proportion of farms producing agricultural products of the total number of beneficiaries, leading to the conclusion that the other beneficiaries ensure public benefits for the population. Income from agriculture in farms that received marked diesel fuel with a reduced excise duty rate averaged almost EUR 58 thousand, or EUR 648 on average per managed ha. All beneficiaries received on average EUR 183 per ha, so it can be concluded that the support accounted for 28% of agricultural income.

Comparing the indicators in all the four groups of specialised farms in Latvia, it can be found that vegetable farming and dairy farming can be considered effective sectors, because they are least dependent on support payments, which in 2019 accounted for 24-26% of their income, calculated per ha, while in arable crop farming the support accounted for 34% of the income, and in cattle breeding – 92%. GHG emissions in 2019 per EUR 1 ha$^{-1}$ of revenue were the largest in cattle breeding – 8 kg; besides, this indicator was 2.7 times higher than that of the dairy production sector, 5.3 times higher than that of arable crop cultivation farms and 16 times higher than in specialised vegetable cultivation farms, and this should be considered when determining the reformed CAP support for farms from 2023. However, the detailed calculations carried out show that the possible base support payments are expected to be higher specifically in cattle breeding and dairy farming, which may contribute to even greater GHG emissions in the future and hinder the achievement of the goals of the European Green Deal. Thus, the hypothesis put forward for the study, namely, that in the application of the CAP reform introduced from 2023, contradictions between support to small farms, employment promotion, GHG reduction, and efficiency promotion in agriculture arise, is confirmed.

## Conclusions

By 2030, on the basis of the European Green Deal policy, the EU must introduce instruments that not only reduce greenhouse gas emissions from agriculture, but also increase carbon sequestration, the sustainability of agricultural production, improve biodiversity in rural areas and help ensure quality food for the growing global population, by envisaging substantial resources for dealing with these issues. Therefore, it is established that in the CAP support for 2021-2027, at least 25% of the direct payments should be earmarked for eco-schemes, while 35% of the funding for rural development should be allocated to climate support measures, biodiversity and animal welfare. Studies have shown that support payments have contributed to increases in labour productivity and value added, and contribute to a certain share of farmers' income. Therefore, support payments influence farm decision-making when planning the direction of agricultural production development.

## Contact Information

Economic and Social Development Faculty, Latvia University of Life Sciences and Technologies, 18 Svetes Street, LV-3001 Jelgava, Latvia;
irina.pilvere@lbtu.lv; aleksejs.nipers@lbtu.lv; aija.pilvere@lbtu.lv
*Correspondence: irina.pilvere@lbtu.lv; Tel.: +371-2921-7851

**Funding:** The research was promoted with the support of the project of the union "Farmers' Parliament", agreement No. L305 in 2021.

**Article available:** https://doi.org/10.3390/agriculture12122028.

Pasaules latviešu zinātnieku kongress

# Jaunu betonu un cementa kompozītu šļūdes un rukuma deformāciju eksperimentālā izpēte

**Dr.Sc.ing. Andīna Sprince**

Rīgas Tehniskā universitāte
Būvniecības inženierzinātņu fakultāte
Būvkonstrukciju inženierzinātņu institūts

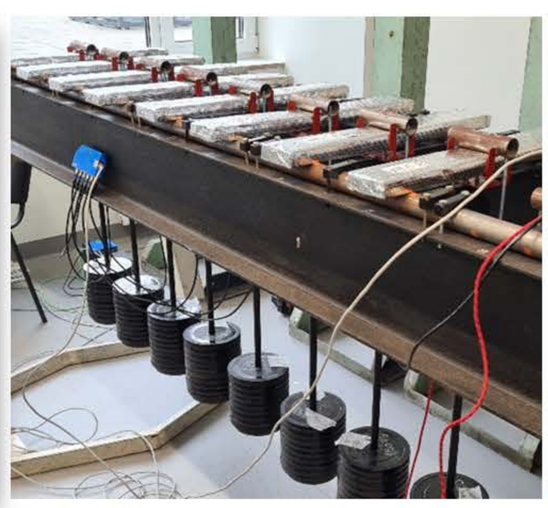
1.1.1.2/VIAA/3/19/401

## Ievads

Kopš 20. gadsimta sākuma zinātnieki un betona tehnologi strādā pie jaunu, atšķirīgu, dažāda veida betona kompozītmateriālu izstrādes. Jaunizveidotie kompozītmateriāli ir ļoti dažādi – ar samazinātu cementa daudzumu, samazinātiem pildvielu izmēriem, pievienotu disperso stiegrojumu šķiedru veidā un pievienotām ķīmiskajām piedevām, pazeminātu ūdens un cementa attiecību, kā arī daļu cementu aizvieto ar otrreizējiem izejmateriāliem. Jaunizveidoto betona kompozītu matricām vispārīgā gadījumā ir uzlabotas fizikāli-mehāniskās īpašības, piemēram, mikrostruktūra, samazināta porainība u.c., kā rezultātā betona kompozītiem ir augstāka spiedes stiprība, mazāka ūdensuzsūce un labāki salizturības rādītāji. Lai arī ietekme uz šīm īpašībām ir apzināta, tomēr pastāv šķēršļi, kas kavē šo jauno, savā ziņā moderno un uzlaboto īpašību betona kompozītmateriālu plašu izmantošanu būvniecībā. Viens no galvenajiem kavēkļiem ir nepietiekama informācija par šādu jaunu betona kompozītmateriālu ilglaicīgajiem rādītājiem – šļūdes un paralēlajām žūšanas rukumu deformācijām, kas ir būtiski, lai garantētu drošu un ilgu būvju ekspluatāciju. Tāpat nav izveidoti būvnormatīvi, kas atbilstu konstrukciju projektēšanai no šādiem uzlabotiem betona kompozītiem.

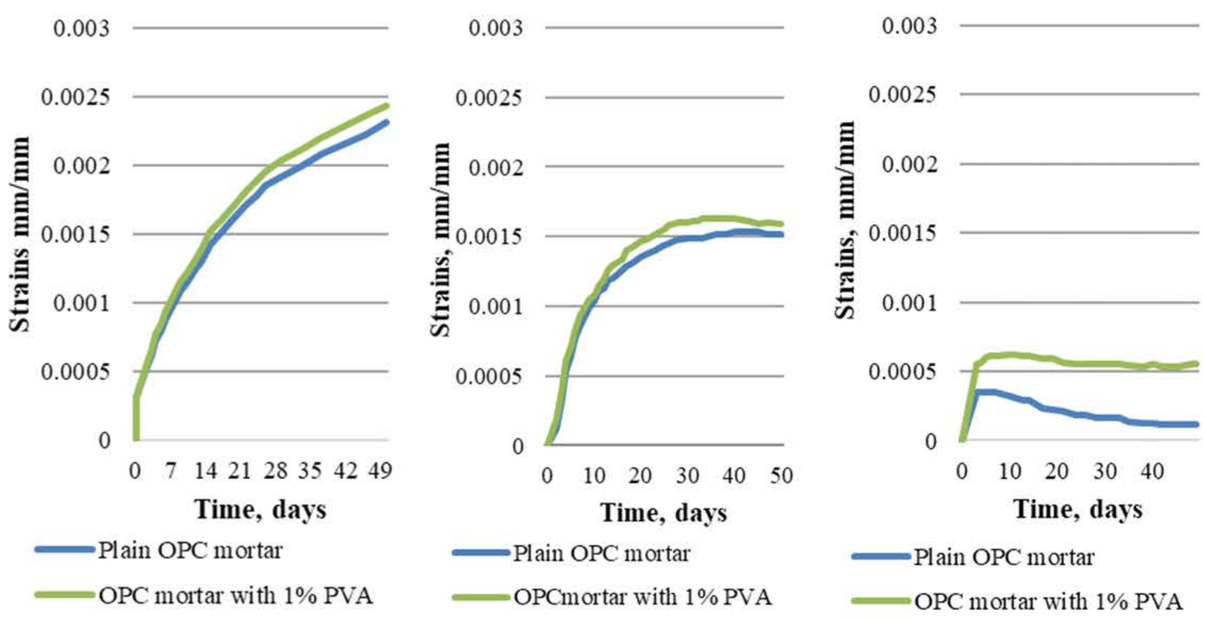
## Pētījuma mērķis

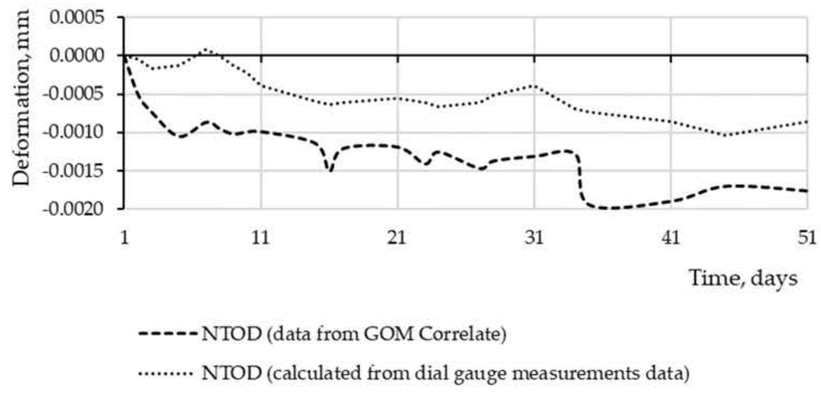
Pētījuma mērķis - eksperimentālā veidā noteikt jauno betonu un cementa kompozītu (JBCK) ilglaicīgās īpašības - šļūdi un rukuma deformācijas, tai skaitā pielietojot digitālo attēlu uzmērīšanas pieeju, kas šādam veida mērķim iepriekš nav izmantota.



## Rezultāti un diskusija

Aprobējot šļūdes deformāciju noteikšanas metodi un jauno deformāciju mērīšanas pieeju kopā pārbaudīti vairāk kā 20 dažādi betona un cementa kompozīti ar dažādām šķiedrām. Paraugi pārbaudīti ilglaicīgā spiedē, stiepē un trīs punktu liecē, nosakot šļūdes deformācijas, kā arī paralēli noteiktas žūšanas rukuma deformācijas (sk. augstāk esošos fotoattēlus). Zemāk redzamas eksperimentāli noteiktās kopējās deformācijas dažādos spriegumu stāvokļos. Detalizētu informāciju par citiem eksperimentālajiem testiem un to rezultātiem skatīt publikācijās (Sopus ID: 55359789500).




**Grafiki ņemti no publikācijām:**

[1] Sprince A., Kozlovskis T., Gailitis R., Valivonis J., Korniejenko K. and Castel A. Tensile creep of cement and concrete composites: Monitoring by means of 2D-digital image correlation, Open Access Journal MDPI Applied Sciences, Special Issue "Structural Performances of Concrete Composite Members: Experimental, Theoretical, Numerical Approaches II", Appl. Sci. 2021, Volume 11, Issue 18, 8334, Published: 8 September 2021; (SCOPUS) / https://doi.org/10.3390/app11188334

[2] Sprince A., Gailitis R., Pakrastins L., Kozlovskis T., Vatin N. Long-term properties of reinforced and plain ordinary Portland cement mortar under compression, tension, and 3-point bending, Magazine of Civil Engineering 105(05), 2021, Article No.10511, ISSN 2712-8172, Date of issue: September 2021 (SCOPUS) / https://doi.org/10.34910/MCE.105.11

## Secinājumi

Jaunā, patentētā (Nr.15667B) deformāciju uzmērīšanas pieeja – digitālo attēlu reģistrēšanas metode (DIC) ir piemērota pētījuma mērķa sasniegšanai.
Iegūtie ilglaicīgie dati – šļūdes un rukuma deformācijas, kā arī noteiktie ilglaicīgie parametri var būt noderīgi konstrukciju projektēšanā, kā arī veidojot jaunus JBCK un pārbaudītu no tiem veidotu konstrukciju ilglaicīgās īpašības.
Iespējams šī jaunā deformāciju noteikšanas pieeja būtu noderīga arī esošo ēku, tiltu u.c. būvkonstrukciju uzraudzībai.

Latvijas Republikas Patentu valde

Citadeles iela 7/70, Rīga, LV-1010, tālr. 67099600, fakss 67099650, e-pasts lietvediba@lrpv.gov.lv, www.lrpv.gov.lv

Adresāts:
Jevgenijs FORTŪNA
FORAL Intelektuālā īpašuma aģentūra, SIA
foral@foral.lv

**LĒMUMS**
Par patenta piešķiršanu saskaņā ar Patentu likuma 37. panta pirmo daļu

| Jūsu šifrs | Pasenta pieteikuma numurs | Datums |
|---|---|---|
| P4325 | 15667 | 07.09.2022. |

Patentu valde paziņo, ka patenta pieteikums atbilst Patentu likuma 37. panta prasībām un tam var piešķirt patentu.

| | |
|---|---|
| (21) Patenta pieteikuma Nr. | LVP2021000080 |
| (22) Pieteikuma datums | 03.11.2021 |
| (51) Starptautiskās patentu klasifikācijas indekss | G01N 3/08; G01N 3/40; G01N 1/28 |
| (41) Pieteikuma publikācijas datums | 20.08.2022. |
| (71) Pieteicēji | RĪGAS TEHNISKĀ UNIVERSITĀTE, Kaļķu iela 1, Rīga, LV-1658, LV |
| (72) Izgudrotāji | Andīna SPRINCE, Ķīpsalas iela 6B, Rīga, LV-1048, LV<br>Tomass KOZLOVSKIS, Ķīpsalas iela 6B, Rīga, LV-1048, LV<br>Leonīds PAKRASTIŅŠ, Ķīpsalas iela 6B, Rīga, LV-1048, LV |
| (74) Pārstāvis/patentpilnvarnieks | Jevgeņijs FORTŪNA, FORAL Intelektuālā īpašuma aģentūra, SIA, Kalēju iela 14 - 7, Rīga, LV-1050, LV |
| (54) Izgudrojuma nosaukums | PAŅĒMIENS SMALKGRAUDAINA BETONA UN CEMENTA KOMPOZĪTU ŠĻŪDES DEFORMĀCIJU STIEPES SLOGOJUMĀ NOTEIKŠANAI |

Ziņas par patentu tiks publicētas Patentu valdes oficiālajā izdevumā saskaņā ar Patentu likuma 38. panta pirmo, otro un trešo daļu un patents tiks reģistrēts patentu reģistrā saskaņā ar Patentu likuma 38. panta ceturto daļu, ja 3 mēnešu laikā saskaņā ar Patentu likuma 38. panta pirmo daļu un 2015. gada 15. decembra Ministru kabineta noteikumiem Nr. 723 "Patentu valdes maksas pakalpojumu cenrādis" tiks samaksāta maksa par patenta piešķiršanu un publikāciju (rēķinu maksājuma veikšanai skatīt pielikumā).

Ja maksa par patenta piešķiršanu un publikāciju noteiktajā termiņā netiks samaksāta, patents saskaņā ar Patentu likuma 38. panta piekto daļu netiks piešķirts.
Veicot apmaksu, maksājuma dokumentos jānorāda patenta pieteikuma numurs un priekšapmaksas rēķina numurs.

Patenta departamenta
vecākā eksperte
D.Orlova
Tālr. 67099643
Diana.orlova@lrpv.gov.lv

## Kontaktinformācija

RTU BIF Būvkonstrukciju inženierzinātņu institūta
Vadošā pētniece Dr.sc.ing. **Andīna Sprince**
andina.sprince@rtu.lv

RĪGAS TEHNISKĀ UNIVERSITĀTE
NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020
EIROPAS SAVIENĪBA
Eiropas Sociālais fonds
IEGULDĪJUMS TAVĀ NĀKOTNĒ

Pasaules latviešu zinātnieku kongress

**Dr.Sc.ing. Andīna Sprince**

Rīgas Tehniskā universitāte
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1.1.1.2/VIAA/3/19/401

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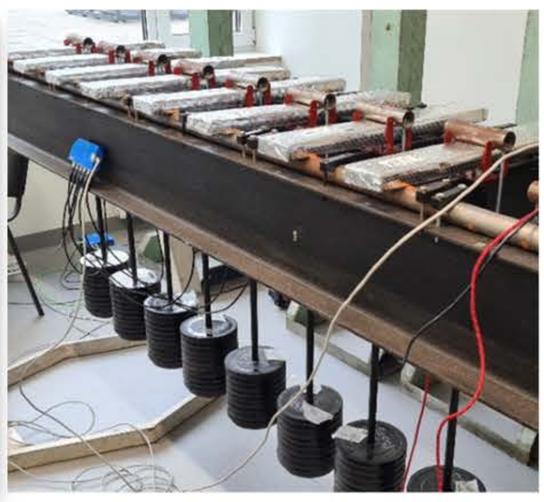
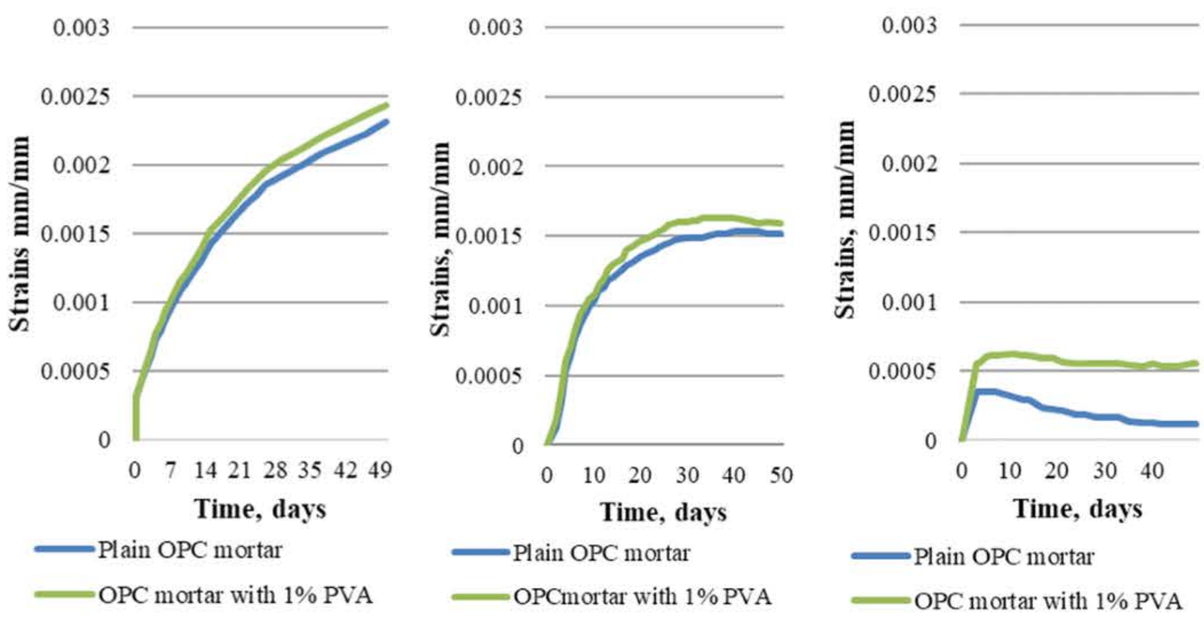
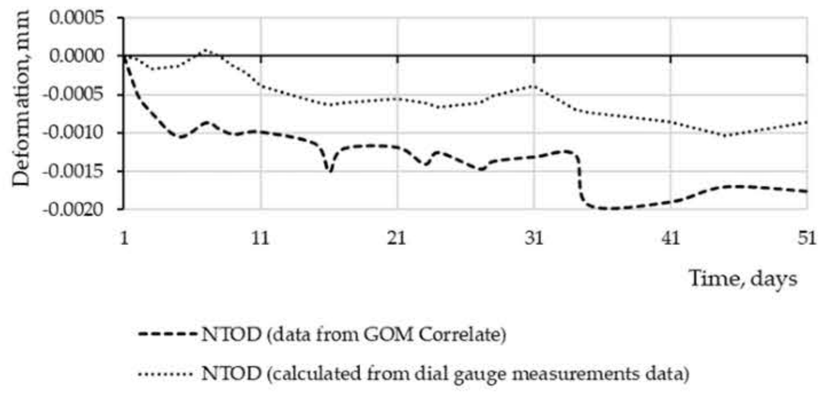


## Rezultāti un diskusija

Aprobējot šļūdes deformāciju noteikšanas metodi un jauno deformāciju mērīšanas pieeju kopā pārbaudīti vairāk kā 20 dažādi betona un cementa kompozīti ar dažādām šķiedrām. Paraugi pārbaudīti ilglaicīgā spiedē, stiepē un trīs punktu liecē, nosakot šļūdes deformācijas, kā arī paralēli noteiktas žūšanas rukuma deformācijas (sk. augstāk esošos fotoattēlus). Zemāk redzamas eksperimentāli noteiktās kopējās deformācijas dažādos spriegumu stāvokļos. Detalizētu informāciju par citiem eksperimentālajiem testiem un to rezultātiem skatīt publikācijās (Sopus ID: 55359789500).



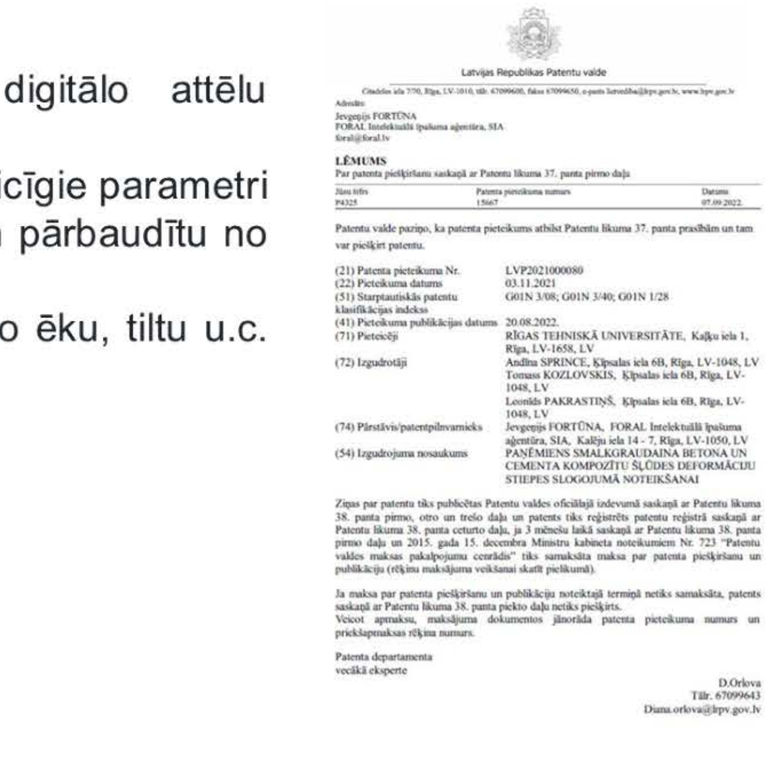

**Grafiki ņemti no publikācijām:**

[1] Sprince A., Kozlovskis T., Gailitis R., Valivonis J., Korniejenko K. and Castel A. Tensile creep of cement and concrete composites: Monitoring by means of 2D-digital image correlation, Open Access Journal MDPI Applied Sciences, Special Issue "Structural Performances of Concrete Composite Members: Experimental, Theoretical, Numerical Approaches II", Appl. Sci. 2021, Volume 11, Issue 18, 8334, Published: 8 September 2021; (SCOPUS) / https://doi.org/10.3390/app11188334

[2] Sprince A., Gailitis R., Pakrastins L., Kozlovskis T., Vatin N. Long-term properties of reinforced and plain ordinary Portland cement mortar under compression, tension, and 3-point bending, Magazine of Civil Engineering 105(05), 2021, Article No.10511, ISSN 2712-8172, Date of issue: September 2021 (SCOPUS) / https://doi.org/10.34910/MCE.105.11

## Secinājumi

Jaunā, patentētā (Nr.15667B) deformāciju uzmērīšanas pieeja – digitālo attēlu reģistrēšanas metode (DIC) ir piemērota pētījuma mērķa sasniegšanai.
Iegūtie ilglaicīgie dati – šļūdes un rukuma deformācijas, kā arī noteiktie ilglaicīgie parametri var būt noderīgi konstrukciju projektēšanā, kā arī veidojot jaunus JBCK un pārbaudītu no tiem veidotu konstrukciju ilglaicīgās īpašības.
Iespējams šī jaunā deformāciju noteikšanas pieeja būtu noderīga arī esošo ēku, tiltu u.c. būvkonstrukciju uzraudzībai.



Latvijas Republikas Patentu valde

Citadeles iela 7/10, Rīga, LV-1010, tālr. 67099600, fakss 67099650, e-pasts lietvediba@lrpv.gov.lv, www.lrpv.gov.lv

Adresātu:
Jevgeņijs FORTŪNA
FORAL Intelektuālā īpašuma aģentūra, SIA
foral@foral.lv

**LĒMUMS**
Par patenta piešķiršanu saskaņā ar Patentu likuma 37. panta pirmo daļu

| Jūsu ref/rs | Patenta pieteikuma numurs | Datums |
|---|---|---|
| P4325 | 15667 | 07.09.2022. |

Patentu valde paziņo, ka patenta pieteikums atbilst Patentu likuma 37. panta prasībām un tam var piešķirt patentu.

| | |
|---|---|
| (21) Patenta pieteikuma Nr. | LVP2021000080 |
| (22) Pieteikuma datums | 03.11.2021 |
| (51) Starptautiskās patentu klasifikācijas indekss | G01N 3/08; G01N 3/40; G01N 1/28 |
| (41) Pieteikuma publikācijas datums | 20.08.2022. |
| (71) Pieteicēji | RĪGAS TEHNISKĀ UNIVERSITĀTE, Kaļķu iela 1, Rīga, LV-1658, LV |
| (72) Izgudrotāji | Andīna SPRINCE, Ķīpsalas iela 6B, Rīga, LV-1048, LV<br>Tomass KOZLOVSKIS, Ķīpsalas iela 6B, Rīga, LV-1048, LV<br>Leonīds PAKRASTIŅŠ, Ķīpsalas iela 6B, Rīga, LV-1048, LV |
| (74) Pārstāvis/patentpilnvarnieks | Jevgeņijs FORTŪNA, FORAL Intelektuālā īpašuma aģentūra, SIA, Kalēju iela 14 - 7, Rīga, LV-1050, LV |
| (54) Izgudrojuma nosaukums | PAŅĒMIENS SMALKGRAUDAINA BETONA UN CEMENTA KOMPOZĪTU ŠĻŪDES DEFORMĀCIJU STIEPES SLOGOJUMĀ NOTEIKŠANAI |

Ziņas par patentu tiks publicētas Patentu valdes oficiālajā izdevumā saskaņā ar Patentu likuma 38. panta pirmo, otro un trešo daļu un patents tiks reģistrēts patentu reģistrā saskaņā ar Patentu likuma 38. panta ceturto daļu, ja 3 mēnešu laikā saskaņā ar Patentu likuma 38. panta pirmo daļu un 2015. gada 15. decembra Ministru kabineta noteikumiem Nr. 723 "Patentu valdes maksas pakalpojumu cenrādis" tiks samaksāta maksa par patenta piešķiršanu un publikāciju (rēķinu maksājuma veikšanai skatīt pielikumā).

Ja maksa par patenta piešķiršanu un publikāciju noteiktajā termiņā netiks samaksāta, patents saskaņā ar Patentu likuma 38. panta piekto daļu netiks piešķirts.
Veicot apmaksu, maksājuma dokumentos jānorāda patenta pieteikuma numurs un priekšapmaksas rēķina numurs.

Patenta departamenta
vecākā eksperte

D.Orlova
Tālr. 67099643
Diana.orlova@lrpv.gov.lv

## Kontaktinformācija

RTU BIF Būvkonstrukciju inženierzinātņu institūta
Vadošā pētniece Dr.sc.ing. **Andīna Sprince**
andina.sprince@rtu.lv

RĪGAS TEHNISKĀ UNIVERSITĀTE
NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020
EIROPAS SAVIENĪBA
Eiropas Sociālais fonds
IEGULDĪJUMS TAVĀ NĀKOTNĒ

World Congress of Latvian Scientists

# MARITIME SPATIAL PLANNING PERSPECTIVES IN THE BALTIC SEA REGION

**Leila Neimane**

University of Latvia,
Faculty of Law, Institute of Legal Science

## Introduction

Recent increased demand for marine space, driven by a variety of needs, must at the same time be balanced by the necessity to ensure the proper functioning of marine ecosystems. In 2014, Directive 2014/89/EU establishing the framework for **maritime spatial planning (MSP)** came into force, requiring the development of countries' maritime spatial plans by 31 March 2021.

Against this background, the Baltic Sea region countries' cooperation in marine governance can be seen more broadly via the lens of MSP, its practical examples, and the field's topicalities, reflecting the necessary environmental transformation. As a result, this research conducts an in-depth study of the framework and implementation challenges of effective MSP regulation and best practice examples in the Baltic Sea region.

## Research Objective

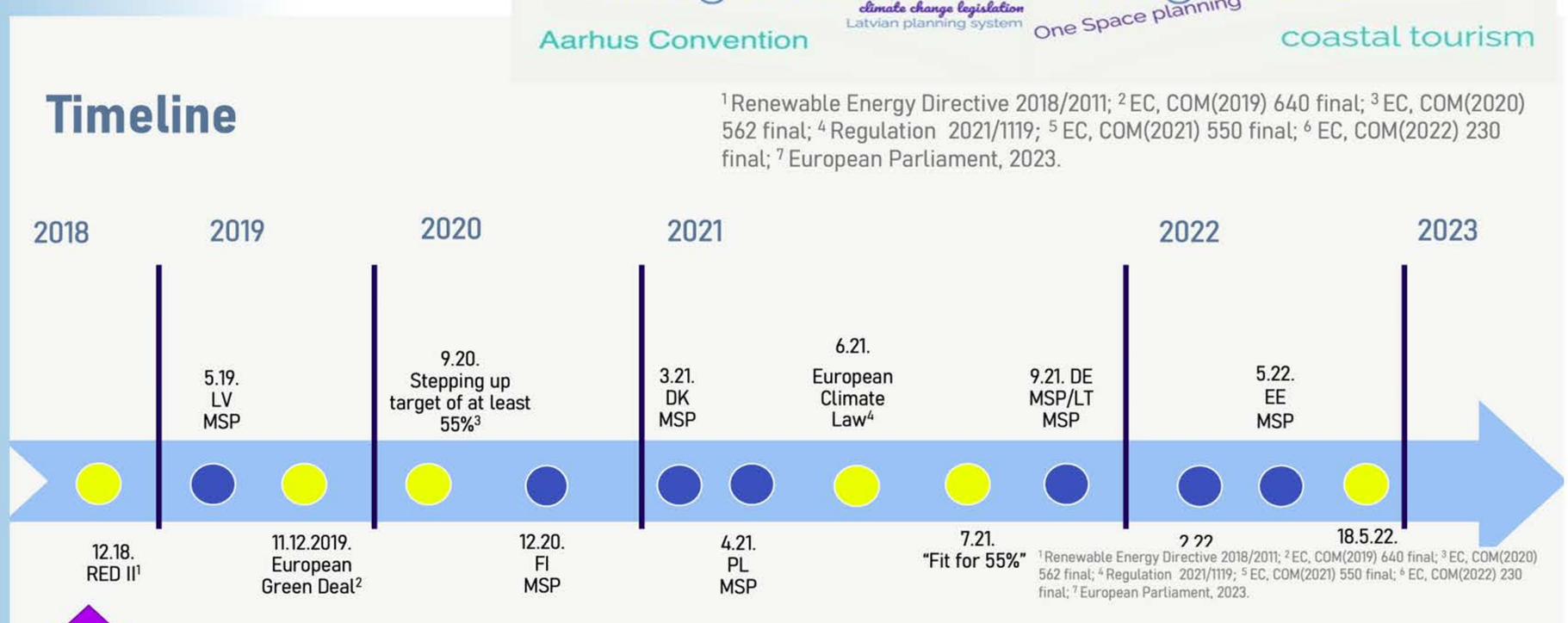
The scientific aim is to ensure transparency of the legal environment, facilitating the implementation of effective MSP in line with the legal framework for those applying legal norms, industry representatives and spatial planning specialists. For this purpose, scientific research methods used are historical, descriptive, analytical, comparative and triangulation, semi-structured in-depth interviews and case studies.

## Results & Discussion

Since MSP is currently a new field on a national scale, and there are few practical activities at sea, the possibility of using the experience of other countries is of particular importance, including concerning the planning process, its efficiency and its coherence with the legal framework. Overall, following the development of MSP in the Baltic Sea region, this can be assessed as consistent and of high quality.


The manual is available here: https://www.jf.lu.lv/par-mums/juridiskas-zinatnes-instituts/instituta-zinas/

### Timeline




[1] Renewable Energy Directive 2018/2011; [2] EC, COM(2019) 640 final; [3] EC, COM(2020) 562 final; [4] Regulation 2021/1119; [5] EC, COM(2021) 550 final; [6] EC, COM(2022) 230 final; [7] European Parliament, 2023.

### The continuing MSP cycle




## Conclusions

However, major challenges to be addressed by the legal framework are the implementation of MSP, monitoring and evaluation, as well as involvement by the general public and taking social and cultural interests into account in MSP. Issues of increasing energy production capacity in the marine environment and protecting biodiversity are also fundamental in light of ambitious climate goals.

**Contact Information:** leila.neimane@lu.lv

This study is implemented at the Research Project "Effective Maritime Spatial Planning Regulation Framework and Implementation Challenges and Best Practice Examples for the Context of the Baltic Sea" (No.1.1.1.2/VIAA/3/19/514) financially supported by the specific support objective activity No.1.1.1.2. "Post-doctoral Research Aid" of the Republic of Latvia and funded by the European Regional Development Fund (No. 1.1.1.2/16/I/001)

LATVIJAS UNIVERSITĀTE · NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020 · EIROPAS SAVIENĪBA Eiropas Reģionālās attīstības fonds
IEGULDĪJUMS TAVĀ NĀKOTNĒ

Pasaules latviešu zinātnieku kongress

# Life cycle recognition in revitalization of degraded sites – step forward to circularity and sustainability

Z. Vincēviča-Gaile
J. Burlakovs
M. Kļaviņš

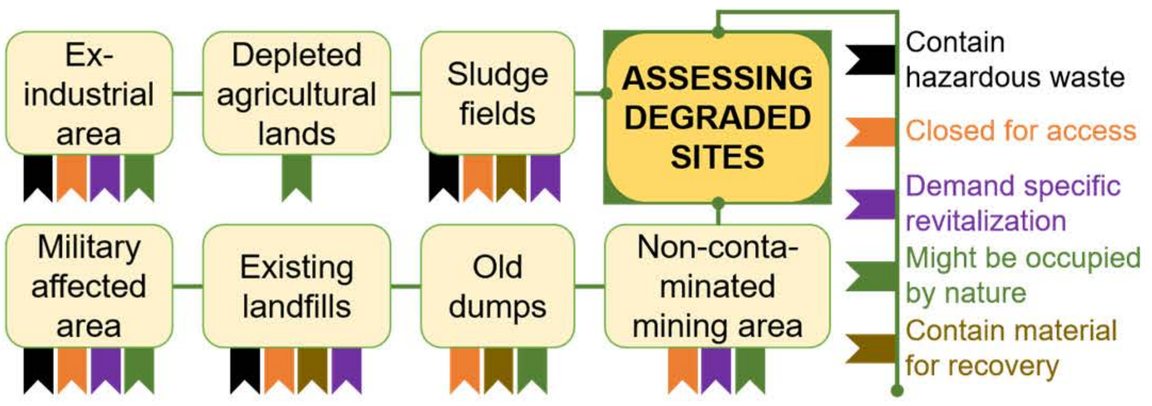
LATVIJAS UNIVERSITĀTE

28.-29.06.2023.

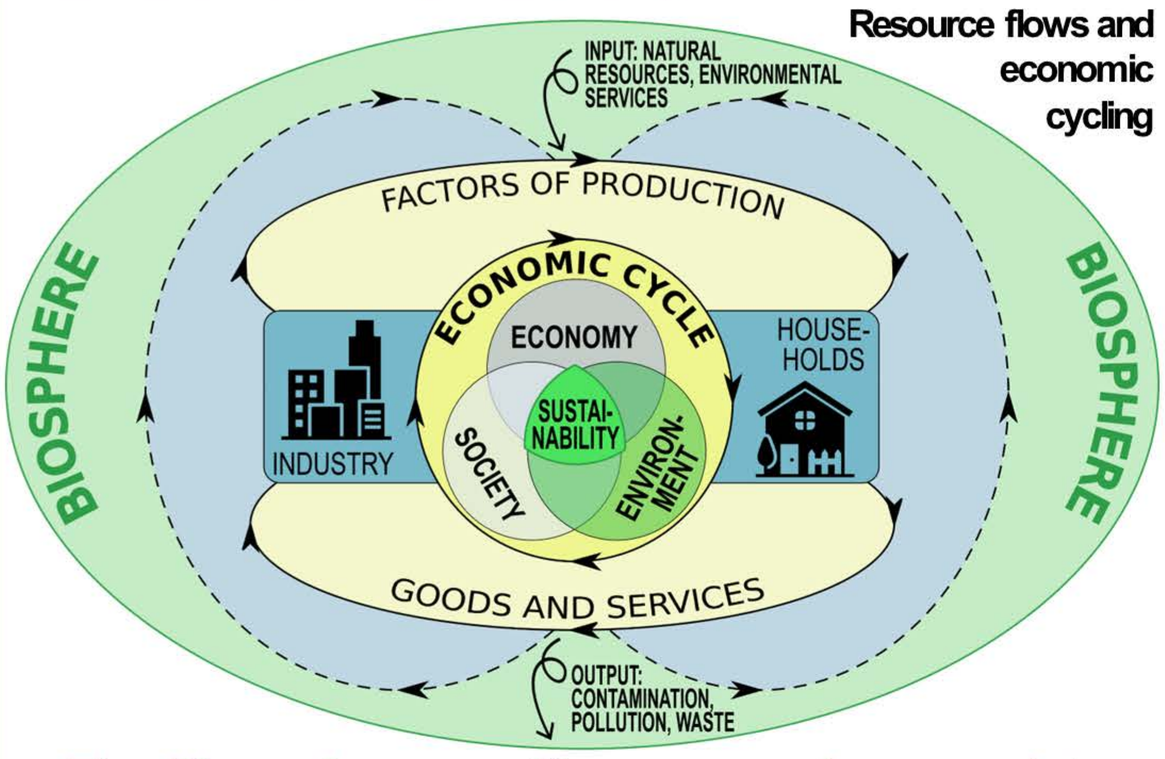
V Pasaules latviešu zinātnieku kongress "Zinātne Latvijai"

## TOPICALITY

More than a million **degraded sites – the territories affected by various contamination or degradation impacts** – such as brownfields, dumps, landfills, and abandoned industrial domains are recognized over the European Union, many of them causing continuing hazards of long-term environmental pollution. Usually, these are distant areas where investors do not see economically viable solutions, and the need for redevelopment is insufficient to cover conventional remediation or recovery costs.




It is common that **degraded sites are forgotten by society, closed, unmaintained and overgrown**. One may say that the 'natural revitalization' of the area happens over time or that 'time cures everything'. But the questions remain – should we waste time waiting, and what are faster solutions in returning the lost site as value to the economy and society?




**Resource flows and economic cycling**

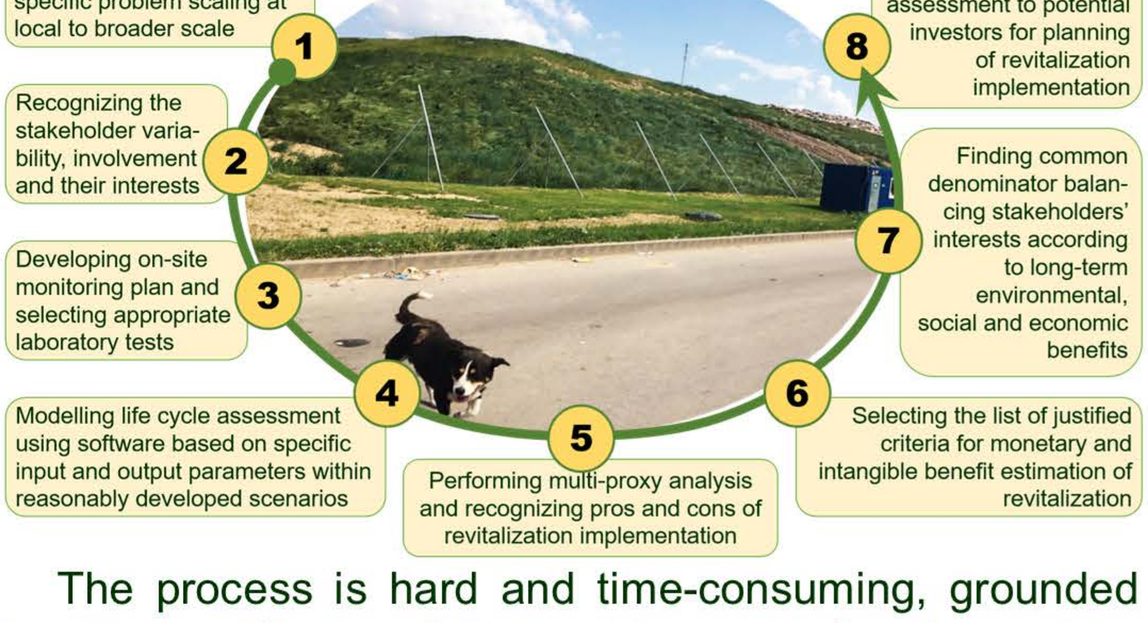
**The life cycle recognition approach means integrating environmental (ecological), social and economic interests for one sustainable solution.**

For instance, revitalizing a former dumpsite may result in recovered ecosystem services in environmental interests, open green space with maintained infrastructure in social interests, and recovery of secondary materials by urban mining followed by regained land assets in economic interests.

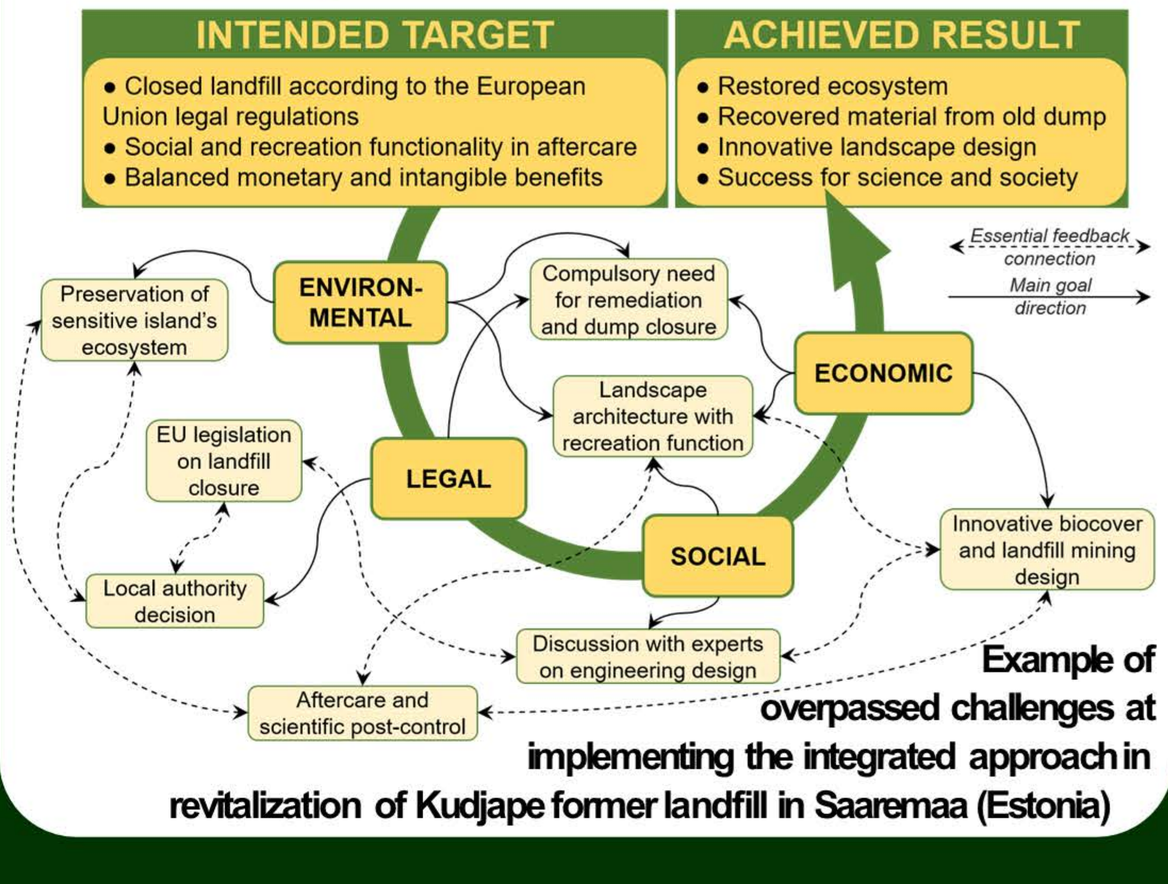
Kudjape former landfill (in Estonia) after revitalization

## RESEARCH AND APPLICATION

Life cycle recognition in degraded site revitalization involves detailed interdisciplinary expertize and integration of a complex of activities:




The process is hard and time-consuming, grounded in site-specifics, and it must be open for discussions among all stakeholders – scientists, experts, legal representatives (from the state level and municipalities), investors, non-governmental organizations and society.




**Example of overpassed challenges at implementing the integrated approach in revitalization of Kudjape former landfill in Saaremaa (Estonia)**

## CONCLUDING REMARKS

The approach of life cycle recognition in revitalization depends on selected indicator estimation expressed in monetary terms and environmental burdens such as emitted or avoided greenhouse gas emissions, impact on humans and ecosystems, and recovery potential of secondary resources and energy, the latter is substantially significant for the implementation of the circular economy in terms of sustainability.

| ECONOMIC | AESTHETIC |
|---|---|
| • Savings from excessive contaminant monitoring<br>• Income from the recovered materials<br>• Financial gains from site redevelopment<br>• Increased land assets value | • Holistic perspective for urban, periurban and rural long-term planning<br>• Site development for society needs<br>• Well-kept landscape<br>• Environmental awareness |

**BENEFITS GAINED FROM REVITALIZATION**

| ENVIRONMENTAL | LEGAL / POLICY |
|---|---|
| • Mitigation of human, animal health risks<br>• Reduction of polluted sites<br>• Recovery of ecosystems<br>• Reduction of emissions<br>• Leachate treatment; purified water return<br>• Geotechnical safety | • Compliance with environmental management and planning documents<br>• Cancelled restrictions and openness of the site for new perspectives<br>• Step forward to environmental sustainability |

Contact us: zane.gaile@lu.lv • juris@geo-it.lv

UNIVERSITY OF LATVIA FACULTY OF GEOGRAPHY AND EARTH SCIENCES

www.wise.lu.lv

Pasaules latviešu zinātnieku kongress

**Līga Proškina , Dace Kaufmane**
**Kaspars Naglis-Liepa , Līga Paula**
**Daniela Proškina, Sallija Ceriņa**

Latvijas Biozinātņu un tehnoloģiju universitāte

# Mājražotāju iekļaušanās bioreģionu sistēmā

## Ievads

Eiropas Ekonomikas un sociālo lietu komitejas atzinumā par ilgtspējīgākām pārtikas sistēmām ir uzsvērta nepieciešamība pēc visaptverošas pārtikas politikas Eiropas Savienībā, kuras pamatā ir vairāki pīlāri, tostarp īsāku pārtikas piegādes ķēžu izveide. Tipiska pieeja, ko izmanto, lai izskaidrotu atšķirības starp īsām un globālām pārtikas piegādes ķēdēm, ir ģeogrāfiskais tuvums starp pārtikas pārstrādes uzņēmumu un patērētāju, kā arī iesaistīto dalībnieku skaits, tomēr ir vairāki pētījumi, kuros uzsvērta saikne starp vietējo pārtikas ražošanu un vietējo kopienu, kā arī pārtikas ražošanas sociālās un vides ietekmes apmērs kā tas nav globālās rūpnieciskās pārtikas ražošanas sistēmas gadījumā.

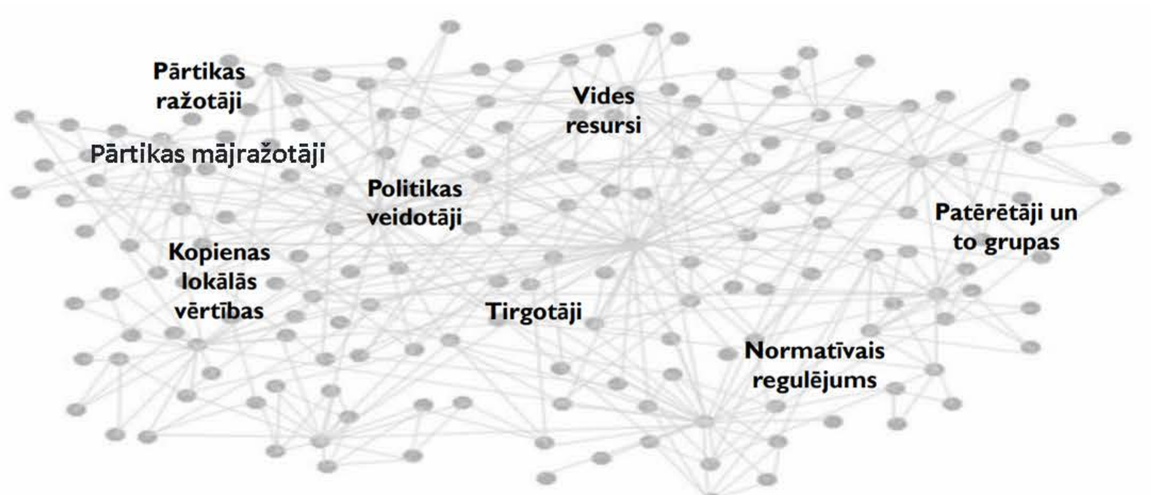
Tas nosaka nepieciešamību meklēt jaunus risinājumus lauku teritoriju ilgtspējīgai attīstībai, kas iedarbotos uz lauku teritorijām no sociālā, ekonomiskā, kultūras un vides aspektiem.
Viens no potenciālajiem risinājumiem, kā mainīt esošās reģionālās attīstības virzienu, varētu būt bioreģionu izveide un attīstība Latvijā, kas vērsti uz vietējās ekonomikas veicināšanu, nacionāli radītu produktu un lokālu pārtikas tīklu attīstību kopienu (mazpilsētu, novadu) līmenī.

## Pētījuma mērķis

Izvērtēt pārtikas mājražotāju iekļaušanos bioreģionu konceptā Latvijā

## Rezultāti un diskusija

Bioreģionu izveides būtība ir vērsta uz ilgtspējīgu teritoriju attīstību, vietējas ekonomikas veicināšanu, nacionāli radītu produktu un lokālu pārtikas ķēžu attīstību, vietējo kopienu līmenī, saglabājot teritorijai raksturīgas ainavas, kultūras mantojumu un gastronomiskās īpatnības.




Vietējā pārtikas sistēma
*Sistēmpieeja, Actor-Network Theory (M. Callon, B. Latour)*

Vietējās pārtikas sistēmas būtībā ir saistītas ar dažādu attiecību veidošanu ar patērētājiem, attiecībām, kas rada vērtību un nozīmi ap produktu un tā izcelsmi, jo iesaistītās saimniecības veic ne vien lauksaimniecisko ražošanu, bet arī citas būtiskas funkcijas: ar vides saudzēšanu un ainavu uzturēšanu saistītas darbības, bioloģiskās daudzveidības saglabāšana, kultūras tradīciju uzturēšana un nodošana nākamajām paaudzēm, lokālo vērtību popularizēšana, lauku apdzīvotības un sakoptības uzturēšana, kas pilnībā atbilst bioreģionu stratēģiskajiem principiem.

| IEINTERESĒTĀ PUSE | KATEGORIJA | | | | | |
|---|---|---|---|---|---|---|
| | RAŽOŠANA | TIRGUS ĶĒDES | ZINĀTNE UN IZGLĪTĪBA | | TERITORIJAS PĀRVALDE | |
| | | | PĒTNIECĪBA | CITS | ASOCIĀCIJAS | INSTITŪCIJAS |
| Lauksaimniecība | Mazie bioloģiskie ražotāji<br>Mazie konvencionālie ražotāji<br>Vidējie bioloģiskie ražotāji<br>Vidējie konvencionālie ražotāji | Bioloģiskās tirgus ķēdes<br>Konvencionālās tirgus ķēdes | Universitātes<br>Izmēģinājuma saimniecības | Apmācību centri<br>Profesionālās vidējās izglītības skolas | Lauksaimnieku asociācijas/kooperatīvi<br>Ražotāju organizācijas | Pašvaldību administrācija<br>Valsts iestāžu administrācija<br>Ministrijas |
| Pārstrāde | Mazie bioloģiskie ražotāji<br>Mazie konvencionālie ražotāji<br>Vidējie bioloģiskie ražotāji<br>Vidējie konvencionālie ražotāji | Bioloģiskās tirgus ķēdes<br>Konvencionālās tirgus ķēdes | Universitātes<br>Izmēģinājuma ražošana | Apmācību centri<br>Profesionālās vidējās izglītības skolas | Mazo ražotāju apvienības<br>Vidējo ražotāju apvienības | |
| Izplatīšana | Lauksaimnieki un ražotāji, kas darbojas asociācijās un vietējos tirgos<br>Tiešā tirdzniecība (lauksaimnieki un ražotāji) | Bioloģisko lauksaimnieku apvienības/asociācijas<br>Vietējais tirgus<br>Konvencionālās tirgus ķēdes<br>Bioloģiskās tirgus ķēdes<br>Mazie tirgotāji | | Mazo tirgotāju asociācijas | Bioloģisko lauksaimnieku apvienības/asociācijas<br>Mazo tirgotāju asociācijas | |

Bioreģionu sistēmas ieinteresēto pušu klasifikācija, atbilstoši vietējo pārtikas sistēmu pieejai
*Gureschi, et al., 2020*

Praktiskie ieguvumi katrā no ilgtspējas dimensijām ir būtiski - ainavu veidošana, stabils tirgus, iekšējas pārtikas ķēdes, nodarbinātības līmeņa pieaugums laukos, pārskatāmība attiecība uz pārtikas produktu izcelsmi, tā pat arī iedzīvotāju pašapziņas celšana par vietējo kultūru un identitāti.

## Secinājumi

Bioreģionu konceptu vislielākajā mērā var attiecināt uz pārtikas ražošanu, taču bioreģionā ražoto pārtikas produktu popularizēšana ir cieši saistīta ar vietējas pārtikas sistēmu attīstīšanu, pašas teritorijas popularizēšanu un tūrisma stratēģiju.
Pārtikas mājražotājus, vietējās pārtikas sistēmas ietvaros, raksturo īsa piegādes ķēde, kurā produktu ražošana, apstrāde, tirdzniecība un patēriņš notiek relatīvi mazā ģeogrāfiskā attālumā,
līdz ar to tām piemīt vairākas priekšrocības, kas sniedz būtisku pozitīvu efektu vietējās ekonomikas veicināšanā - dažādo lauku ekonomiku, veicina lielāku ekonomisko neatkarību, sekmē vietējā potenciāla attīstību un uzlabo teritorijas tēlu.

## Kontaktinformācija

**Latvijas Biozinātņu un tehnoloģiju universitāte**
**Ekonomikas un sabiedrības attīstības fakultāte**
**Dr.oec, Asoc.prof. Līga Proškina**
**liga.proskina@lbtu.lv**

Fundamentālo un lietišķo pētījumu projekts Nr. lzp-2022/1-0519 «**Bio-reģioni kā integrēta stratēģija ilgtspējīgai lauku teritoriju attīstībai Latvijā».**

FLPP FUNDAMENTĀLO UN LIETIŠĶO PĒTĪJUMU PROJEKTI
Latvijas Biozinātņu un tehnoloģiju universitāte

Pasaules latviešu zinātnieku kongress

# APPLICABILITY OF LOCAL BIOMASS RESOURCES FOR EFFICIENT AND GREEN HEAT ENERGY PRODUCTION

**Raimonds Valdmanis, Maija Zaķe**

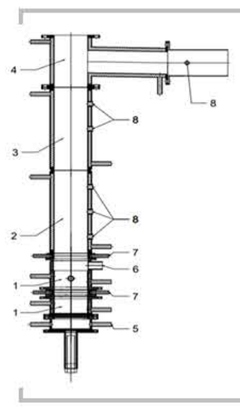
Latvijas Universitātes Fizikas Institūts

## Introduction

« **The given study meets the requirements set in the context of climate change in the Sustainable Development Program for 2030 and the Paris Agreement: increase the quotas of renewable energy resources and switch to greener technologies, improving sustainable energy production with a gradual transition from the use of fossil fuels (coal, oil and natural gas) in energy production on renewable energy resources (solar, wind, water or biomass). Since seasonal climate changes in Latvia significantly affect the production of solar, wind and hydropower, research is being conducted on the use of locally available bioenergy resources (wood, straw, peat) for efficient and sustainable heat energy production, developing innovative methods for the local heat production process control and improvement.**

## Research Objective

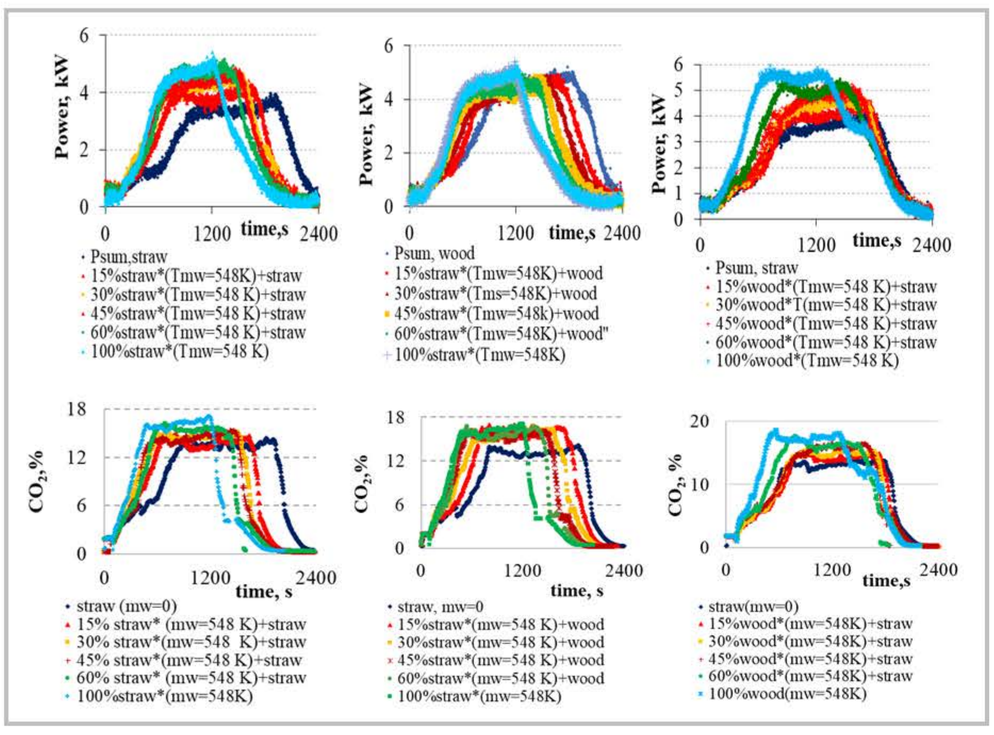
**The aim of research is to promote wider use of regional bioenergy resources to produce environmentally friendly, sustainable, and efficient heat energy with innovative approach to the improvement of heat production. This approach includes microwave (MW) pretreatment of biomass pellets of different origins (wood, straw, peat), creation of selectively activated pellet mixtures of optimal composition and use of the electric field to enhance the processes of heat/mass transfer.**

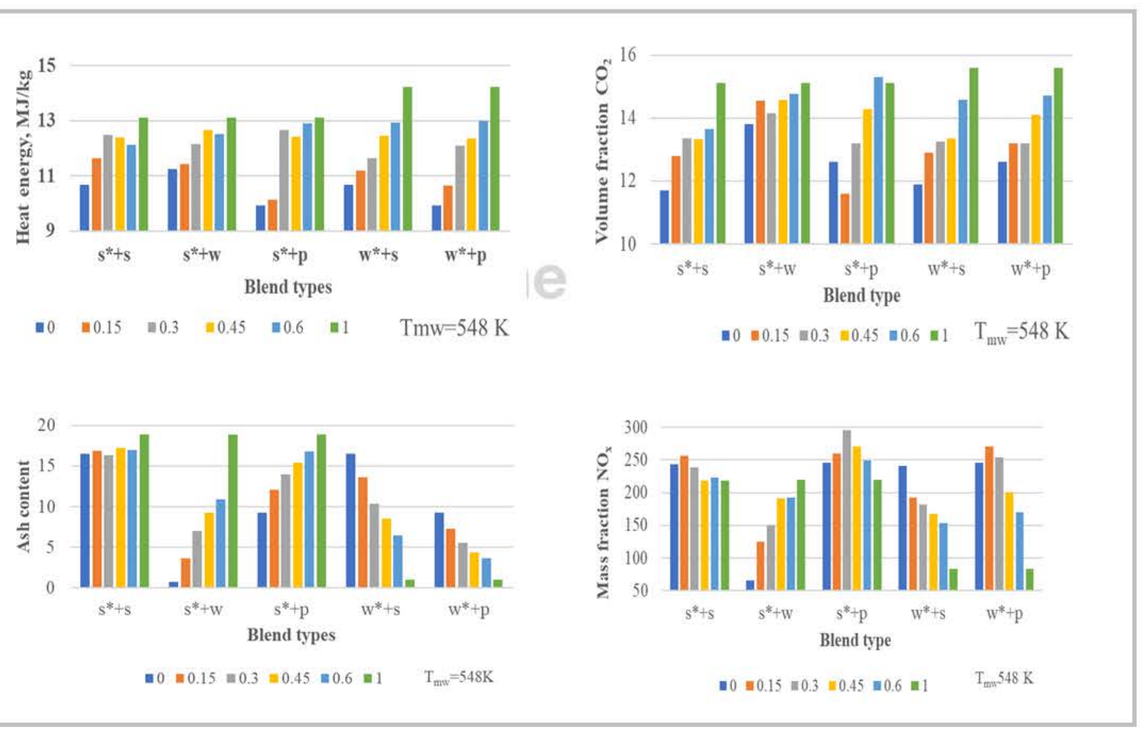


For the picture

A sketch of the experimental device: 1 – gasifier; 2, 3, 4 – water-cooled sections of the combustor; 5 - primary air; 6 – propane flame supply nozzle; 7 – secondary air supply nozzle; 8.- orifices for the diagnostic tools. supply nozzle

## Results & Discussion

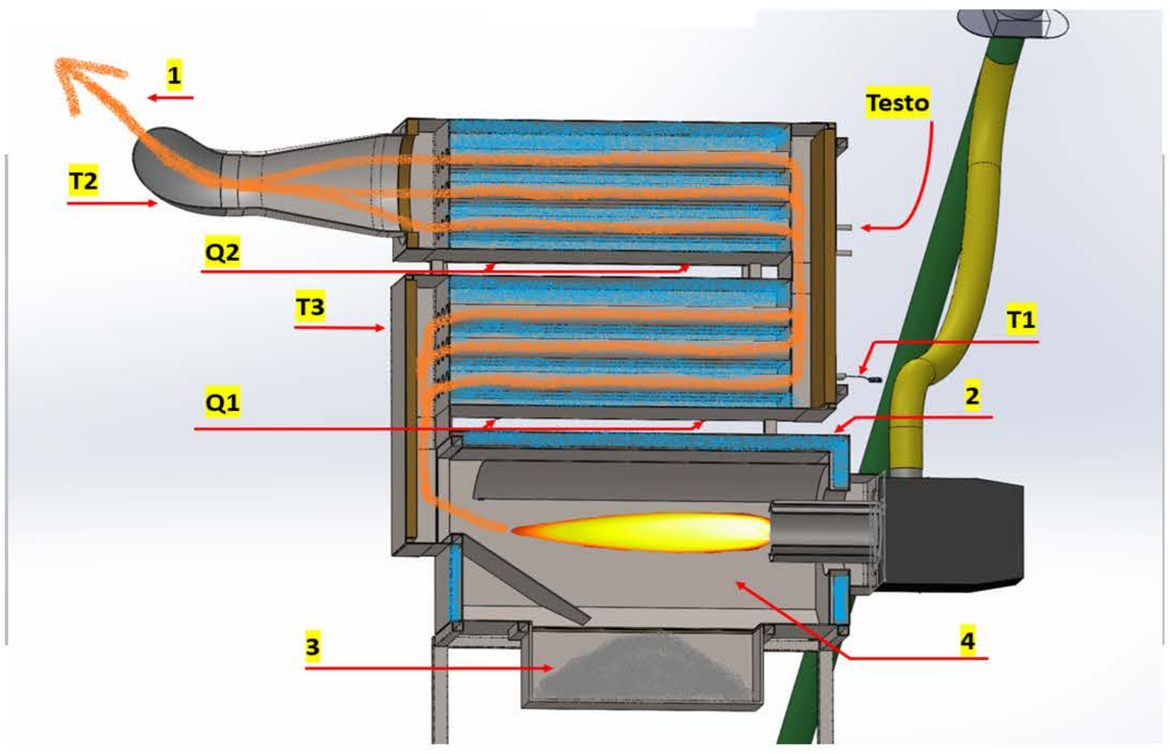



Research has been conducted evaluating the impact of MW pretreatment of pellets on the formation of combustion and heat production processes of selectively activated mixtures. It has been established that MW pretreatment of biomass pellets and their mixing with non-activated biomass pellets of different origin contribute to faster ignition and more complete combustion of the mixture, improving the heat production process and the composition of emissions, depending on the mixture composition and the temperature of MW pretreatment. An additional improvement of heat production (by 10-12%) is achieved using electric field effects on the flame.

## Conclusions

Results presented above suggest that microwave pretreatment of local energy resources – different origin biomass pellets, the formation of selectively activated biomass blends and electric field enhanced process of heat/mass transfer can be used as the effective tool to provide control of biomass thermochemical conversion, improving heat energy production and composition of emissions.




## Contact Information

Raimonds Valdmanis mob. 371 20 393 880, raimonds.valdmanis@lu.lv

Pasaules latviešu zinātnieku kongress

# Dzīvsudraba piesārņojums melnajos stārķos Latvijā

Atis Skudra, Rita Veilande, Gita Rēvalde, Anda Ābola, Māris Strazds, Zanda Briķe, Antonija Rimša

Latvijas Universitāte, Atomfizikas un spektroskopijas institūts un Bioloģijas institūts

## Ievads

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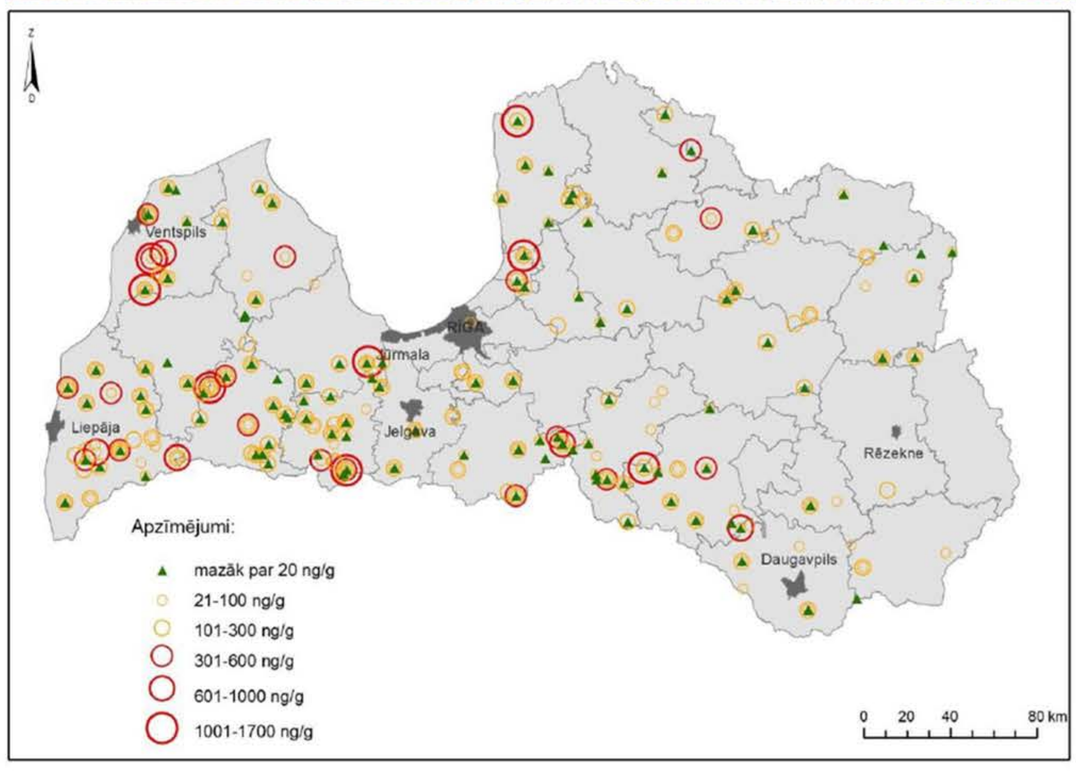
## Pētījuma mērķis

Ir noteikt dzīvsudraba (Hg) koncentrāciju Latvijas vidē, izmantojot par monitoringa indikatoriem ar putniem saistītus vienumus (piemēram, olu čaumalas). Mērījumi paraugos tika veikti ar Zēmana absorbcijas dzīvsudraba analizatoru.


## Rezultāti un diskusija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- Tā kā melnie stārķi ir aizsargājami, mēs izmantojam paraugus, ko iespējams iegūt, netraucējot putnus – neveiksmīgu vai šķīlušos olu čaumalas un kakas.
- Paraugu vākšana notiek pavasara-vasaras sezonā.
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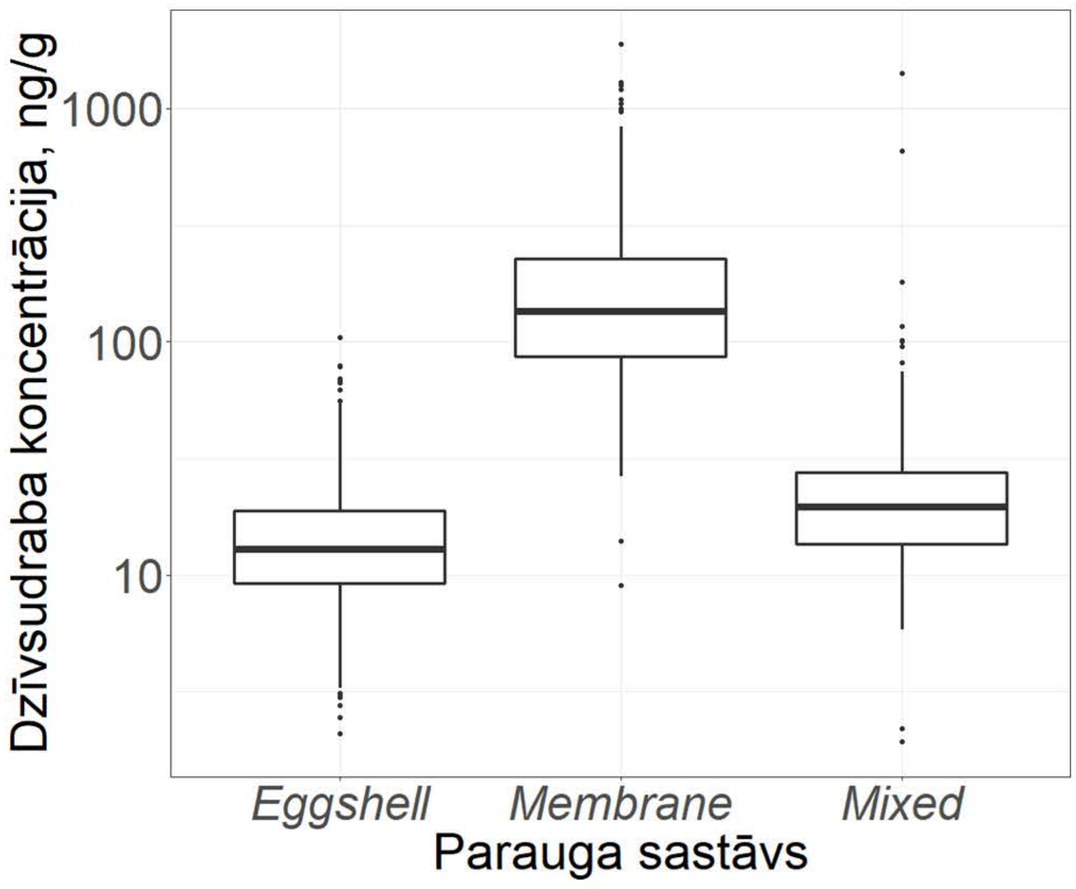


## Kontaktinformācija

askudra@latnet.lv

Pētniecības darbu finansē Latvijas Zinātnes padomes projekts «Dzīvsudraba piesārņojums savvaļas putnos Latvijā: pašreizējais stāvoklis un līdzšinējo pārmaiņu rekonstrukcija» Nr. lzp-2020/1-0005.

FLPP Fundamentāro un lietišķo pētījumu projekti

LATVIJAS UNIVERSITĀTE ATOMFIZIKAS UN SPEKTROSKOPIJAS INSTITŪTS

Pasaules latviešu zinātnieku kongress

# Dzīvsudraba piesārņojums melnajos stārķos Latvijā

Atis Skudra, Rita Veilande, Gita Rēvalde, Anda Ābola, Māris Strazds, Zanda Briķe, Antonija Rimša

Latvijas Universitāte, Atomfizikas un spektroskopijas institūts un Bioloģijas institūts

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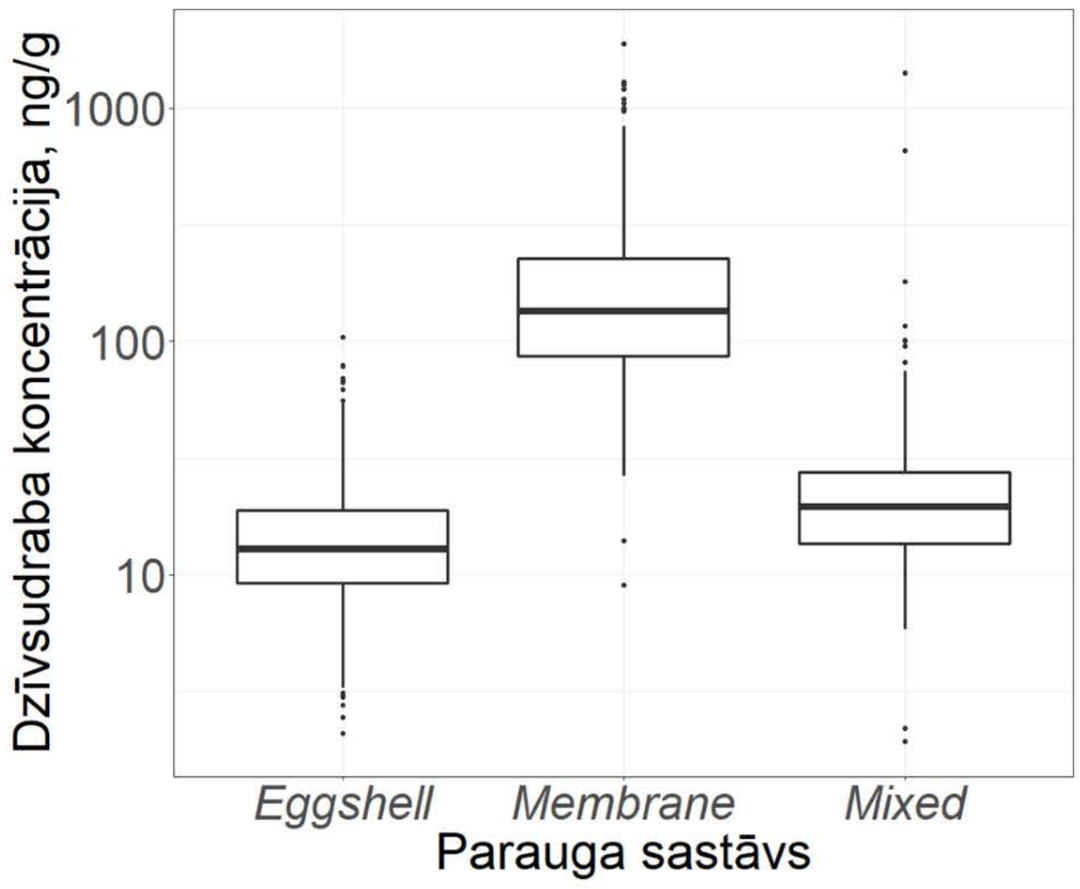


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World Congress of Latvian Scientists

# Co-design in Participatory Budgeting Process for Regeneration of Open Space in Large Housing Estates

**Sandra Treija, Uģis Bratuškins, Alisa Koroļova**
Riga Technical University

## Introduction

In many European cities large housing estates built after the Second World War occupy wide areas outside the city's historic cores. Their adaptation to today's needs is among the most challenging problems facing the cities in the Baltic Sea region. One of the widely used urban renewal strategies is the regeneration of outdoor spaces. Improving the quality of outdoor spaces has many positive results, the most significant being the improvement of the quality of life for residents and the reduction of social exclusion. More active use of outdoor spaces also results in a sense of community and a definition of identity. Residents' participation in these regeneration strategies has become an essential tool for a positive outcome of the regeneration process. In the process of developing participatory budgeting projects, the co-design approach ensures the involvement of all stakeholders.

## Research Objective

The study identifies the suitability of the co-design approach to the context of participatory budgeting projects, compares the used co-design models, and creates guidelines for the successful adaptation of co-design principles to specific circumstances of regeneration of outdoor spaces.
Starting from 2022, Riga municipality and RTU Faculty of Architecture cooperate in the PB project competition. Participation in the preparation of PB project proposals is delegated to the 3rd year students who worked in groups. Each year there are projects aiming regeneration of outdoor space in large housing estates, showing importance of this issue.

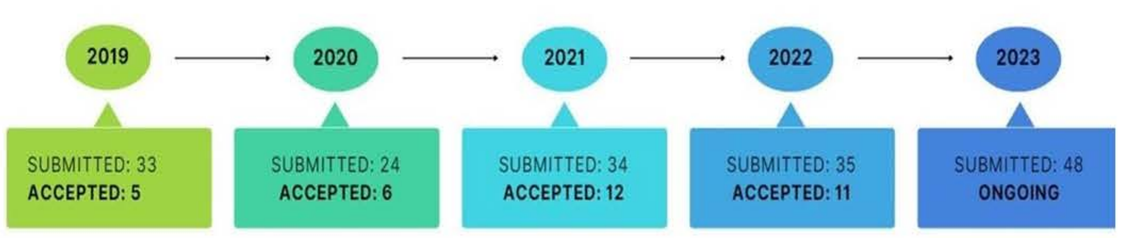



Fig. 1. The number of projects and voting results in program "Riga City Participatory Budgeting Project Ideas Competition" [developed by the authors using publicly available data from https://balso.riga.lv/].

## Results & Discussion

When starting cooperation with neighbourhood initiative groups, the diversity of needs, wishes and expectations regarding student involvement was revealed, thus the role of students was very different in each individual case. Although there was a diversity of roles, in general, clearly defined co-design principles could be fixed in the cooperation, such as intentionally involving target users in designing solutions; postponing design decisions until feedback is collected; synthesizing target user feedback into insights; and development of solutions based on a feedback.

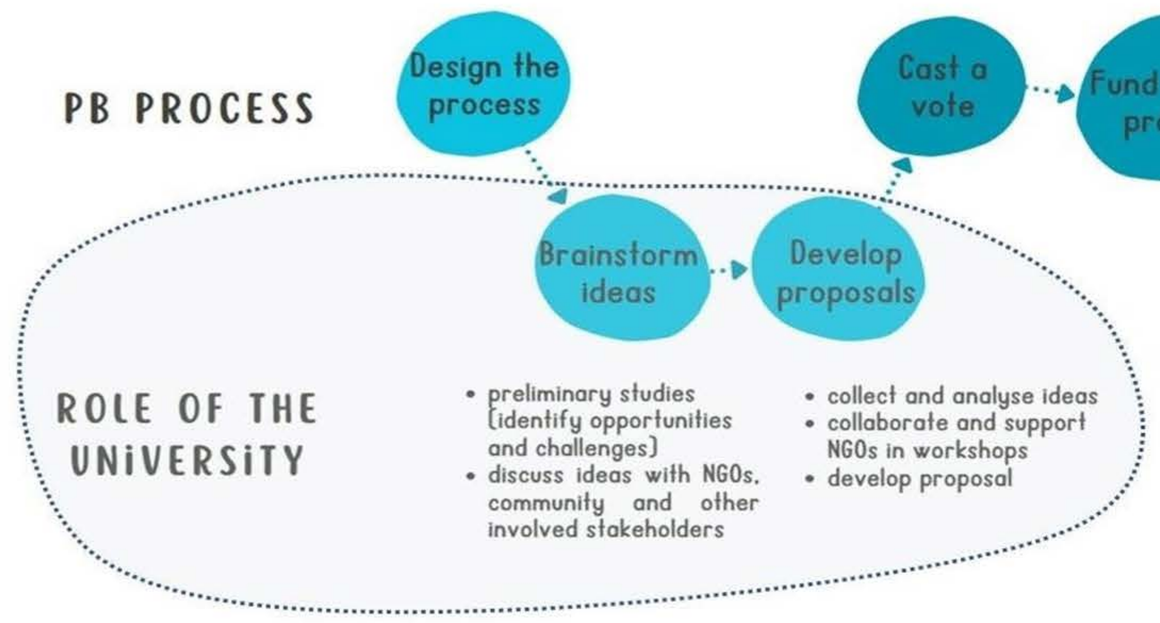



Fig. 2. Role of the university in the participatory budgeting process in Riga, Latvia [diagram created by the authors].

Fig. 3 and 4. Proposals for "Riga City Participatory Budgeting Project Ideas Competition 2023" in Bolderāja large housing estate and in Jugla large housing estate [student proposals].

## Conclusions

- PB opens up new opportunities for outdoor space regeneration in large housing estates, as the competition requirements and the available funding is suitable for a small-scale improvements in courtyards and other public open spaces within the estate.
- There may be a gap between the ideas of the local people regarding site improvement initiatives corresponding to the PB projects and the way how they are presented. Collaboration and co-design on different stages of project proposal development ensures a more professional approach of delivering the ideas to the involved parties. Students of related fields to architecture and urban design as well as universities may take the role of facilitator in the PB process, bridging the gap in the PB brainstorming stage and acting as a point of contact between the municipality and local people.
- The added value turned out to be the expansion of the circle of involved persons. Students not only actively participated in the development of proposals but also became agents of PB projects, forming activist groups in their neighbourhoods.

## Contact Information

E-mail: sandra.treija@rtu.lv, ugis.bratuskins@rtu.lv, alisa.korolova@rtu.lv

RTU ARHITEKTŪRAS FAKULTĀTE

World Congress of Latvian Scientists

# Food production residues as a valuable source of functional ingredients
# Cranberry Procyanidin Example

**Linards Klavins(1*), Ingus Pērkons(2), Mārcis Mežulis(1), Arturs Vīksna(3) and Maris Klavins(1)**

(1) Department of Environmental Science, University of Latvia, LV-1004, Riga, Latvia; linards.klavins@lu.lv; marcis.mezulis@lu.lv; maris.klavins@lu.lv
(2) Institute of Food Safety, Animal Health and Environment "BIOR", LV-1076, Riga, Latvia; ingus.perkons@bior.lv
(3) Faculty of Chemistry, University of Latvia, Jelgavas street 1, LV-1004, Riga, Latvia; arturs.viksna@lu.lv(*) linards.klavins@lu.lv

## Introduction

Procyanidins are a polyphenolic group that can be found in a variety of foods – chocolate, tea, cranberries and others. Type A procyanidins can be found in a handful of sources and one of the richest sources are American cranberries. These compounds possess antioxidative, anticancer, anti-inflammatory activities and are most widely used as prevention for urinary tract infections. Cranberries are utilized for jam and juice production, and the latter produces an industrial food-waste – press residues.

## Research Objective

The aim of this study was to compare and optimize (RSM) the extraction solvent variables most suitable for extraction of cranberry press residues to retrieve procyanidins. Purified extract was analysed using LC-FTICR-HRMS and antioxidative effects of extracts were evaluated.

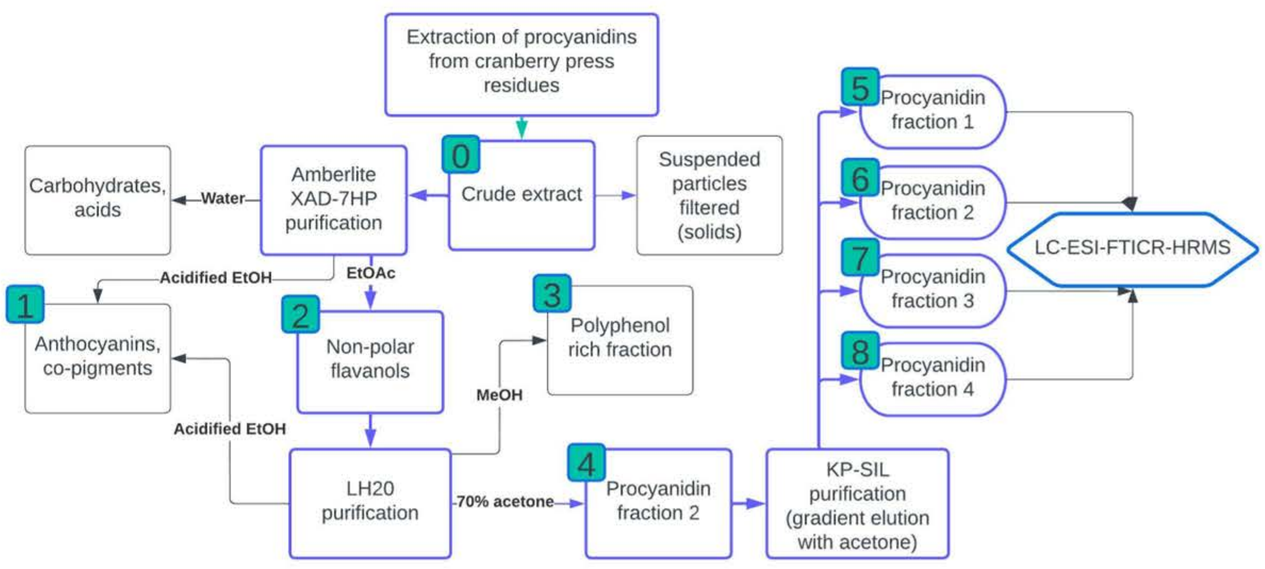
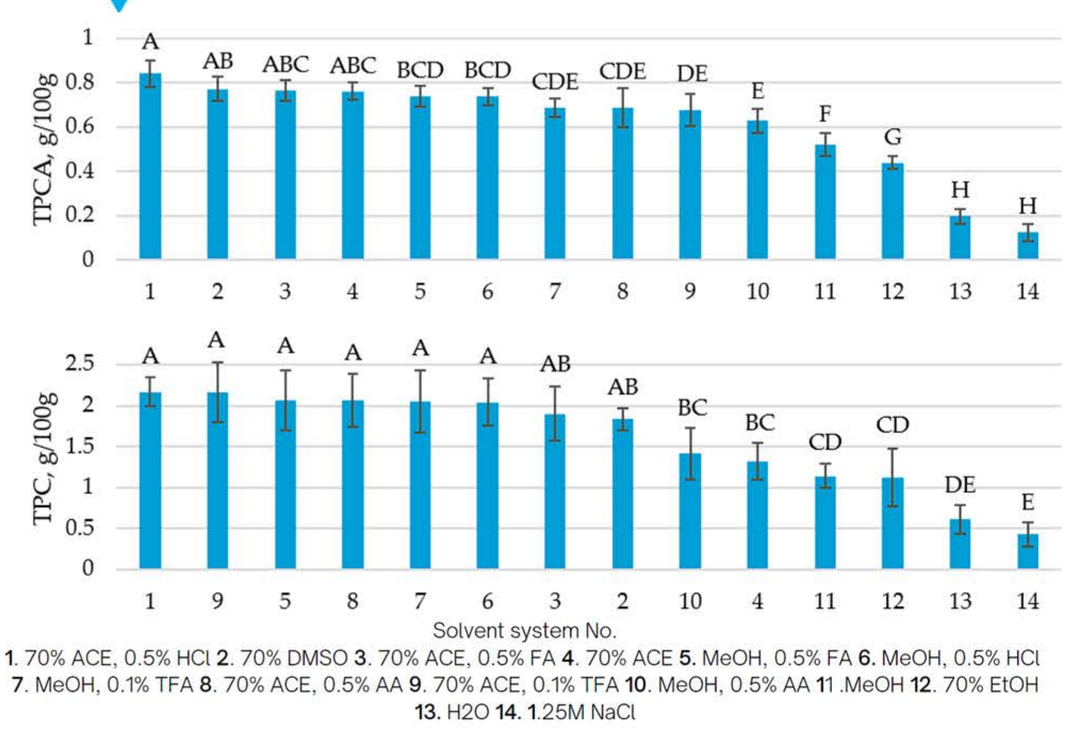



**Figure 1**. Purification of the prepared optimal procyanidin extract from cranberry press residues.

## Results & Discussion




**1**. 70% ACE, 0.5% HCl **2**. 70% DMSO **3**. 70% ACE, 0.5% FA **4**. 70% ACE **5**. MeOH, 0.5% FA **6**. MeOH, 0.5% HCl **7**. MeOH, 0.1% TFA **8**. 70% ACE, 0.5% AA **9**. 70% ACE, 0.1% TFA **10**. MeOH, 0.5% AA **11** .MeOH **12**. 70% EtOH **13**. H2O **14**. 1.25M NaCl

**Figure 2.** Screening of solvent compositions used for the extraction of procyanidins (TPCA) and total polyphenolics (TPC) from American cranberry press residues.

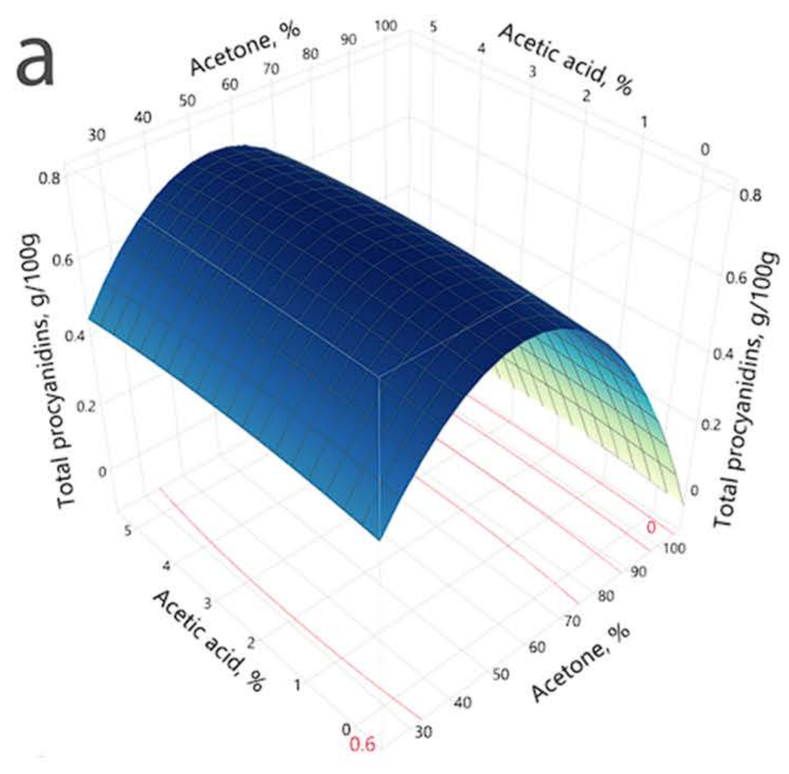



**Figure 3**. Response surface graphshowing the effect of acetone and acetic acid concentration on the measured response (total procyanidins).

Antioxidative potential analysis showed that increasing procyanidin concentration in a specific fraction leads to higher antioxidant potential. LC-ESI-FTICR-HRMS analysis showed that the most frequently detected PCs were pentamers (N=15) and tetramers (N=11) with one A-type linkage, followed by hexamers (N=8) and pentamers (N=7) with two A-type linkages. In fact, 76 out of 78 compounds contained (epi)catechin as the sole monomeric unit. B-type dimers produced higher intensity chromatographic peaks compared to A-type dimers, A-type PCs accounted for almost 80% of the total peak area. Their prevalence increased along with the degree of polymerization.

## Conclusions

Different extraction solvents commonly used for the extraction of procyanidins were compared to extract American cranberry press residues. The solvent providing the highest total procyanidin yield was acetone. The optimal extract was prepared and purified to obtain procyanidin rich fractions, which were tested for their antioxidative properties and qualitative composition. Addition of acidifying agent for the extraction of procyanidins did not increase the procyanidin yield significantly over a gradient concentrations. Additionally, to the known procyanidin properties for the prevention of urinary tract infection prevention, it was shown that these phytochemicals have high radical scavenging properties. The use of (LC-FT-ICR-HRMS allowed the identification of 78 individual procyanidins with the degree of polymerization up to 9. 65 of the identified procyanidins belonged to the A-type procyanidins, which is the conformation of procyanidins responsible for the specific *E.coli* anti-adhesion ability. Altogether our results show the possibility of cranberry press residue possible use in biorefinery strategies to obtain beneficial functional ingredients that could potentially benefit human health.

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# *Bacillus subtilis* preparation obtainment for agriculture use

**O. Grigs[1], E. Bolmanis[1], E. Didrihsone[1], M. Senkovs[2,3], V. Nikolajeva[2,3]**

1 Latvian State Institute of Wood Chemistry, Laboratory of Bioengineering, Dzerbenes st. 27, Riga, LATVIA
2 University of Latvia, Faculty of Biology, Jelgavas Street 1, LV-1004 Riga, LATVIA
3 Bioefekts, Ltd., Livzemes st. 30, Salaspils, LATVIA

## Introduction

*Bacillus subtilis* (Bs) is a bacterium that benefits plants and is used in the production of plant biostimulants and protection agents. Cultivation of Bs is a crucial step in bio-control preparation production, as it greatly impacts the quality and price of the final product. In 2020 started 3 year cooperation project between Bioefekts Ltd. and Latvian State Institute of Wood Chemistry in which task of Bs cultivation scale-up from laboratory 2 L flasks to pilot bioreactor conditions took place.

## Research Objective

A series of shake flask and bioreactor experiments were sellected for investigating the economically feasible legume-based (broad-bean) broth composition and bioreactor parameters for spore production of *Bacillus subtilis* MSCL 897, a Latvian soil isolate.

Media evaluation in shake flasks.

Cultivation scale-up in 100 L bioreactor.

## Results & Discussion

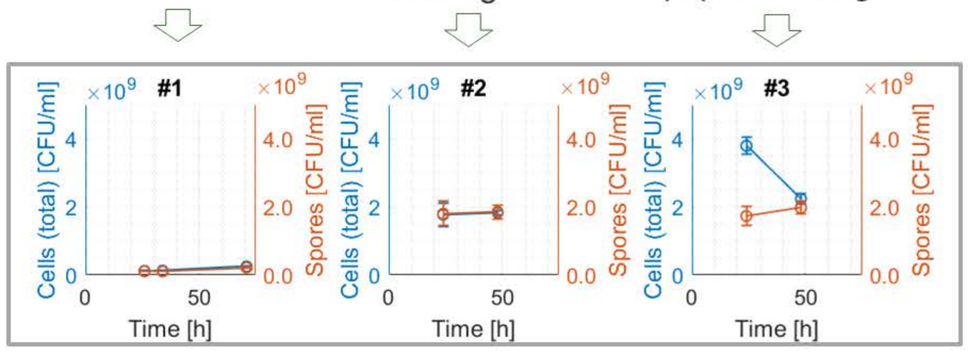
Process off-line and on-line data from 3 explorative batch cultivation runs in the different culture media characterize spore productivity and factors influencing it.

Were found that a little amount of peptone or yeast extract addition (0.5 g/l) has a positive effect on microbial growth, spore yield and preparation antifungal properties!

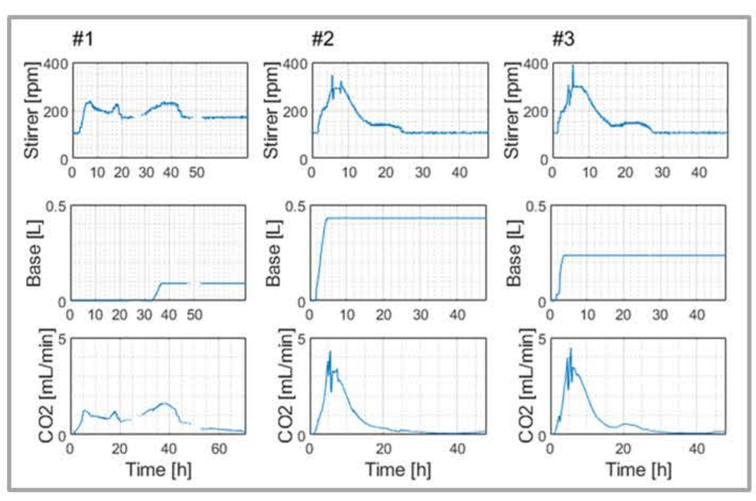
- molasses 10 g/l
- BB* flour 10 g/l

- molasses 10 g/l
- BB* flour 10 g/l
- YE 0.5 g/l

- molasses 10 g/l
- BB* flour 10 g/l
- peptone 0.5 g/l




On-line parameters characteristic in processes with high spore productivity were evaluated: sharp and reduced culture growth at the process beginning and at the end respectively (observed by agitation speed, base consumption and $CO_2$ evolution rate parameters).




* BB – broad bean

Antifungal analysis showed preparation effectiveness against several well known fungal pathogens:


| C. herbarum | F. graminearum | A. niger | A. tenuis | F. culmorum | |
|---|---|---|---|---|---|
| 1.7 cm | 1.5 cm | 1.6 cm | — | — | ← Sterile zone diameter, exp. #3 |
| — | — | — | 1.5 cm | 1.0 cm | ← Growth inhibition zone diameter,exp. #3 |

## Conclusions

High yied (1.8-2.0 CFU/ml) spore production in 24-48 h cultivation demonstrated for *Bacillus subtilis* MSCL 897 pilot-scale bioractor process. Investigated that obtained product has an anti-fungal properties against well known *C. herbarum, F. graminearum, A. niger, A. tenuis* and *F. culumorum* pathogen-fungus.

## Aknowledgements

This research was co-funded by the European Regional Development Fund, grant number 1.1.1.1/19/A/150 (“Scale-up research of the microbiological soil fertilizer and biocontrol agent obtained in submerged and surface cultivation processes”).

## Contact Information

Oskars Grīgs, Dr. Sc. Ing.
E-pasts: oskars.grigs@kki.lv
Tel.: +371 29840838

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Valērijs Ņikuļins

International Association for Promoting Geoethics biedrs
SIA «Geo Consultants»


# Ģeodinamiskā faktora nozīme Pļaviņu HES bīstamības novērtēšanā

## Ievads

« Latvijas lielākā HES - Pļaviņu HES atrodas nelabvēlīgos ģeodinamiskos apstākļos. PHES atrodas netālu no Piebalgas tektoniskā lūzuma dienvidrietumu malas, un ūdenskrātuvi šķērso Aizkraukles tektoniskais lūzums. Šie lūzumi veido grabeveida struktūru, kurā kristāliskais pamatklintajs ir pazeminās attiecībā pret tā līmeni ārpus šīs struktūras.

Ģeodēziskie pētījumi Pļaviņu ģeodinamiska poligonā (Āboltiņš, 1969 un 1971) pirms un pēc rezervuāra piepildīšanas uzrādīja tektonisko spriegumu pārdali. 2,5 km no Piebalgas lūzuma dienvidrietumu malā konstatēta intensīvu vertikālu kustību zona.

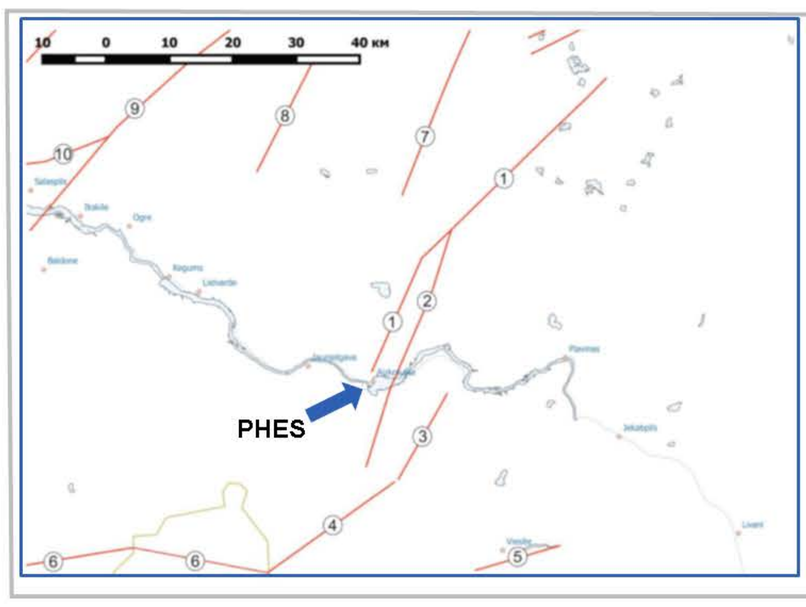
2015. gadā dambja labajā krastā konstatēta tektonisko lūzumu pēdas (Fugro Consult, 2015). Tādējādi tika apstiprināts 1985. gadā atklāts Piebalgas lūzums (Bebrišs et al., 1985).

## Pētījuma mērķis

« Izpētīt ģeodinamisko situāciju PHES rajonā. Ģeodinamiskie apstākļi var ietekmēt PHES drošību. Šie pētījumi ietver:

1) iepriekš veikto pētījumu kompleksa analīze ar dažādām metodēm: ģeoloģiskajām un ģeofizikālajām, ģeodēziskajām un citām metodēm;

2) veikt zemes garozas sprieguma-deformācijas stāvokļa modelēšanu PHES rajonā.




Kaledonijas struktūras kompleksa tektoniskie lūzumi

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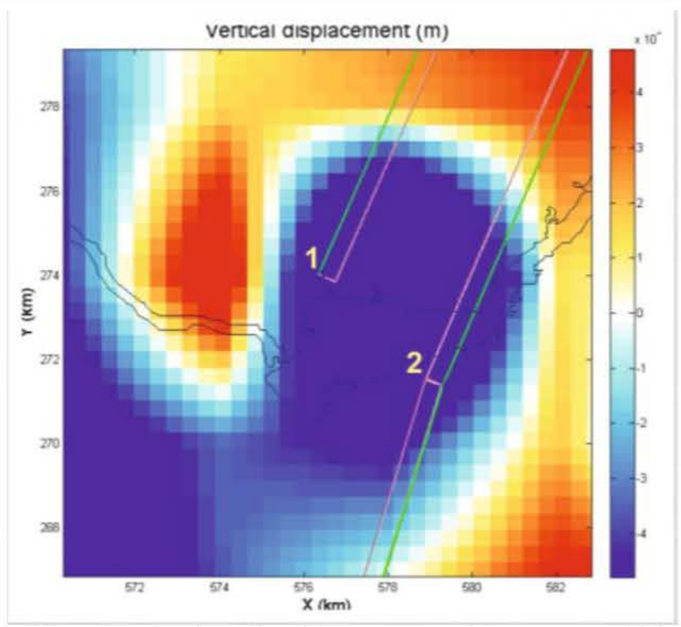
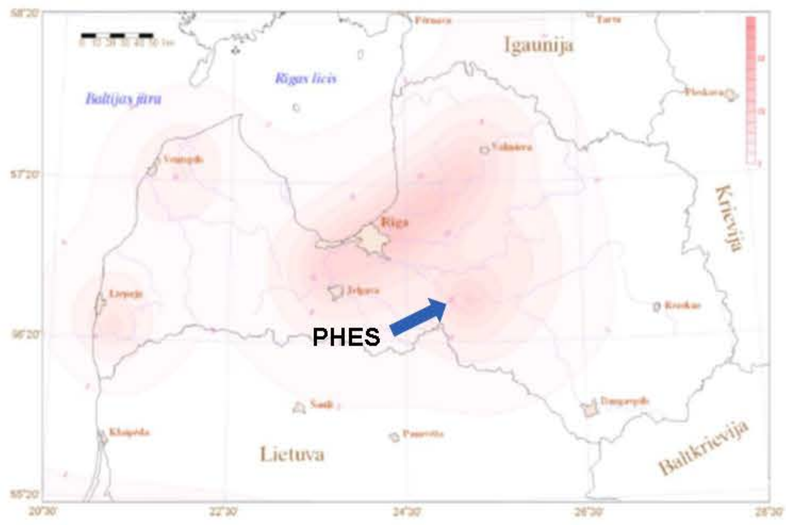



Vertikālā nobīde Zemes virsmas *PHES*




Ņikuļins V., 2011. Assessment of the seismic hazard in Latvia. Version of 2007 year.

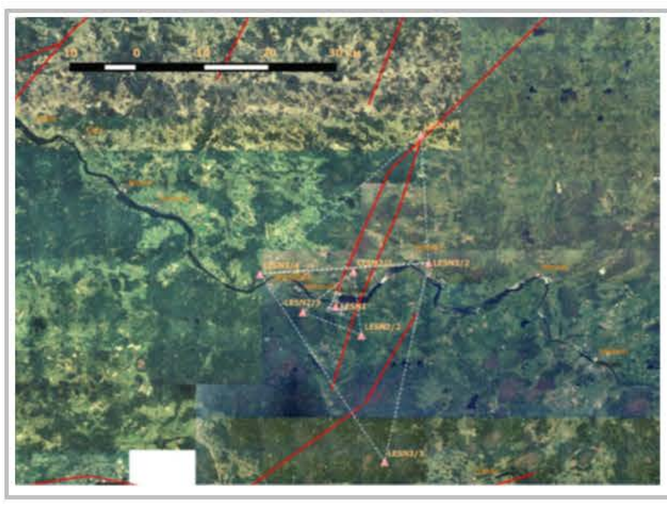
Karte horizontālais maksimuma paātrinājums (PGA) cietās gruntīs ar 10% varbūtības iespējamību pārsniegt aprēķināto seismisko intensitāti (cm/sek2) 50 gadu garumā

« Tika veikta dažādu zemes garozas ģeoloģisko un ģeodinamisko procesu saistību analīze PHES rajonā. Tika veikta zemestrīču tektonisko viļņu ietekmes analīze no seismiski aktīvajām zonām, tehnogēnās seismiskuma ietekmes analīze (sprādzieni Latvijas un Igaunijas karjeros), reģionālās, dabiskās seismiskuma analīze (reģionālajā un Ziemeļatlantijā) un novēroto deformāciju analīze uz PHES struktūrām. Izanalizēti iespējamie tektonisko spriegumu parametri Latvijas zemes garozā. Šim nolūkam tika izmantoti zemestrīču fokusa mehānismi Zviedrijā un Baltijā. Tiek veikta sprieguma-deformācijas stāvokļa simulācija. Atklāta deformācijas zona starp Piebalgas un Aizkraukles lūzumiem.

## Secinājumi

« Deformācijas ieplaka konstatēta apvidū starp Piebalgas lūzuma dienvidrietumu malu un Aizkrauklas lūzuma vidusdaļu.

Tādējādi tika apstiprināti iepriekš noteiktie ģeodinamiskās bīstamības faktori. Drošība prasa labāku lēnu un ātru kustību kontroli. Ieteicams izveidot lokālo seismisko tīklu. Tas ļaus izsekot ģeodinamisko apstākļu izmaiņām no dabas un cilvēka radītas ietekmes.



*Pļaviņu* HES un lokālās seismisko novērojumu sistēmas projekts

## Kontaktinformācija


Dr.geol., seismologs, ģeofiziķis, Valērijs Ņikuļins, e-pasts: seismolat@gmail.com

World Congress of Latvian Scientists

# The Baltic States on the Road to Citizen Science: Researcher and Citizen Engagement

**Mg.sc.soc. Mārīte Saviča, Mg.sc.soc. Gita Rozenberga**
University of Latvia Library

## Introduction

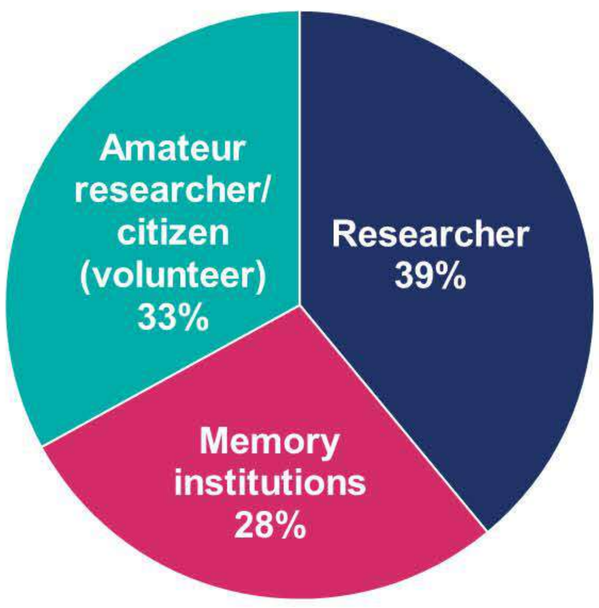
Citizen science has been taking an increasingly stable place among the components of open science in recent years. Citizen science activities allow interaction between various interested parties, which is an essential prerequisite for the well-being of society, scientific progress, and solving global problems. For more powerful progress, in addition to collaboration between researchers and citizens, it is good to attract specialists from other fields or use their services.

In 2022, a study was conducted in the Baltic States, which revealed various aspects of cooperation between scientists, amateur researchers, library and museum specialists in the context of citizen science.

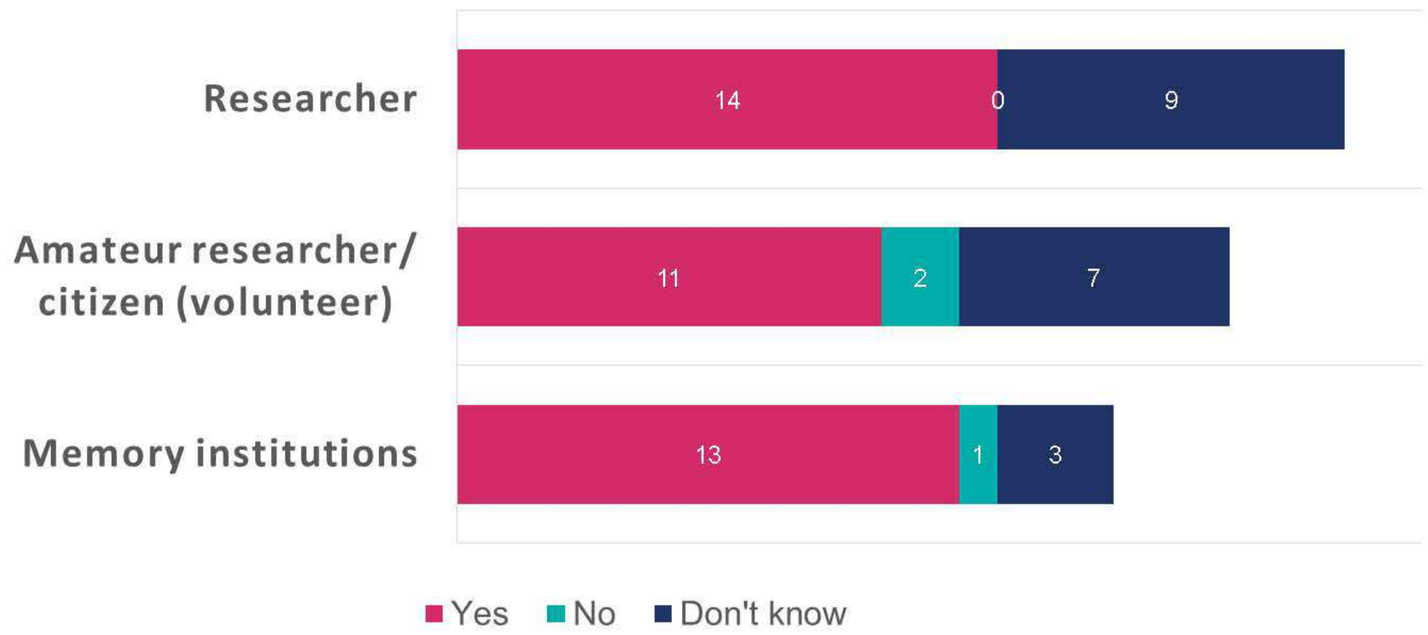
## Research Objective

During the study, the experience of all three parties involved in the citizen science projects and activities: scientists, librarians and specialists of other memory institutions, amateur researchers was learned. The study also explored the general situation and understanding of citizen science, as well as the collaboration among the parties involved. The research focused a lot on the role of memory institutions, especially libraries, in promoting citizen science.

## Results & Discussion




*Respondents by occupation*




*Would you like to collaborate with professionals from memory institutions (libraries, museums, archives) in research projects/activities in the future?*

The responses received from the three groups of respondents lead to the conclusion that citizen science is perceived positively, it is closely related not only to support science but also to society's welfare and education. Respondents were able to both give examples of such activities and confirm their participation in citizen science projects. Respondents express their desire to collaborate, and appreciated the memory institutions support service with the ability to perform the tasks related to the organization of research projects and activities, the research progress, including data management, community gathering, promotion of knowledge sharing and skills and others.

## Conclusions

The knowledge expansion on citizen science projects would promote the collaboration in research in general as well as constitute the interest in giving feedback among researchers and society, and vice versa.

Memory institution's role in research and citizen science in particular is expanding.

The results and conclusions of the study have highlighted the significant potential of citizen science for research, society and sustainability.

## Contact Information

E-mail: gita.rozenberga[@]lu.lv
More information is available in the LibOCS project material collection on Zenodo.

The project LibOCS under the Erasmus+ KA2 Strategic Partnerships program, Project Number: 2021-1-EE01-KA220-HED-000031125

LibOCS

LATVIJAS UNIVERSITĀTE BIBLIOTĒKA

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# INOVATĪVI PRODUKTI KULTŪRU AUDZĒŠANAI LATVIJĀ – VIDEI DRAUDZĪGS, ALTERNATĪVS UN EKONOMISKS RISINĀJUMS

PhD studente, *Mg. oec.* **Vivita Vīksniņa un** prof. **Baiba Rivža**

Latvijas Biozinātņu un tehnoloģiju universitāte

## Ievads

Klimata pārmaiņas un vispārējās apkārtējās vides negatīvās izmaiņas ir pasaules un Eiropas nākotnes drauds, kas liek pārvērtēt rīcības plānus un izvēlēties uz ilgtspējīgu saimniekošanu vēstu ekonomikas pieeju. Lauksaimniecības nozare ir viena no siltumnīcefekta gāzu emisiju radītājām un Eiropas Zaļā kursa stratēģija: "No lauka līdz galdam" rada nepieciešamību izstrādāt un ieviest jaunas inovācijas augkopībā. Zaļā kursa mērķi ir savstarpēji saistīti. Viena no augkopības prioritātēm ir augsnes un ūdens vides atjaunošana un saglabāšana. Patlaban priekšplānā izvirzās augkopības ražojošo saimniecību divas iespējas: 1) digitalizācija un 2) biotehnoloģijas, tai skaitā inovatīvu mikroorganismus saturošu produktu lietošana augkopībā.

## Pētījuma mērķis un metodes

Ir svarīgi, lai pārtikas ražošana nesamazinātos un būtisks pārtikas ražošanas izejvielu nodrošinājums ir augkopības produkcija. Pētījuma mērķis ir ilgtspējīgi, inovatīvi un ekonomiski pamatoti risinājumi augkopībai Latvijā.

Lai sasniegtu mērķi, ir veikts 21 (divdesmit viens) lauku pētījums ar 68 atšķirīgiem variantiem, laika periodā no 2018. līdz 2021. gadam - ziemas rapsim un kviešiem, vasaras rapsim, kviešiem, miežiem, lauku pupām un zirņiem. Tika apkopoti pētījumu rezultāti, par inovatīvu, dabiskas izcelsmes produktu rezultātiem augkopībā. Pētījumā pielietotās metodes: monogrāfiskā metode, zinātniskā indukcijas un dedukcijas metodes, statistikas un finanšu analīzes metodes, loģiski konstruktīvā metode.

## Rezultāti un diskusija

Viens no lielākiem izaicinājumiem ir zināšanas inovatīvu produktu lietošanā. Katrs atsevišķs produkts var nesniegt vēlamo ekonomisko ietekmi uz ražas veidošanos, bet šo produktu kombinēšana un precīza lietošana sniedz ievērojamu ekonomisko ieguvumu un pozitīvu ietekmi uz kultūrauga ražu gan konvencionālajā, gan bioloģiskajā saimniekošanas metodē. Dabiskas izcelsmes inovatīvie produkti var daļēji aizvietot un papildināt ķīmiskos mēslošanas, kā arī augu aizsardzības līdzekļus.

**Ienākumu palielinājums konvencionālās un integrētās augkopības saimniecībai, pielietojot inovatīvus augkopības produktus Latvijā, aprēķina periods: 2018. – 2021.**

| Kultūraugs | Raža (*K), t/ha | Raža (*IP), t/ha | Ražas starpība, t/ha | IP iegādes izdevumi, EUR/ha | *LIZ, % | Peļņa pēc produktu izmaksu atskaitīšanas, EUR/ha | Kopējais peļņas palielinājums, EUR |
|---|---|---|---|---|---|---|---|
| Ziemas kvieši | 5.10 | 6.10 | 1.00 | 9.00 | 32% | 159.14 | 5,044.74 |
| Vasaras kvieši | 4.59 | 4.94 | 0.35 | 103.42 | 21% | 183.75 | 3,766.88 |
| Ziemas rapsis | 4.90 | 5.20 | 0.30 | 5.25 | 10% | 344.88 | 3,517.78 |
| Lauku pupas | 2.96 | 3.46 | 0.50 | 9.32 | 4% | 109.48 | 416.02 |
| Vasaras rapsis | 3.92 | 4.69 | 0.77 | 57.00 | 1% | 241.76 | 265.94 |
| Pārējie augi | – | – | – | – | 33% | – | – |
| | | | | Kopā platība: | 100% | – | – |
| | | | | | Ienākuma palielinājums kopā, EUR uz 100 LIZ ha: | | **13,011.35** |

*K – kontroles raža; *IP – raža pielietojot inovatīvus produktu; *LIZ – Lauksaimniecībā izmantojamā zeme

## Secinājumi

Lai panāktu "Zaļā kursa" izvirzītos mērķus, lauksaimniecībai ir jāsamazina SEG emisiju apjoms. SEG emisiju apjoma samazināšana ir iespējama, izstrādājot un ieviešot inovatīvus lauksaimniecībā izmantojamus produktus;

Inovatīvie mikrobioloģiskie un humusvielu produkti ir ekonomiski izdevīgi ne tikai bioloģiskajām saimniecībām, bet arī konvencionālajām saimniecībām;

Pielietojot inovatīvus produktus konvencionālajā lauksaimniecībā uz katriem LIZ 100 ha var gūt papildu ienākumus 13 tūkst. EUR.

## Kontaktinformācija

Vivita Vīksniņa: viksnina.vivita@gmail.com

Baiba Rivža: baiba.rivza@llu.lv

Latvijas Biozinātņu un tehnoloģiju universitāte

ESAF

Ekonomikas un sabiedrības attīstības fakultāte

Pasaules latviešu zinātnieku kongress

# The environmental behavior of the Latvian population during the convergence of crises

Authors Renārs Felcis, Aija Zobena, Jurijs Ņikišins, Elgars Felcis, Weronika Felcis, Anete Melgalve, Ieva Strode, Elīna Briede

University of Latvia, Advanced Social and Political Research Institute (ASPRI)

## Introduction

**The current global challenges of mutual interdependence can be described by the concept of crisis convergence, where environmental collapse (climate crisis, rapid disappearance of biodiversity, environmental pollution), wider spread of diseases as a result of human impact on the natural world, and Russia's invasion in Ukraine, which is partially rooted in various social, political, and resource tensions, all exist simultaneously.**

**The theory of risk society allows us to explain both the increase of welfare and the unintended side-effects - risks that threaten society, communities, and individuals (social security and inequality, financial and economic security, the economic and social consequences of the climate crisis, and the loss of biodiversity).**

## Research Objective

The aim of research is what is society's readiness for crisis convergence?

Research questions:

What are people saying, what are they doing personally?

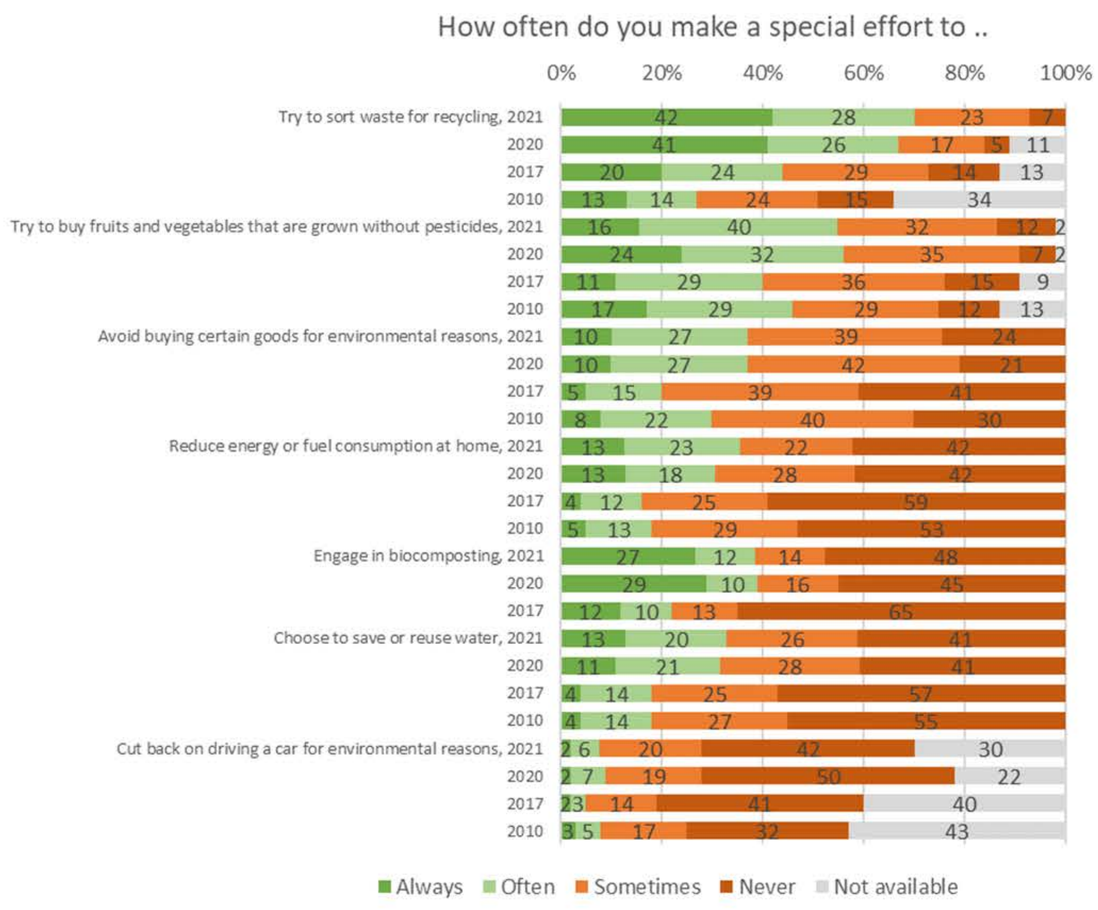
What do people say, how do they do personally?

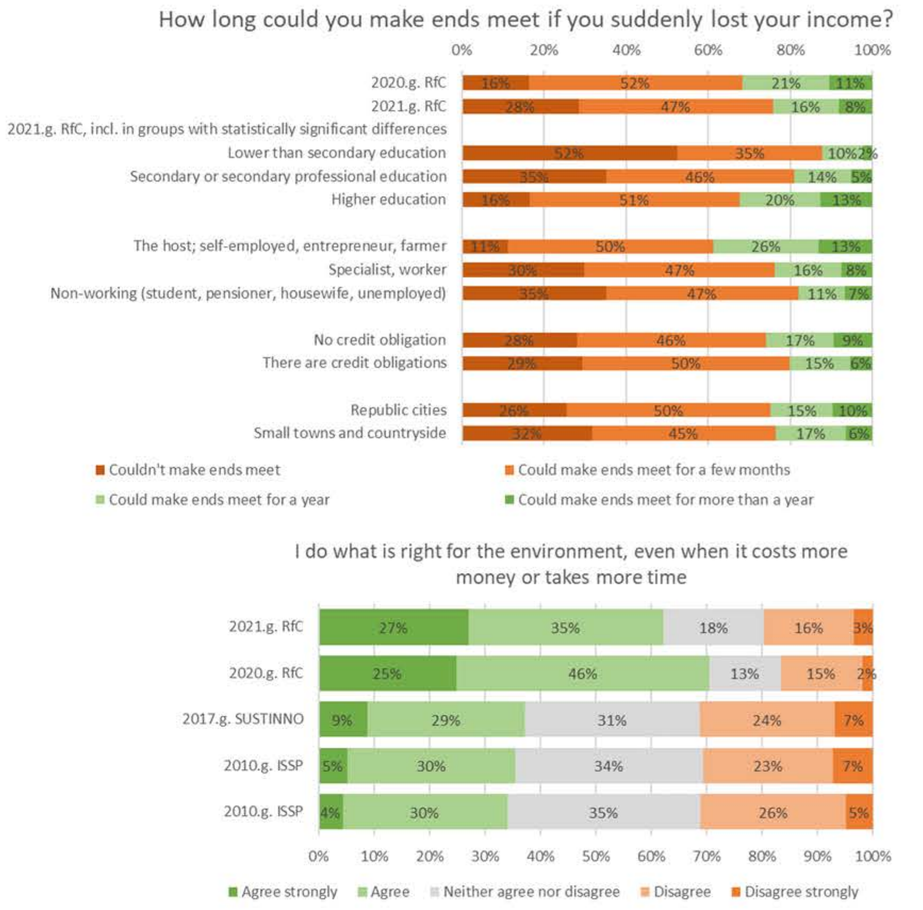
What do people say should be done structurally?

The most significant insights from the scientific project "Ready for Change? Sustainable Management of Common Natural Resources" are offered:

1. Representative citizen survey data on environmental behavior - practicing environmentally friendly behavior
2. Case studies on shared resource situations where there is societal, economic, and environment management - in the development plans of Gauja National Park, organic farming development, and among communities living in regions.

## Results & Discussion



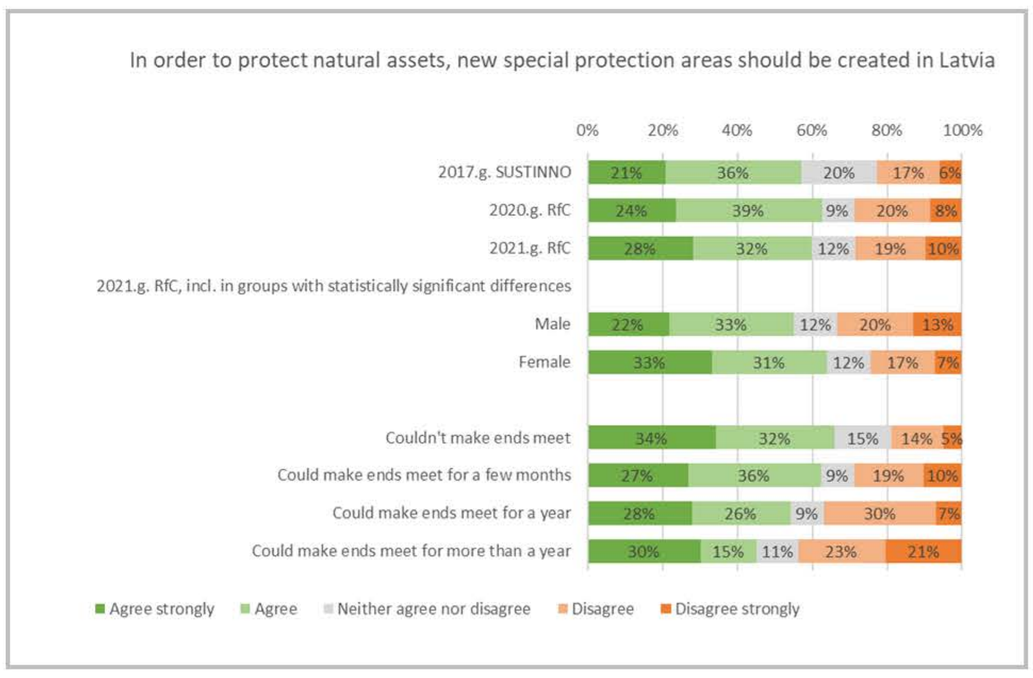

**People's ability to meet ends during a crisis has diminished, with environmental behavior similar in 2020 and 2021. Financial security indicators are not the only ones that define environmentally friendly actions, as poorer and rural populations often take more environmentally-oriented actions. Support to create new nature protection areas is higher among women and a more financially insecure population (would not be able to make ends meet or would be able to do it for a short time in case of loss of income).**

## Conclusions

Long-term data trends offer valuable insights into what has changed or stagnated in terms of attitudes and actions from 2000 to 2021.

Trends in different directions:

1. Hope for more responsible environmental action.
2. An inability to break the paradigms that have defined our economy and societal development, including the emergence of various side-effects of progress that are becoming increasingly difficult to address.




## Contact Information

renars.felcis@lu.lv

This research is funded by the Latvian Council of Science, project "Ready for change? Sustainable management of common natural resources (RfC)", project No. lzp-2019/1-0319.

World Congress of Latvian Scientists

# Latvian Construction Export Challenges in the Context of the "Green Economy"

**Ludmila Lozova, PhD student**
**Biruta Sloka, Dr.oec. prof.**
University of Latvia

## Research Objective

The goal of the present research is to discover if an export to the EU countries was one of the determining factors of Latvian construction entrepreneurs to implement the “Green” principles in their work?

## Context

The nature of such question raised by understanding that the countries who don’t implement the “Green” principles will be denied to access the markets and technologies of EU. The difficulty is that Latvian entrepreneurs need to follow special EU procedures, certification, proof of material origin and other complicated actions that in result are making final product more expensive and less attractive on the export market.

## Discussion

Different sources and prognostics are predicting a further decline in demand and a recession in the technology industries in Europe as a whole in 2023 (see *Fig.1*)

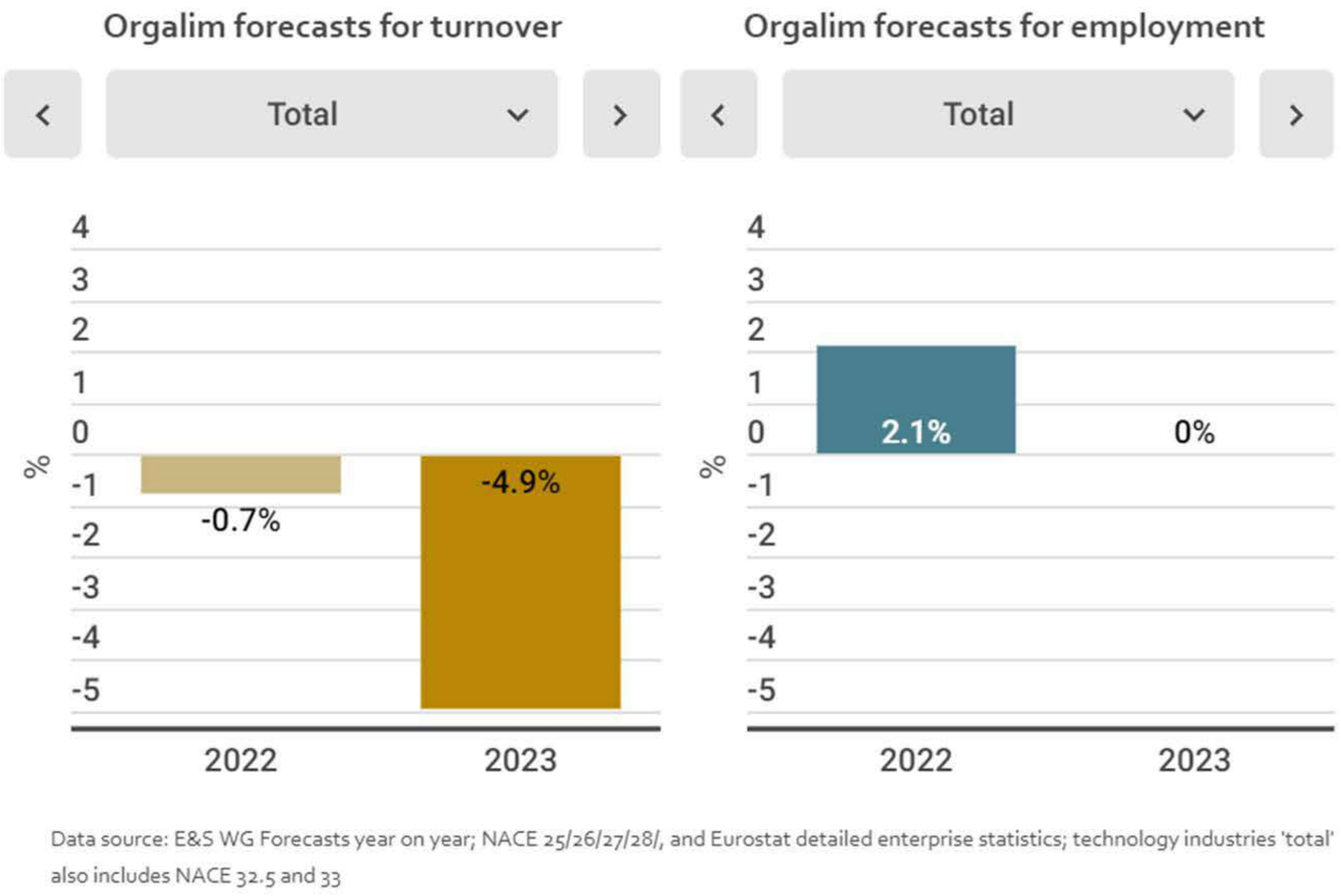



Figure 1. *Orgalim (Europe’s Technology Industries Organization) forecasts for turnover and employment in Metal, Electrical and electronic, Mechanical sectors (“Total”).*

## Conclusions

There is a probability that Latvian entrepreneurs will evaluate the opportunities and risks for alternative markets outside the EU and what aspects have to be considered to realize it.

There is a necessity to discover an alternative markets outside the EU, where Latvian construction entrepreneurs could export (to regions such as Central Asia, the Middle East or possibly Africa, but at the expense of high risks).

## Contact Information

Faculty of Business, Management and Economics, University of Latvia
Biruta Sloka, Dr.oec., prof., biruta.sloka@lu.lv
Ludmila Lozova, PhD student, ludmila@ludmilalozova.lv

World Congress of Latvian Scientists

# Developing on-job-trainings' curriculum on sustainable waste management at food industry enterprises

**Gunta Grīnberga-Zālīte, dr.oec; Andra Zvirbule, dr.oec; Madara Dobele, MBA; Linda Groma, MBA**

Latvia University of Life Sciences and Technologies

## Introduction

Economic growth increases environmental pressure, thus emphasizing waste minimization's importance. European countries' waste management approaches at the micro level are relatively understudied. This research aims to analyse waste minimization challenges in European food industry enterprises and identify best practices in selected countries. It uses mixed-methods, combining qualitative and quantitative approaches, to enhance production waste reduction and efficient use of resources. Data collection methods include secondary data analysis, case studies, and focus group interviews. The analysis of food waste management in European food sub-sectors reveals the need for nationally available and economically justified waste management system, regardless of waste production volumes. Promoting waste minimization culture in Europe requires raising awareness among food industry stakeholders, including employers, employees, and consumers, about effective waste reduction strategies.

## Research Objective

This study has posed a research question:

**What skills should be integrated in on-the-job training programs in contemporary waste management in food industry enterprises?**

The specific research tasks are:

(1) to present the discourses and the role of social aspects in ESG investing;
(2) to analyze and systematize the food sector's requirements for on-the-job training in contemporary waste management in selected European countries.

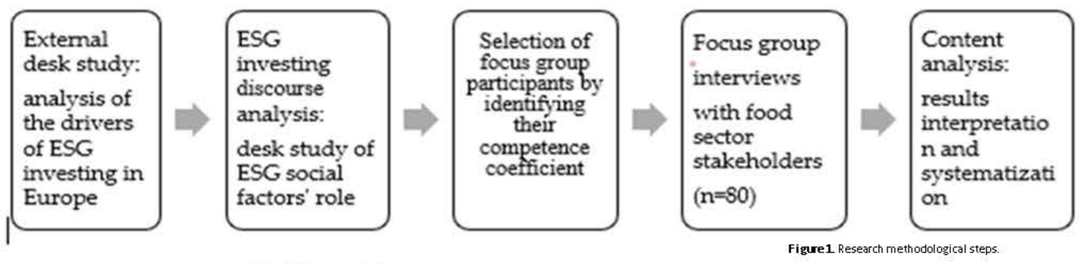



Figure 1. Research methodological steps.


Figure 2. Geographical representation of the focusgroup interviews (MapChart Europe n.d.).

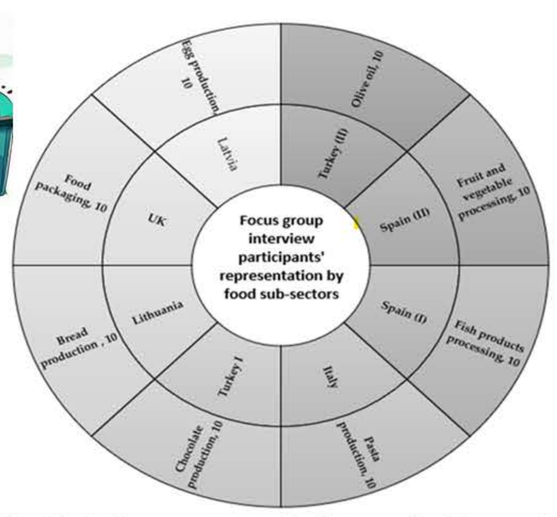



Figure 3. Number of focus group participants (n = 80) and their represented food sub-sectors (n = 8).

- In the eight focus group interviews, the stakeholders of food sub-sectors suggested more than 200 different formulations of general and specific skills that were claimed as necessary for the employees and in their opinion needed to be integrated in on-the-job training.
- In scope of the content analysis, we aggregated the skills that were similar to all food sectors and thus could be structured as explicit knowledge, tacit knowledge, soft skills and hard skills.
- To systematize all the viewpoints, we prepared a conceptual framework for on-the-job training content that could afterwards be supplemented according to the specific needs of each sub-sector and thus would provide a safe on-the-job training basis that is relevant in the opinion of industry professionals.

## Results & Discussion

**Knowledge**

**Explicit knowledge**

- Knowledge of the **complexity of sustainable development**
- Knowledge of **waste classification types, their characteristic, impact** on the environment
- Knowledge of **legal requirements imposed for waste management** from the European perspective
- Knowledge of **developing waste management strategy** in the food sector enterprise
- Knowledge of **social and corporate responsibility** in the achievement of food waste minimization

**Tacit knowledge**

- Knowledge of the **legislative framework and regulatory enactments** that regulate waste management system in the food sub-sector
- Knowledge of the procedures and technical specifications for **monitoring raw materials, semi-finished products, finished products and manufacturing processes**
- Knowledge of the **types of waste generated in the food sub-sector**, their amounts, reduction and disposal specifics, impact on the environment
- Knowledge of the **product life cycle and good practice examples in extending it**: industrial symbiosis and innovations for waste minimization in the food sub-sector

**Skills**

**Soft skills**

- Cognitive skills to **identify waste types** that are generated in the technological processes of food sub-sector
- Cognitive skills to **identify the elements of the waste management system** in food sub-sector
- Cognitive skills to **provide a constructive feedback and refer to the binding documents**; to analyse and comprehend the commitments and objectives to be achieved

**Hard skills**

- Practical skills to **explain how those waste types that are generated** in the technological processes of food sub-sector affect the environment
- Practical skills to **generate solutions to specific problems** related with averting risks of waste management system in different situations typical for food sub-sector
- Practical skills to find and understand the binding documents to **clarify a specific waste management issues** typical for food sub-sector
- Use of logical and creative thinking to **identify and justify the most appropriate set of activities to waste minimization** in different situations typical for food sub-sector
- Practical skills to **identify and justify the most appropriate recycling and recovery options** of waste generated in the technological processes of food sub-sector

**Competence**

**Attitude**

- Awareness of **raw and intermediate materials** in the sub-sector
- Ability to assess and **critically evaluate science-based and statistical information** from multiple disciplines and sources
- Competence to discuss issues related with **regulatory enactments and legal framework for sustainable waste management** that are specifically binding for sub-sector
- Take **initiative and responsibility for evaluation of waste minimization** options in the production processes
- Ability to **integrate and organize oneself in the environment that fosters waste recycling and recovery**

Figure 4. The content and structure of on-the-job training in waste management in the food sector enterprises developed based on the focus group interviews (n = 80).

## Conclusions

1. Nowadays, employees of the food production sector need, regardless of their employment position, to be trained not only to identify different waste types, but also be aware of their impact on the environment and be in charge of legal requirements for food waste and the importance of waste management in terms of overall business corporate responsibility.
2. There are many types of hard skills that food sector experts listed as important, and they all are related to empowering employees to generate solutions and take initiative in waste minimization in the enterprise.
3. The content and structure of on-the-job training in waste management, which will be validated and accordingly adapted by the European food industry professionals, will be practically applicable in the direction of ESG investment.

## Contact Information

Faculty of Economics and Social Development
Latvia University of Life Sciences and Technologies

- gunta.grinberga@lbtu.lv
- andra.zvirbule@lbtu.lv
- madara.dobele@lbtu.lv
- linda.groma@lbtu.lv

**Acknowledgement**

The research was supported by the project "Go-Zero - Zero Waste Management in the Food Sector", No. 2020-1-TR01-KA202-093424, co-funded by the Erasmus+ programme of the European Union.

Co-funded by the Erasmus+ Programme of the European Union

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# Conveyor-type Wind Energy Conversion Device

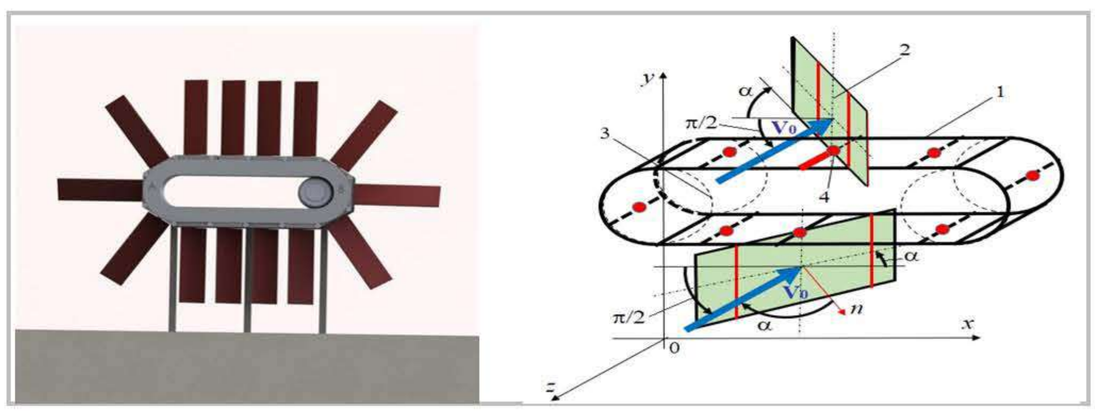
**Authors: Vitālijs Beresņevičs, Jānis Vība, Mārtiņš Irbe, Marina Čerpinska**
Riga Technical university

## Introduction

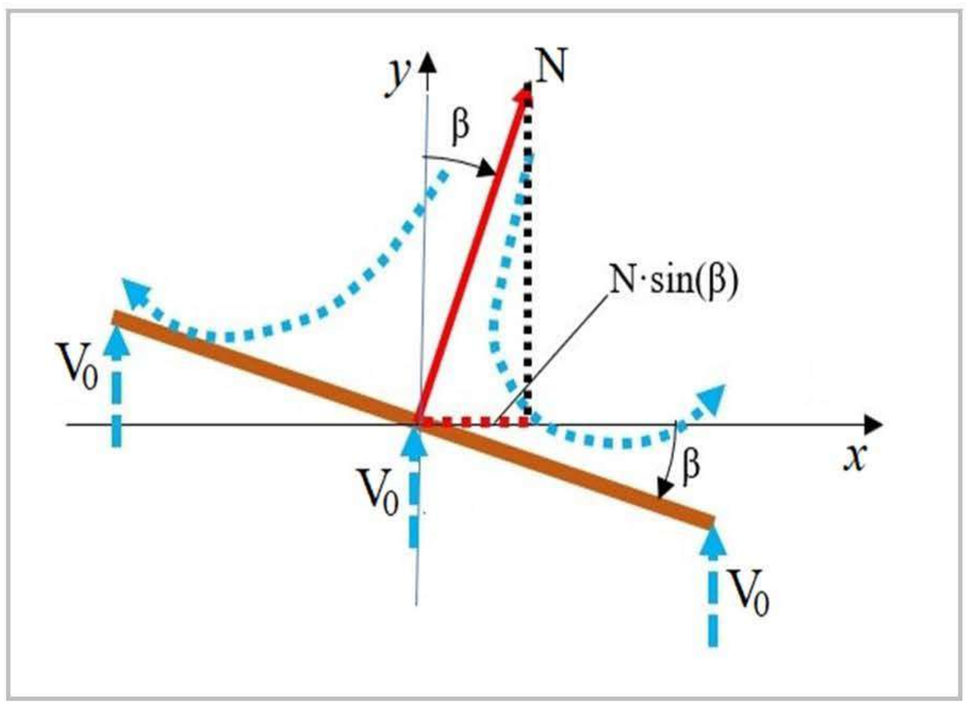
A progress on the development of a small wind power plant on the base of closed loop conveyor is reported, including the comparison of the proposed device with the existing technologies.
The proposed design offers a closed-shaped belt conveyor equipped with flat-shaped blades. Several identical flat blades interacting with air flow are mounted on conveyor belt and have an opportunity to move together with the belt in one straight line direction. Then after turning in the reversing mechanism, blades move in the opposite direction. Therefore, air flow kinetic energy is transformed into translation motion of flat blades. The conveyor can be placed both horizontally and at any angle to the horizon. The conveyor system has a built-in energy generator.

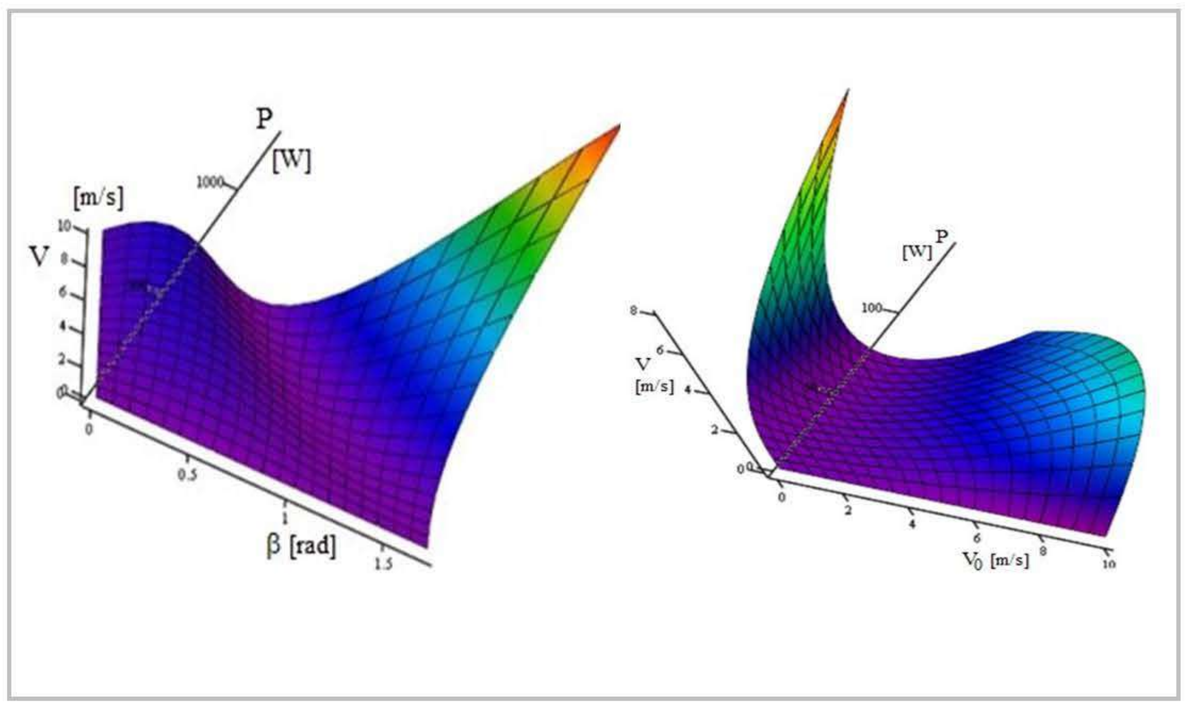
## Research Objective

Elimination of shortcomings of existing wind equipment with rotating blades (big vertical dimensions, increased noise and vibration level) by the development of a small or medium wind power plant providing efficient conversion of air flow energy. To achieve this goal, a new operational principle of the wind device is proposed, based on use of flat blades translational motion excited by the air flow.




## Results & Discussion

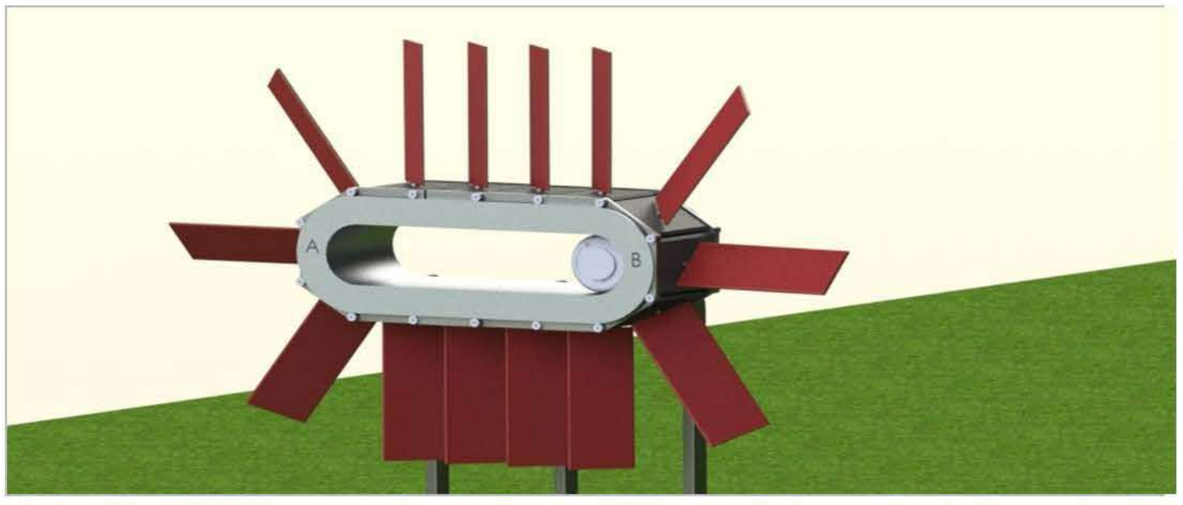



Dynamics of the system under the action of air flow is modelled with computer program MathCAD. Optimization of the system parameters is made using the generated power as a criterion. Simulation results confirm the serviceability and operational efficiency of the proposed device. Response surface for the optimization criterion P as a function of blade turning angle β and velocity V (for the case of air flow velocity V0 = 10 m/s) and response surface for the optimization criterion P as a function of air flow velocity V0 and blade velocity V (for the case of blade turning angle β = 0,707 rad) is demonstrated above.

## Conclusions

New design of wind energy conversion device was developed, made in the form of closed loop conveyor equipped with several flat blades. Blades move in one straight line direction. Operation principle of the device is based on utilization of flat blades translation and rotation motion due to the interaction with air flow.




## Contact Information

E-mail address: vitalijs.beresnevics@rtu.lv

1862
RIGA TECHNICAL UNIVERSITY
Faculty of Mechanical Engineering, Transport and Aeronautics

Pasaules latviešu zinātnieku kongress

# Mikroaļģes spirulīnas audzēšana iekštelpās
# Indoor farming of microalgae *spirulina*

**Agnese Stunda-Zujeva, Megija Berele**

Rīgas Tehniskā universitāte
Materiālzinātnes un lietišķās ķīmijas fakultāte Vispārīgās ķīmijas tehnoloģijas institūts

## Ievads

K**limata pārmaiņu dēļ** ir jāmeklē **jaunas šķirnes** un jauni veidi, kā audzēt pārtiku. Mikroskopiskā aļģe – cianobaktērija **Spirulīna (*Arthrospira platensis*)** ir atzīta par vienu no kompaktākajiem produktiem pēc uzturvērtības. Jau šobrīd spirulīna ir pazīstams uztura bagātinātājs, tomēr tā kvalitāte ir svārstīga un **Audzēšanas iespējas** limitētas. Tā tiek audzēta tropu zonas.

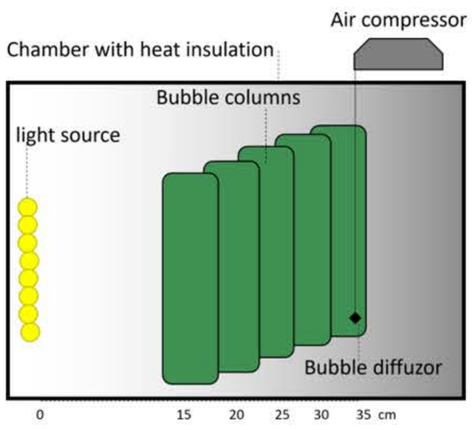

https://thinksid.org/?p=43

## Pētījuma mērķis

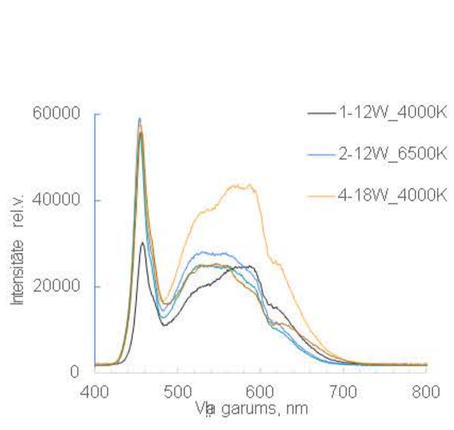
Mikroaļģes aug daudz ātrāk par augstākiem augiem, tomēr *A.platensis* ir zilaļģe, kurā bez hlorofila gaismu uztver arī fikocianīns un citi fikobiliproteīni un karotenoīdi, tādēļ tām nepieciešams noteikt optimālo gaismas spektru, intensitāti un ilgumu, kā arī maisīšanas režīmu, kas nodrošinātu optimālu šūnu piekļuvi gaismai.

AeroFarm's vertical farming facility source: https://time.com/collection/best-inventions-2019/5733085/aerofarms/

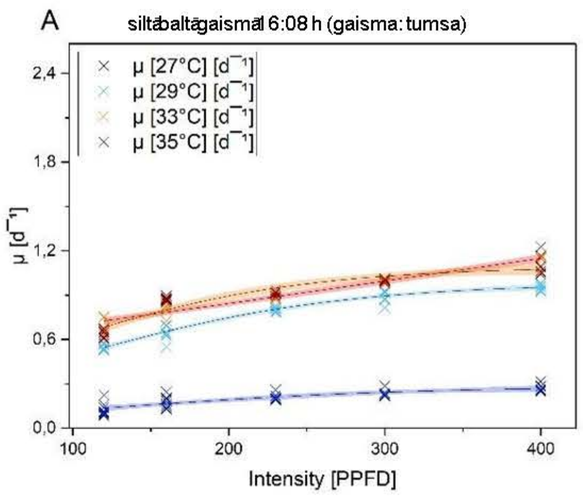
## Rezultāti un diskusija

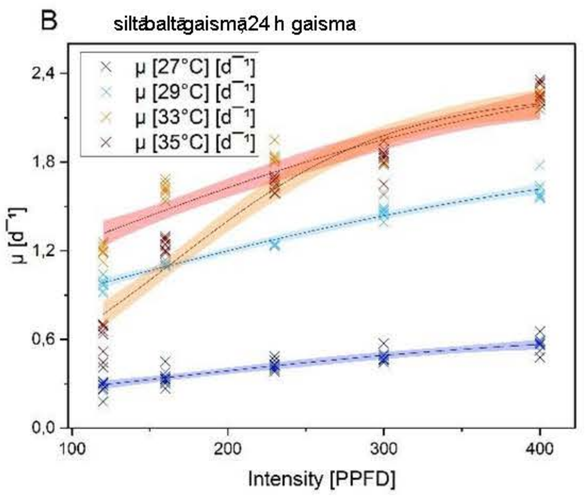



Eksperimenta norises shēma



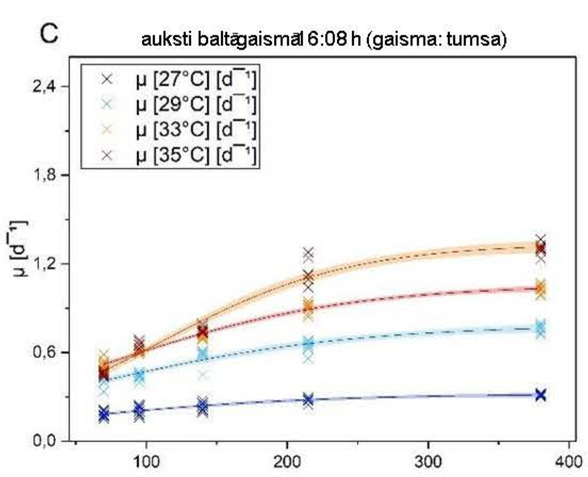

LED gaismas spektri

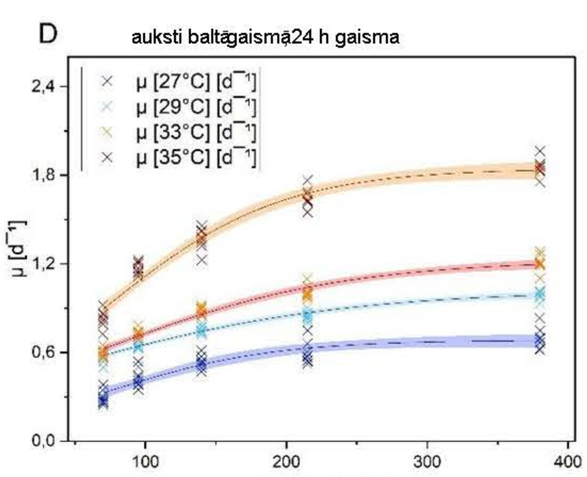



Pie auksti baltas LED gaismas *A.platensis* augšanas ātrums ir lielāks un tās ir energoefektīvākas nekā silti baltasLED gaismas. Siltās un aukstās baltās gaismas spektri atšķiras ar gaismas proporciju pie 450 nm un 500 līdz 600 nm

**Maksimālais īpatnējais augšanas ātrums** 2,34±0,07 tika iegūts aukstā gaismā nepārtrauktā gaismā 33 - 35 °C temperatūrā pirmās dienas laikā, un tas bija par 30% lielāks nekā literatūrā. Ieteicamais augšanas periods ir viena diena.

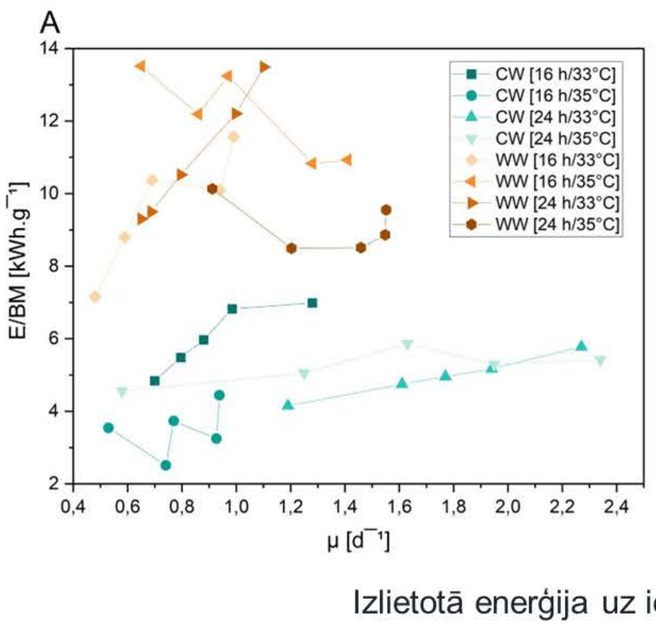


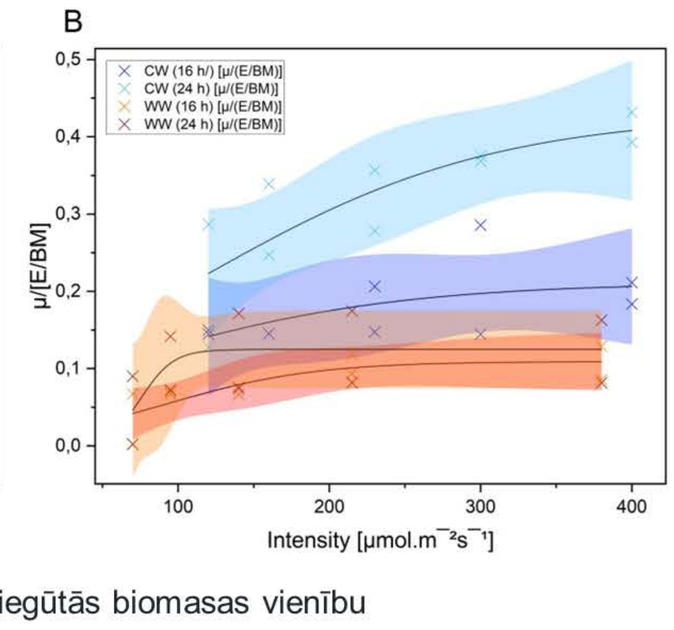




Augšanas ātruma atkarība no gaismas spektra, intensitātes un ilguma

## Secinājumi

Vislielākais augšanas ātrums tika iegūts pie nepārtrauktas gaismas pie maksimālās intensitātes – 400 μmol·fotoni·m-2·s-1, savukārt visekonomiskākā gaismas intensitāte bija pie 193 μmol·fotoni·m-2·s-1 un augšanas ātruma 1,85. ±0,06.




Izlietotā enerģija uz iegūtās biomasas vienību

## Atsauce

Šis darbs izstrādāts ar Eiropas Reģionālās attīstības fonda atbalstu darbības programmas "Izaugsme un nodarbinātība" 1.1.1. specifiskā atbalsta mērķa "Palielināt Latvijas zinātnisko institūciju pētniecisko un inovatīvo kapacitāti un spēju piesaistīt ārējo finansējumu, ieguldot cilvēkresursos un infrastruktūrā" 1.1.1.2. pasākuma "Pēcdoktorantūras pētniecības atbalsts" ietvaros (Nr.1.1.1.2/VIAA/3/19/427.).

## Kontakti

Agnese.stunda-zujeva@rtu.lv

PostDoc Latvia

NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020

EIROPAS SAVIENĪBA
Eiropas Reģionālās attīstības fonds

IEGULDĪJUMS TAVĀ NĀKOTNĒ

1862
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World Congress of Latvian Scientists

# Personal protective equipment. Impact on the wearer and the environment

**Inga DĀBOLIŅA, Ausma VIĻUMSONE, Inese FIĻIPOVA, Eva LAPKOVSKA, Liene SILIŅA**

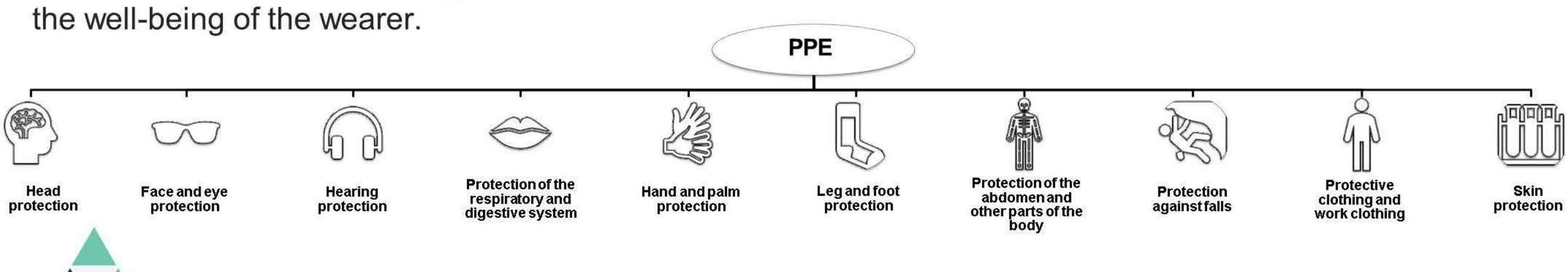
Research Laboratory of Ergonomics Electrical Technologies
Personal Protective Equipment Testing Laboratory

## Introduction

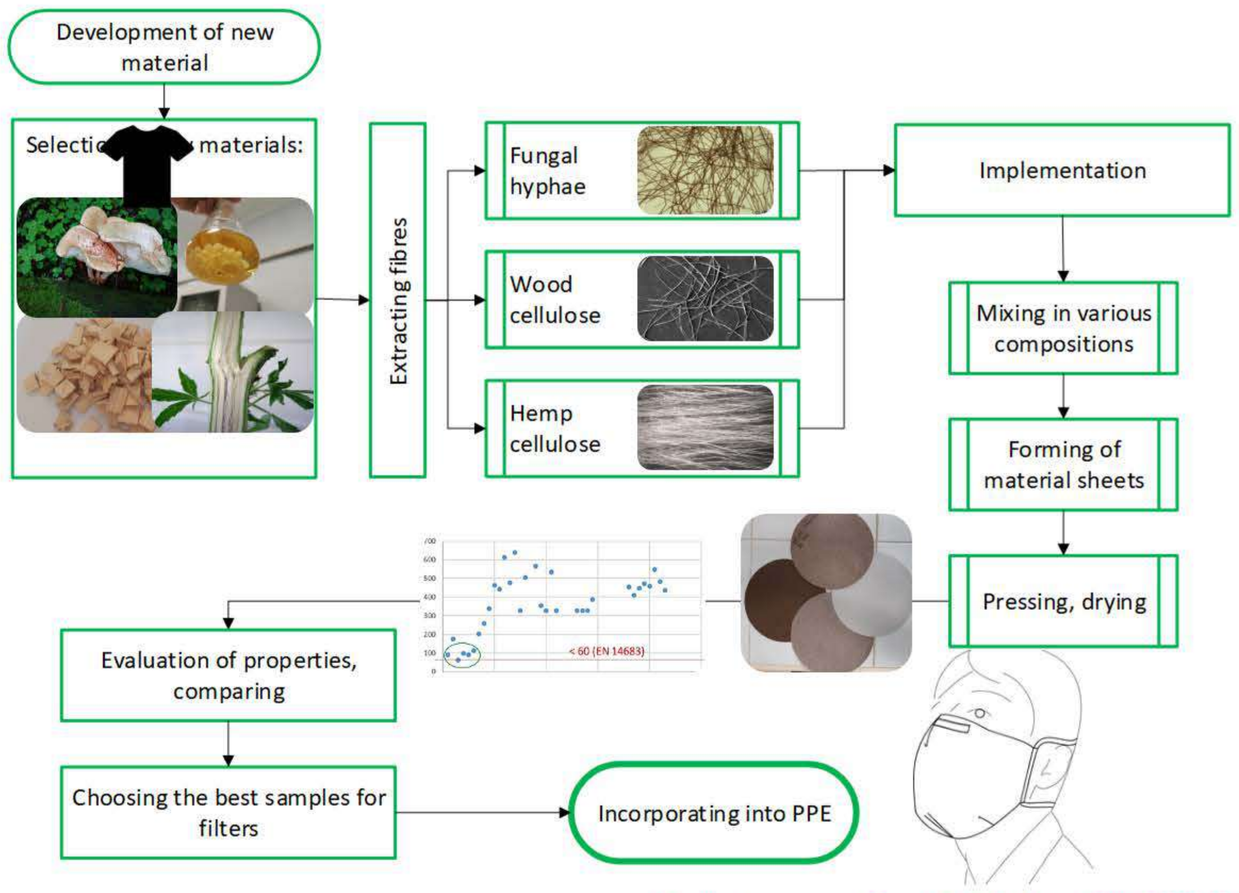
Personal protective equipment includes a wide range of products made from various textile materials. With the development of synthetic materials, part of the PPE is produced for one-time use, this creates a big impact on the environment. We experienced this especially during the pandemic, when the waste of disposable masks was found at every step. The impact on the environment is permanent. Similar problems accompany other PPE, such as work wear and other functional clothing (uniforms). Where procurement for the lowest price often allows to buy products made of materials that are not only less durable (thus contributing to faster material waste - landfill), but also do not contribute to the well-being of the wearer.

## Research Objective

According to the European directives (https://environment.ec.europa.eu/news/waste-framework-directive-revision-2022-02-14_en), waste management and non-generation policies are defined. This research contributes mainly to limiting the creation of waste, both in terms of biodegradable materials and in the research of functional clothing, so that their creation and wear life are as environmentally friendly as possible.




## Results & Discussion




Design sample https://euipo.europa.eu/eSearch/#details/designs/007780150-0001

PPE, protective clothing, work-wear, sports-wear and other special purpose clothing - unlike everyday fashion, is designed for specific wearer needs. Therefore, it must meet several compliance indicators - functional, anthropometric fit and ergonomics. Procurement of inappropriate and/or unusable PPE can lead to economic losses at national level. The creation of unusable and disposable products contributes to significant resource consumption and environmental damage

## Conclusions

Outdated anthropometric data are mostly available, and new data sets are limited and/or unavailable (expensive, closed), but research on individual target sample datasets is a costly and time-consuming process.

There is a need for a set of practical principles for assessing the anthropometric fit and ergonomics (also due material properties and microclimat) of PPE, and for establishing sustainability principles in PPE design and development.

- Special-purpose clothing and devices (PPE) *(objects)*
- Material properties, tests
- Users/consumers *(subjects)*
- Competent contact-persons
- Experts/specialists
- Anthropometric research
- Interviews
- Surveys
- Tests of ergonomics

## Contact Information

ppelab@rtu.lv; inga.dabolina@rtu.lv

RIGA TECHNICAL UNIVERSITY

Pasaules latviešu zinātnieku kongress

# Veģetārais uzturs Latvijā vēsturiskā perspektīvā

**Gita Krūmiņa-Zemture, Ilze Beitāne, Sandra Īriste**

Latvijas Biozinātņu un tehnoloģiju universitāte

## Ievads

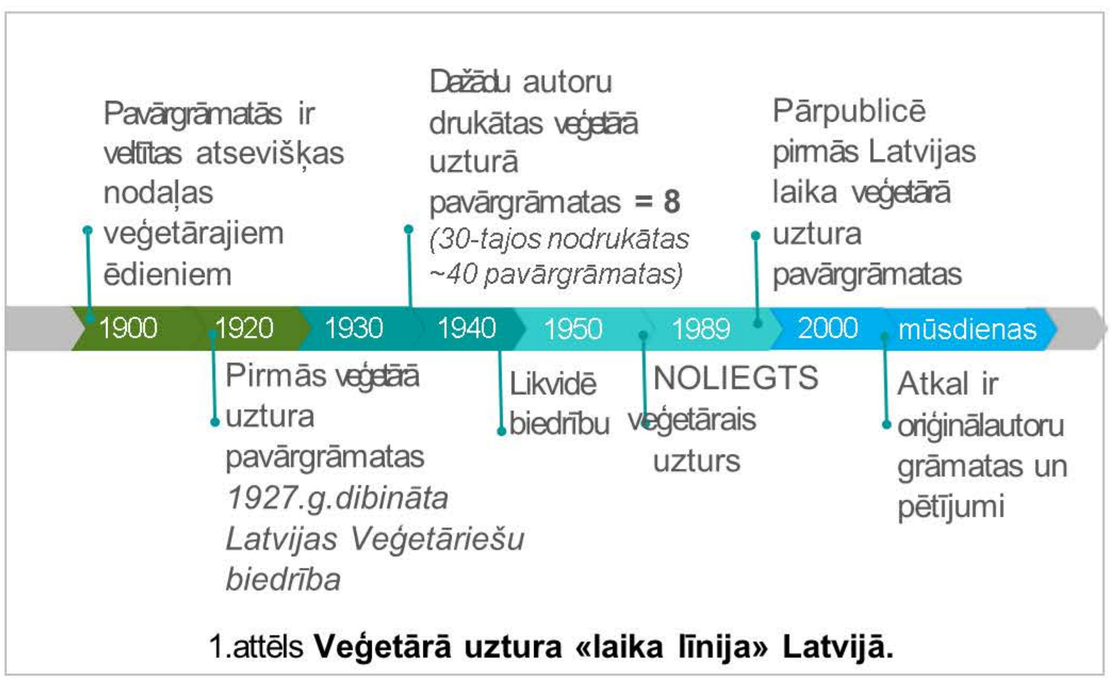
Veģetārisma jēdzienu latviešu sabiedrība iepazina latviešu valodā izdotajās pavārgrāmatās jau 19. gs. beigās, bet savu popularitāti veģetārisms Latvijā ieguva pagājušā gadsimta 30-tajos gados *(skatīt 1.att.)*. Latvijas Veģetāriešu biedrības atziņas lasāmas Marijas Āriņas sastādītajā pavārgrāmatā "Veģetārā virtuve" (1935.), kur teikts: *"zem vārda "veģetārisms", kas cēlies no latiņu vārda "vegetus" ir jāsaprot veselīgs, jautrs un priecīgs dzīves veids, saskaņā ar dabas likumiem."* Mainoties politiskajai iekārtai Latvijā, tās padomju savienības laikā, veģetāro uzturu noliedza un atzina visēdāju uztura pieeju, bet atgūstot Latvijas neatkarību, arī veģetārisms kā dzīvesveids atgriezās Latvijas sabiedrībā.

Jau vēsturiski veģetārismu plašāk latvieši iepazina caur dažādu autoru sastādītajām veģetārajām pavārgrāmatām *(skatīt 2.att.)*.

## Pētījuma mērķis

Analizēt veģetāro uzturu Latvijā vēsturiskā un mūsdienu kontekstā.

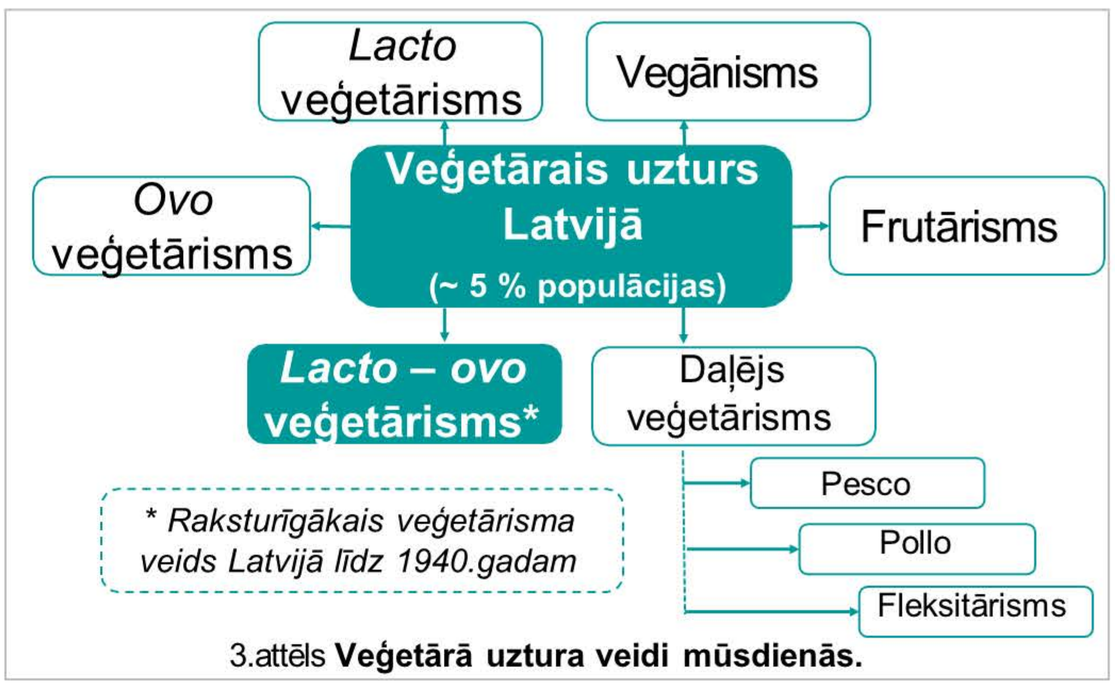
Pētījuma veikšanā pielietotā pētnieciskā metode ir kontentanalīze.




1.attēls **Veģetārā uztura «laika līnija» Latvijā.**

## Rezultāti un diskusija


2.attēls **Veģetārā uztura pavārgrāmatas 1930-tajos un pārpublicētās 1990-tajos.**




3.attēls **Veģetārā uztura veidi mūsdienās.**

Pagājušā gadsimta Latvijā veģetārisms tika saistīts ar tādām atziņām, kā ēdieni gaļas vietā; veselīgs, jautrs un priecīgs dzīves veids, saskaņā ar dabas likumiem; barības reformēšana un uztura palētināšana; barības jautājumā ienest modernās zinātnes atziņas; mērenība un veselīga dzīvesveida īstenošana. Pirmās Latvijas laikā no izdotajām vairāk nekā 40 pavārgrāmatām, astoņas (8) tika veltītas veģetārajam uzturam, sniedzot veģetārā uztura izvēles pamatojumu un daudzveidīgu ēdienu receptūru, ēdienkaršu klāstu *(skatīt 1.tab.)*.
Mūsdienās daudzveidīgais veģetārais uzturs *(skatīt 3.att.)* ir balstīts uz veselīga uztura un ilgtspējīgas dzīves pamatprincipiem, tas aizsargā un respektē bioloģisko daudzveidību un ekosistēmas, kas rosina veselīgu dzīvesveidu tagadnē un nākotnes paaudzēm, kas ir viens no prioritārajiem virzieniem Latvijas pamatdokumentā Sabiedrības veselības pamatnostādnes 2021. - 2027.gadam.

## Secinājumi

Mūsdienu Latvijas sabiedrībā ir izplatīti dažādi veģetārā uztura veidi, savukārt 20. gs. 30–tajos gados tas raksturojams kā *ovo-lakto* veģetārisms. Vēsturiski veģetārisma attīstībai bija cieša saistība ar lauksaimniecības straujo attīstību un sarežģīto ekonomisko situāciju Latvijā, kā arī ar aktuāliem tā laika veselīga uztura zinātniskiem pētījumiem Eiropā, tad mūsdienu Latvijā veģetārisms ietver sevī ne tikai veselīga uztura un ētikas aspektus, bet arī vides, sociālo un ilgtspējības apsvērumu.

1.tabula

**20. gs. 30-tajos Latvijā publicēto veģetāro pavārgrāmatu izvērtējums**

| Kritērijs | Dora Švīkule | Marija Āriņa | Leontīne Birnbaums | Emīlija Oga | Marija Feldmanis |
|---|---|---|---|---|---|
| Zinātniski pamatots un balstīts uz pētījumiem | Dr.Hanischa Dr.Robertsa | Latvijas Veģetāriešu biedrība | Latvijas Veģetāriešu biedrība | Vācijas dziedniecības iestādes vad. Dr. Med. M.Birhers-Benners | Zviedru prof. J.Holmgrēns, dāņu uzturvielu speciālists Dr.M.Hindhede, u.c. |
| Cittautu ēdieni | Latviskā virtuve | Bļiņas | Risotto | Itāļu, franču, angļu virtuves | Boršč̌s, pildīti dārzeņi angļu gaumē |
| Receptūras | Apraksts | Precīzas | Dažāda pieeja | Precīzas | Precīzas |
| **KOPĀ ēdieni, skaits** | **210** | **172** | **210** | **417** | **295** |

## Kontaktinformācija

Gita Krūmiņa-Zemture e-pasts: gita.krumina@lbtu.lv; tālruņa Nr. +371 63021075

Latvijas Biozinātņu un tehnoloģiju universitāte

GASTROPOĒTIKA

World Congress of Latvian Scientists

# Bioresource circularity in agriculture, forestry and aquaculture: typology of intra-sectoral and cross-sectoral solutions

Anda Ādamsone-Fiskoviča, Tālis Tisenkopfs, Oksana Žabko, Emīls Ķīlis, Sandra Šūmane, Miķelis Grīviņš
Baltic Studies Centre

## Introduction

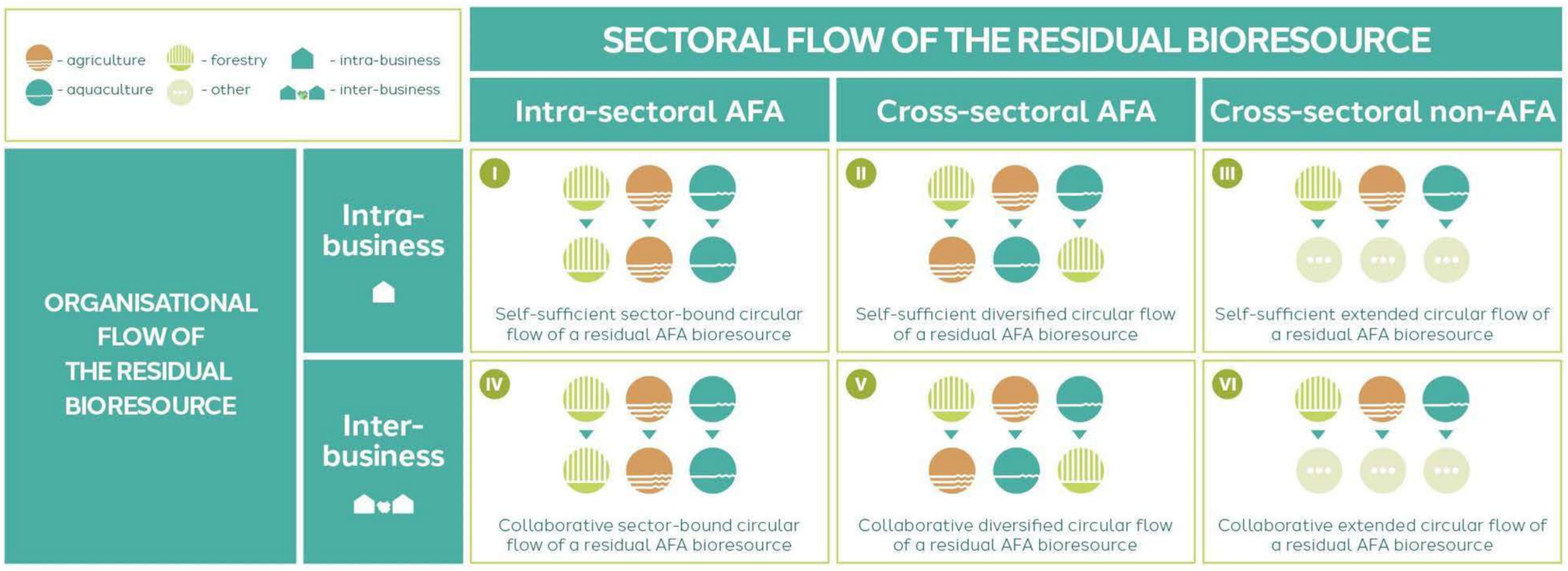
The widespread adoption of the 'reduce', 'reuse', 'recycle' and 'recover' principles inherent in the circular economy is a core aspect of future-proof development that aims to reduce waste and increase efficient use of resources. Promoting loop-closing practices and business models organised around circular resource use in value chains is of strategic importance. Unsurprisingly, food, water and nutrients are among the core foci of the Circular Economy Action Plan (EC, 2020). While the Action Plan touches upon agriculture, a broader, cross-sectoral understanding linking the bioeconomy sectors of agriculture, forestry, and aquaculture (AFA) is lacking.

## Research Objective

The study has been carried out as part of a research project CIRCLE that develops an interdisciplinary perspective on circular bioeconomy in the Baltic-Nordic region and focuses on the role of collaboration in the development and implementation of circular solutions in AFA sectors. With the aim to explore and systematise the diversity of circular initiatives in the bioeconomy sector, we have built a typology that charaterises circular flows of residual bioresources within and across AFA sectors and businesses. The typology is based on a collection of 120 diverse examples of circular solutions in AFA sectors in Latvia, Lithuania, Estonia and Norway.

## Results & Discussion

The unit of analysis chosen for the construction of the typology was a specific residual AFA bioresource and its (1) sectoral flow (i.e., intra-sectoral, cross-sectoral AFA, cross-sectoral non-AFA), and (2) organisational flow (i.e., intra-business, inter-business). The intersection of the two dimensions results in six types of circularity initiatives that feature sector-bound, diversified, or extended flows of residual AFA bioresources managed in either a self-sufficient or collaborative way.




**Example 1: Type I**

Using in-house sheep manure and residuals of sheep wool as fertilisers for own grapes

**Example 2: Type V**

Using pine bark from log peeling for production of mulch in horticulture

**Example 3: Type III**

Using in-house chicken manure in a biogas plant for producing own electricity and heat

## Conclusions

The proposed typology of circularity initiatives involving residual bioresources stemming from and/or finding their application in AFA sectors shows that there are notable variations in the way their flow is organised within and/or between different sectors and companies. The core categories of sectoral and organisational flow of bioresources underlying the typology offers a new way to conceptualise and systematise the rich diversity of practical arrangements in bioresource circulation, by integrating the technological and socio-economic aspects of circularity.

## Contact Information

E-mail: anda.adamsone-fiskovica@bscresearch.lv

"CIRCLE receives financial support from the Baltic Research Programme project No. EEZ/BPP/VIAA/2021/9 "Promoting collaboration for sustainable and circular use of bioresources across agriculture, forestry, and aquaculture (CIRCLE)" under the EEA Grant of Iceland, Liechtenstein and Norway."

BSC BALTIC STUDIES CENTRE

CIRCLE

Promoting collaboration for sustainable and circular use of bioresources across agriculture, forestry, and aquaculture

Iceland Liechtenstein Norway grants

World Congress of Latvian Scientists

# Advanced Techniques for Wireless Power Transfer

**Ruslans Babajans*, Janis Eidaks, Romans Kusnins, Kristaps Gailis, Pavels Krukovskis, Anna Litvinenko***

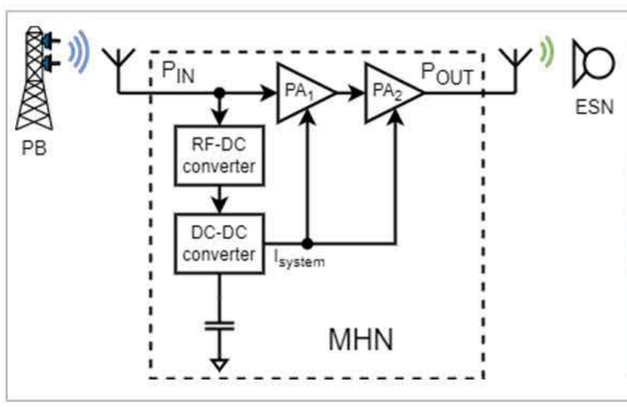
Riga Technical University, Institute of Microwave Engineering and Electronics

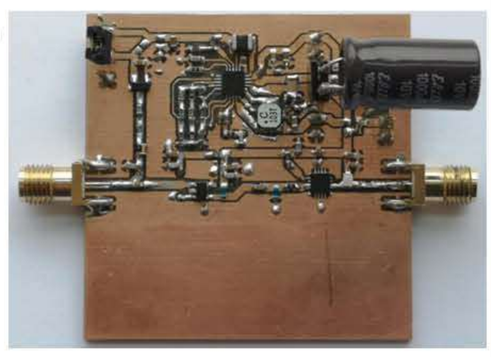
## Introduction

Wireless Sensor Networks (WSNs) rapidly change the modern world by creating interconnected smart environments for various applications. The most challenging issues in this area are the WSN system-level design and the operational efficiency of sensor nodes (SNs), including energy efficiency. They require innovative approaches and methods in energy supply solutions. The growing interest in overcoming this challenge was directed toward developing far field wireless power transfer (WPT). The growing employment of wireless devices in various branches of the Latvian industry makes WPT a feasible solution to the powering challenge using batteries. While the given powering technique is feasible, WPT performance enhancement is the main challenge.

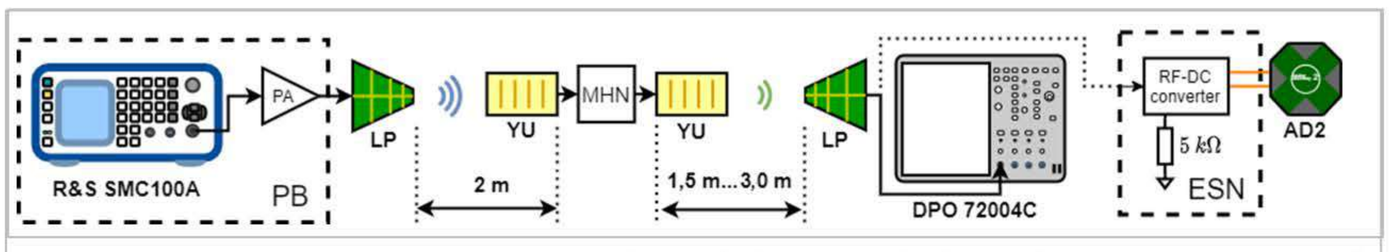
## Research Objective

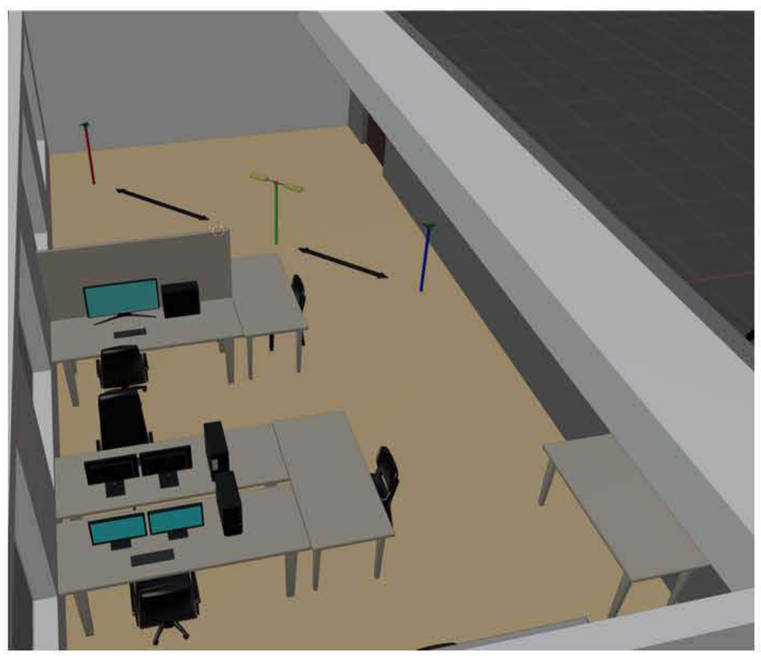
The current research aims to investigate and experimentally study several innovative techniques of wireless power transfer: multi-hop energy transfer, passive beamforming using intelligent reflecting surfaces (IRSs), and application of RF powering signals adapted to the transmission channel. The research also studies the combinations of the techniques for more efficient WPT. The research is based on simulation of energy transfer processes and experimental study performed in the laboratory.

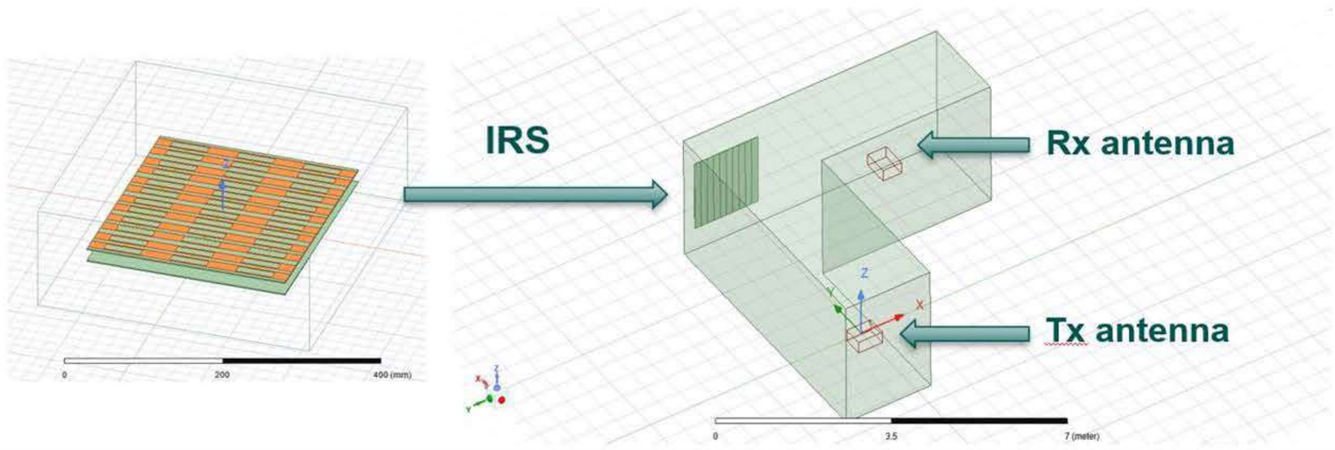


## Results & Discussion



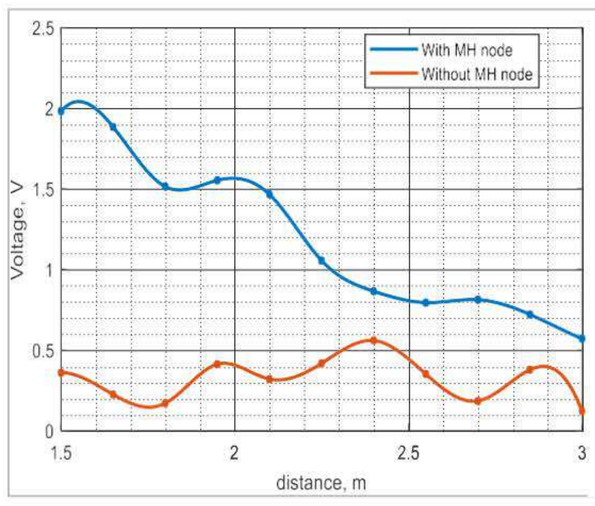


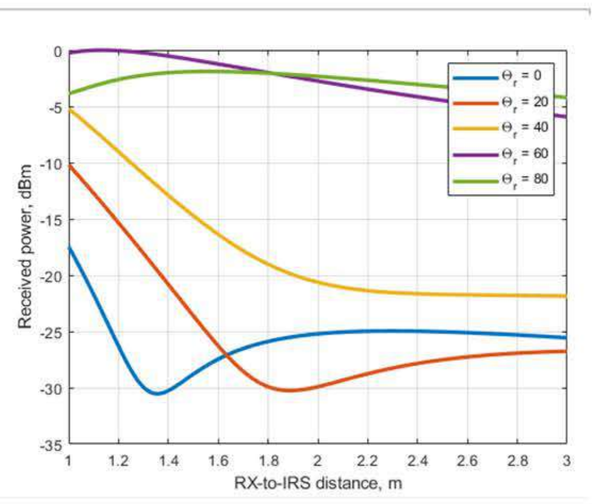

At the given time, the research team has acquired the following results:

- A multi-hop node has been designed based on RF energy harvesting and signal amplification. The multi-hop node comprises a pair Yagi-Uda antennas, a voltage doubler-based converter, a two-stage amplifier, and an energy-storing capacitor. For a 27 dBm transmitted powering signal, the proposed multi-hop energy transfer approach increases the received power and, therefore, the efficiency of the WPT system.
- The development of intelligent reflective surfaces has led to the finalized design. The simulation of the IRS demonstrates that employing a single IRS makes it possible to increase the received power by more than an order of magnitude. Experimental verification of the simulation results is ongoing.

## Conclusions

The results of the research demonstrate that the innovative techniques of WPT, such as multi-hop energy transfer and passive beamforming using intelligent, reflective surfaces, are promising solutions for enhancing the performance of WPT. The next step of the research is investigating the application of RF powering signals adapted to the transmission channel.




## Contact Information

Ruslans Babajans (ruslans.babajans@rtu.lv)

Anna Litvinenko (anna.litvinenko@rtu.lv)

RIGA TECHNICAL UNIVERSITY

Pasaules latviešu zinātnieku kongress

# RISINĀJUMI ILGTSPĒJĪGAI ATTĪSTĪBAI SPORTĀ

**Antra Gulbe**

Latvijas Sporta pedagoģijas akadēmija

## Ievads

Arī sports var kalpot par pozitīvu, ilgtspējīgu pārmaiņu līdzekli. Viens no lielākajiem sporta pasākumiem pasaulē ir olimpiskās spēles. Olimpiskās kustības dalībniekiem ir pienākums aktīvi piedalīties globālajās ilgtspējas debatēs, iesaistoties nākotnes rīcības programmā 21. gadsimtam par „pasaules pārveidošanu par labāku vietu ar sporta palīdzību". Starptautiskā Olimpiskā komiteja 2019. gadā lēma dot iespēju vairākām pilsētām vienoties par kopīgu spēļu rīkošanu, lai izvairītos gan no milzīgu naudas līdzekļu tērēšanas, gan orietējoties uz esošās sporta infrastruktūras izmantošanu un jaunas nebūvēšanu, uz spēļu norises ilgtspēju un citām vadlīnijām jauna standarta spēļu rīkošanai.

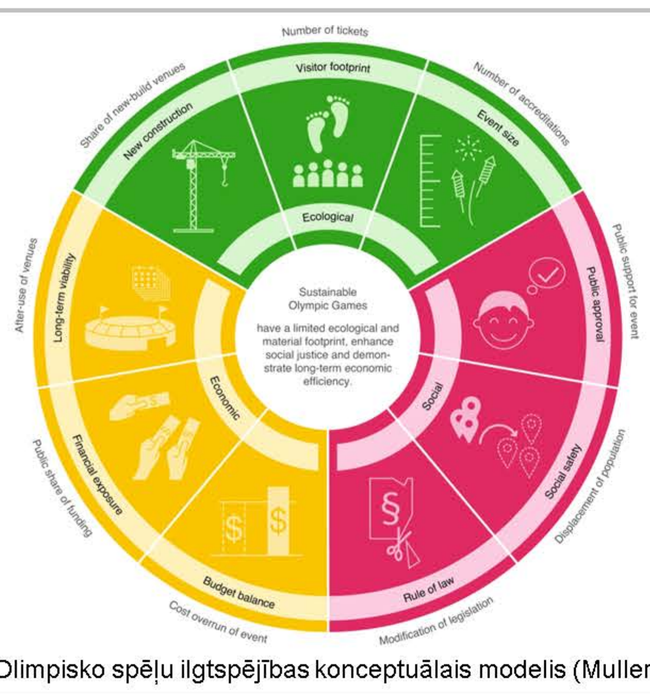
## Pētījuma aktualitāte

Lai īstenotu vides ilgtspējas koncepciju, galvenie izaicinājumi olimpisko spēļu organizatoriem:

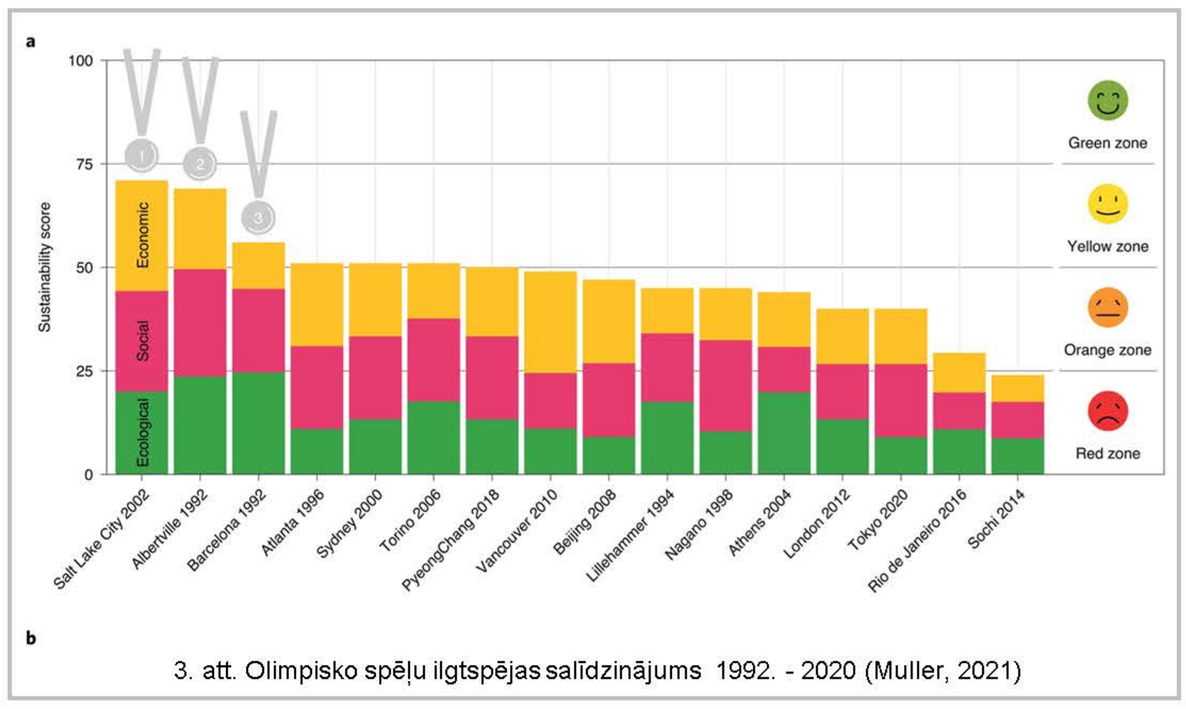
- maksimāli izmantot esošās būves; jaunas veidot tikai tad, ja tās sniedz ilgtermiņa ieguvumu vietējām kopienām;
- prioritāte iepriekš attīstītas vai degradētas zemes izmantošanai, nevis zaļajām teritorijām;
- saglabāt aizsardzības statusu visām aizsargājamajām dabas vai kultūras teritorijām;
- optimizēt norises vietu ekoloģiskos raksturlielumus (ietekmi uz gaisu, ūdeni, augsni, bioloģisko daudzveidību, klimatu un izejvielu pieejamību).


1. att. Starptautiskās Olimpiskās komitejas noteiktās vides ilgtspējas fokusa jomas

## Rezultāti un diskusija




2. att. Olimpisko spēļu ilgtspējības konceptuālais modelis (Muller, 2021)

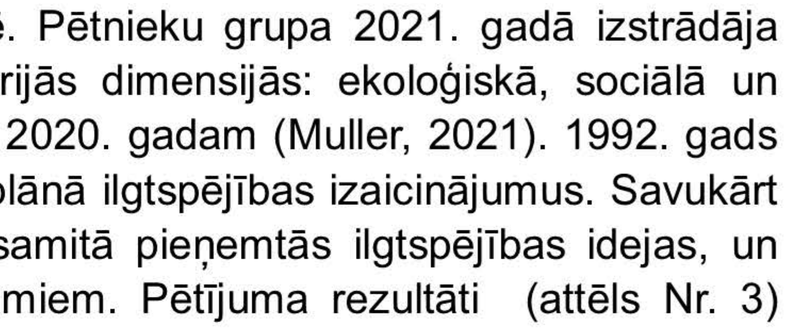



3. att. Olimpisko spēļu ilgtspējas salīdzinājums 1992. - 2020 (Muller, 2021)

Olimpiskās spēles ir visskatītākie un dārgākie sporta notikumi pasaulē. Pētnieku grupa 2021. gadā izstrādāja ilgtspējas izvērtēšanas modeli ar deviņiem rādītājiem (attēls Nr. 2), trijās dimensijās: ekoloģiskā, sociālā un ekonomiskā, lai novērtētu olimpisko spēļu ilgtspējību laikā no 1992. līdz 2020. gadam (Muller, 2021). 1992. gads iezīmējās ar strauju olimpisko spēļu izaugsmes sākumu, izvirzot priekšplānā ilgtspējības izaicinājumus. Savukārt 2016. gadā Riodežaneiro Olimpiādes spēlēs populāras kļuva Zemes samitā pieņemtās ilgtspējības idejas, un olimpiskajās spēlēs sāka parādīties pastāvīga uzmanība vides jautājumiem. Pētījuma rezultāti (attēls Nr. 3) parādīja, ka olimpisko spēļu kopējā ilgtspējība ir vidēja un laika gaitā tā ir samazinājusies. Spēles Soltleiksitijā 2002. gadā bija ilgtspējīgākās olimpiskās spēles šajā periodā, savukārt Soči 2014. gadā un Riodežaneiro 2016. gadā bija vismazāk ilgtspējīgas. Nevienas olimpiskās spēles neieguva augstākos punktus nevienā kategorijā. Pētījuma rezultāti ļauj secināt - olimpisko spēļu rīkošanu ilgtspējīgāku varētu sekmēt, ievērojami samazinot pasākuma apjomu; olimpisko spēļu rotācija starp tām pašām pilsētām; neatkarīgu ilgtspējības standartu ieviešana.

## Secinājumi

Kaut arī Starptautiskā Olimpiskā komiteja izstrādājusi vairākus ilgtspējīgas attīstības dokumentus un vadlīnijas, sarīkot plašus sporta pasākumus ir izaicinājums ikvienai pilsētai. Tas ir aktuāli arī Latvijai, jo patlaban tiek izskatītas sadarbības iespējas, lai virzītu kandidatūru 2030. gada ziemas olimpisko spēļu sarīkošanai Stokholmā un Siguldā. Olimpisko sacensību rīkošana Siguldā būtu loģiska, jo Zviedrijai būvēt savu ledusrenes trasi nebūtu ilgtspējīgi, jo šādu sporta objektu pasaulē jau pietiek.



## Kontaktinformācija

Antra.Gulbe@lspa.lv

World Congress of Latvian Scientists

# The release of non-extractable ferulic acid from cereal by-products by enzyme-assisted hydrolysis for possible utilization in green synthesis of silver nanoparticles

**Vitalijs Radenkovs[1,2,*], Karina Juhnevica-Radenkova[1], Dmitrijs Jakovlevs[2], Anda Valdovska[2]**

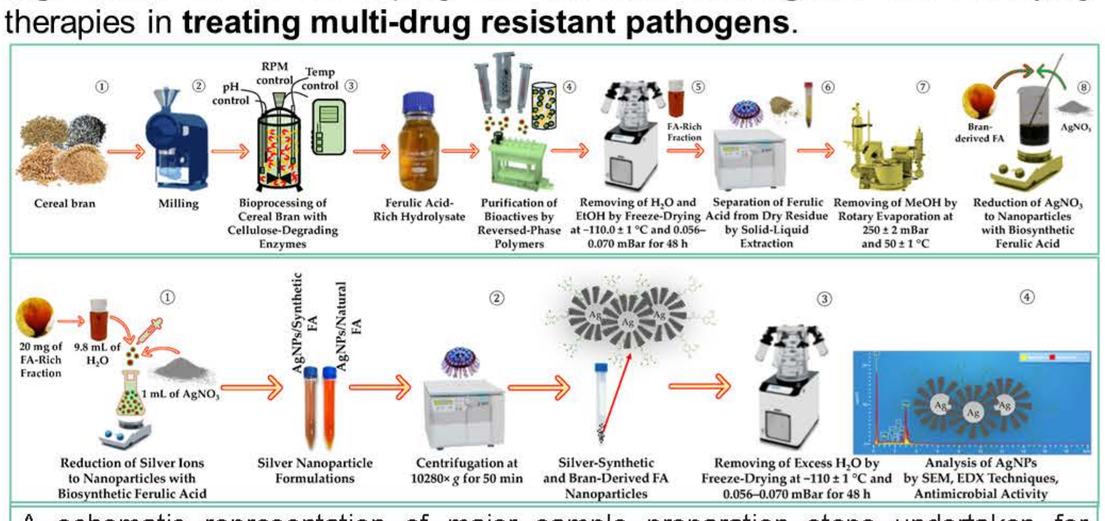
[1] Institute of Horticulture, Dobele, Latvia; [2] Latvia University of Life Sciences and Technologies, Jelgava, Latvia

## Introduction

The present work was undertaken to elucidate the potential contribution of biosynthetically produced ferulic acid (FA) via enzymatic hydrolysis (EH) of rye bran (RB) to the formation of silver nanoparticles (AgNPs) during green synthesis. An analytical approach accomplished by multiple reaction monitoring (MRM) using HPLC-ESI-TQ-MS/MS of the obtained hydrolysate revealed a relative abundance of two isomeric forms of FA, i.e., *trans-FA* (t-FA) and *trans-iso-FA* (*t-iso-FA*). Further analysis utilizing HPLC-RID confirmed the effectiveness of RB EH, indicating the presence of cellulose and hemicellulose degradation products in the hydrolysate, i.e., xylose, arabinose, and glucose. The purification process by solid-phase extraction with styrene-divinylbenzene-based sorbent ensured up to 116.02 and 126.21 mg $g^{-1}$ of *t*-FA and *t-iso*-FA in the final eluate fraction, respectively. In the green synthesis of AgNPs using synthetic *t*-FA, the formation of NPs with an average size of 56.8 nm was confirmed by SEM and EDS techniques. The inclusion of polyvinylpyrrolidone (PVP-40) in the composition of NPs during synthesis favorably affected the morphological features, i.e., the size and shape of AgNPs, in which as big as 22.4 nm NPs were engineered. Round-shaped AgNPs with an average size of 16.5 nm were engineered using biosynthetically produced a mixture of *t*-FA and t-*iso*-FA and PVP-40 as a capping agent. The antimicrobial activity of AgNPs against Pseudomonas aeruginosa, *E. coli*, *E. faecalis*, *B. subtilis*, and *S. aureus* was confirmed by the disk diffusion method and supported by MIC and MBC values.

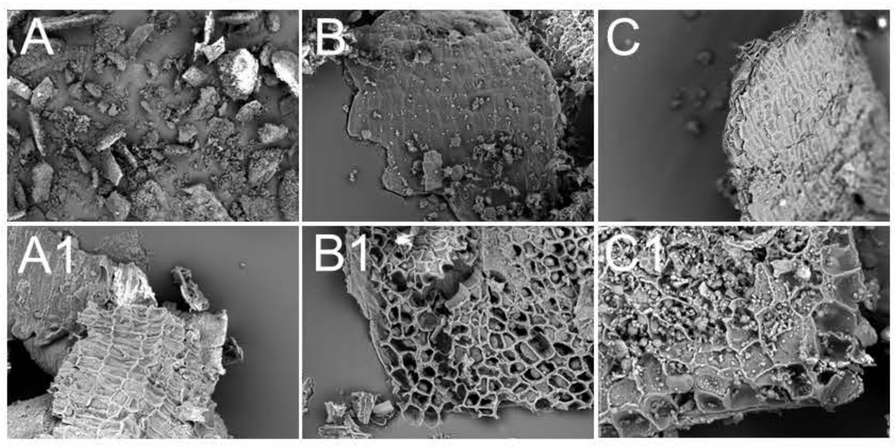
## Research Objective

Among the global threats this century, controlling and suppressing the spread of microbial infections has become the number one challenge. Overuse of antibiotics is the main driver leading to the development of multidrug-resistant (MDR) pathogens. There is a demand for developing new antimicrobial agents and modifying therapies effective in treating MDR pathogens. Lately, cutting-edge research in nanotechnology comes with the development of nano-scale objects with superior antimicrobial actions against MDR pathogens, indicating a platform to combat ESKAPE (*E. faecium*, *S. aureus*, *K. pneumoniae*, *A. baumannii*, *P. aeruginosa*, and *Enterobacter* spp.) in the era of antimicrobial resistance (AMR). Given the need to reduce problems of environmental pollution with cereal processing by-products, this study **demonstrates** a technological solution of RB rational use in the **sustainable** production of **AgNPs** during **green synthesis**, which effectively can be used as **active pharmaceutical ingredients** in the developing new **antimicrobial agents** and modifying therapies in **treating multi-drug resistant pathogens**.

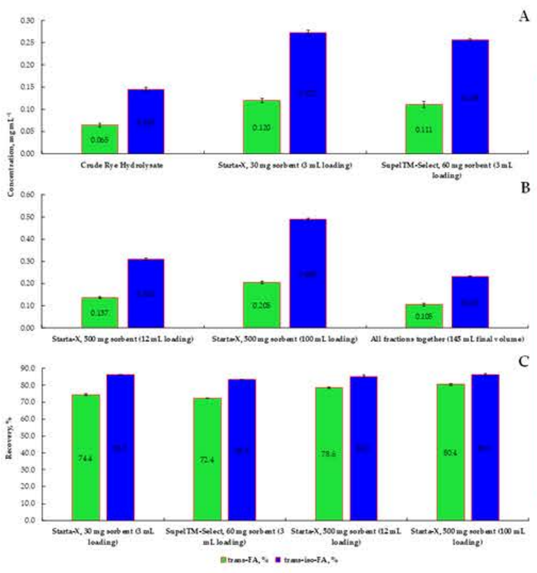



A schematic representation of major sample preparation steps undertaken for isolation of *t*-FA and *t-iso*-FA from RB and subsequent use as reducing agents in green synthesis of silver nanoparticles.

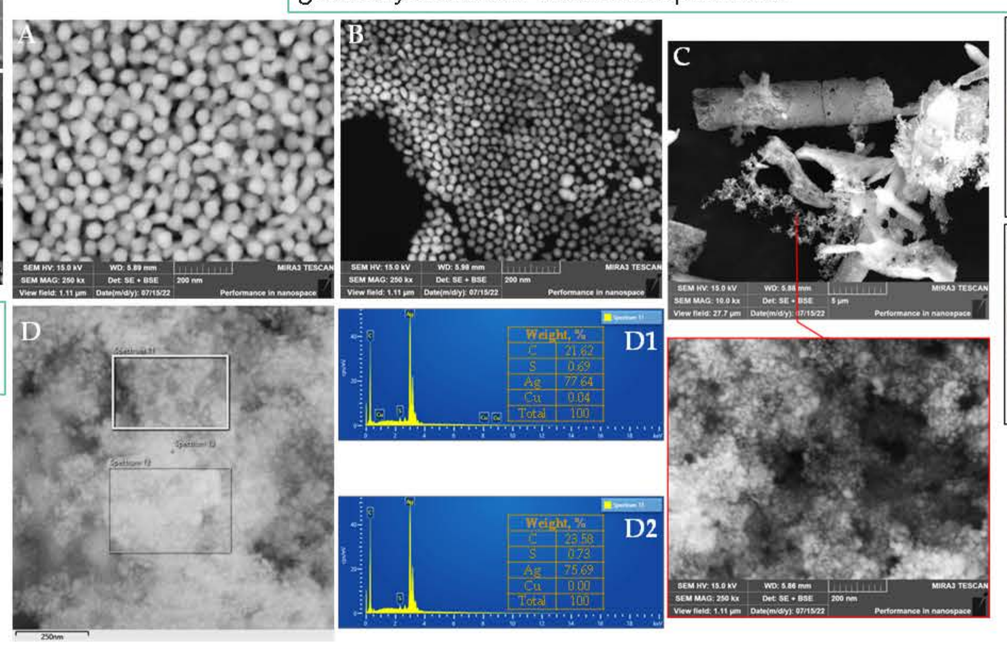
## Results & Discussion



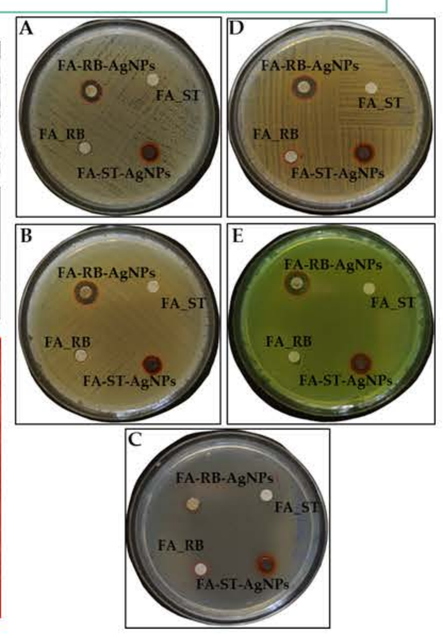

Scanning electron microscopy (SEM) images of untreated (**A**,**B**,**C**,) and EH RB samples (**A1**,**B1**,**C1**).




The concentration of *t*-FA and *t-iso*-FA after EH of RB with subsequent SPE process conducted within small-scale (**A**) and large-scale (**B**) using styrene-divinylbenzene-based sorbents.



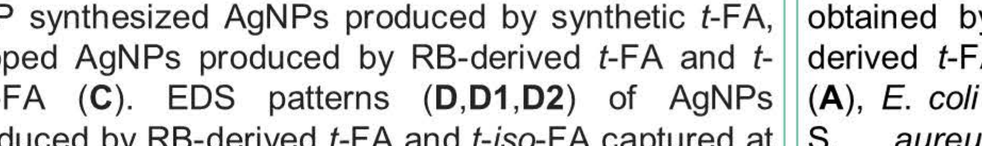

SEM images of uncapped (**A**) and capped (**B**) with PVP synthesized AgNPs produced by synthetic *t*-FA, capped AgNPs produced by RB-derived *t*-FA and *t-iso*-FA (**C**). EDS patterns (**D**,**D1**,**D2**) of AgNPs produced by RB-derived *t*-FA and *t-iso*-FA captured at two randomly selected regions for EDS analysis.




Disk diffusion tests for AgNPs obtained by synthetic and RB-derived *t*-FA against *B. subtilis* (**A**), *E. coli* (**B**), *E. faecium* (**C**), S. *aureus* (**D**), and *P. aeruginosa* (**E**).

Partial degradation and fracture of lignocellulose-rich RB fraction after EH was confirmed by SEM analysis, leading to the increase in the cellulose and hemicellulose-derived monosaccharides content along with the release of bioactive compounds, FA in particular.

Subsequent purification of hydrolysate using SPE with styrene-divinylbenzene-based sorbent ensured complete removal of carbohydrates from hydrolysates. Up to 116.02 and 126.21 mg $g^{-1}$ of *t*-FA and *t*-iso-FA in the final syrup-like fraction were obtained following SPE approach. In the course of green synthesis of AgNPs, recovered FA-rich fraction ensured the formation of round-shaped AgNPS with narrow size distribution with 16.5 ± 3.2 nm on average. The EDX pattern at two randomly selected regions revealed the presence of sulfur (S) and copper (Cu) elements, whose contribution was below 1% of the weight, indicating the relative purity of obtained AgNPs. The antimicrobial activity probing of AgNPs engineered by biosynthetic *t*-FA and *t-iso-FA* revealed its effectiveness in inhibiting pathogenic bacteria. However, *P. aeruginosa* and *S. aureus* were found to be the most resistant to AgNPs, as 0.69 mg $mL^{-1}$ AgNPs were needed to cause irreversible consequences that resulted in death.



## Conclusions

This study demonstrated a technological solution of RB rational use by taking advantage of EH, indicating that RB could be considered a cheap and renewable source of both *t*-FA and *t-iso*-FA, the bioactives that greatly contributed to the formation of AgNPs during green synthesis. Incorporating amphiphilic PVP-40 as a capping and additional reducing agent greatly facilitated the formation of AgNPs with an average size of 16.5 nm. The fabricated AgNPs have shown effectiveness against both Gram-positive and Gram-negative pathogenic bacteria supported by the values of MIC and MBC. However, the ability of *P. aeruginosa* to form a strong matrix of biofilm and the positive surface charge of *S. aureus* perhaps were the main factors that contributed to the relatively stronger resistance to the fabricated AgNPs.

## Contact Information

Head of Division of Smart Technologies, LBTU, Vitalijs Radenkovs, vitalijs.radenkovs@llu.lv

DĀRZKOPĪBAS INSTITŪTS

Pasaules latviešu zinātnieku kongress

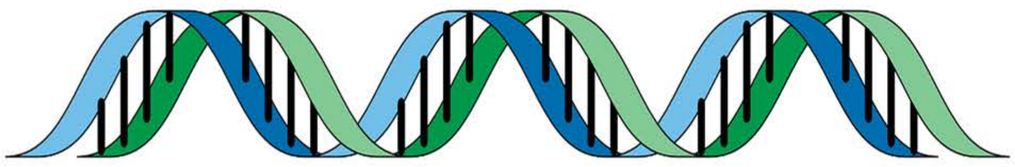
# Ģenētiskie un genomiskie pētījumi Latvijas Valsts mežzinātnes institūtā "Silava"

**Šķipars V, Krivmane B, Ramanenka M, Bitenieks K, Šņepste I, Sirsniņa V, Ruņģe KS, Lazdiņa V, Ruņģe MM, Baranova M, Ruņģis DE.**

Ģenētisko resursu centrs, Latvijas Valsts mežzinātnes institūts "Silava"

## Ievads

Latvijas Valsts mežzinātnes institūtā "Silava" (LVMI "Silava") atrodas Ģenētisko resursu centrs (ĢRC), kas koordinē aktivitātes ģenētisko resursu jomā un uztur Latvijas kultūraugu gēnu banku. Molekulārās ģenētikas laboratorijā veic ģenētiskos un genomiskos pētījumus dažādās augu, dzīvnieku, sēņu un mikrobu sugās. ĢRC sadarbojas ar visiem LVMI "Silava" pētniecības virzieniem, kā arī ar Latvijas un starptautiskajiem partneriem dažādos izpētes virzienos. ĢRC veic arī funkcionālos molekulāri ģenētiskos pētījumus par meža koku sugām, piemēram, priedi un bērzu. Izmantojot genoma, transkriptoma un īso RNS (mikroRNS) sekvenēšanu, tiek pētīti rezistences un adaptīvo īpašību molekulārie pamati.



ĢRC specializējās uz ne-modeļu sugu ģenētiskiem pētījumiem. Pētījumi, izmantojot dažādus molekulāros marķierus un metodes, ietver sugu un indivīdu identifikāciju, vides DNS analīzes, augsnes mikrobiotisko sabiedrību raksturojumus un biodaudzveidības monitoringu.

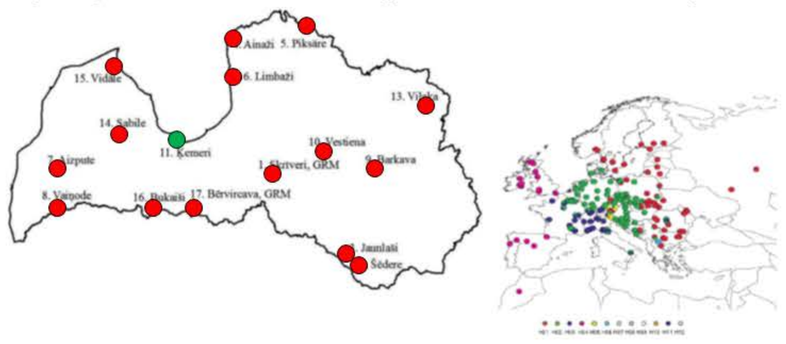
## Populāciju pētījumi

Ģenētiskie un genomiskie pētījumi var sniegt padziļinātu informāciju par populāciju daudzveidību, struktūru, izcelsmi, radniecību utt. ĢRC veic populāciju pētījumus par meža koku, laukaugu un savvaļas sugām, kā arī par sūnām, bezmugurkaulniekiem un zīdītājiem.

**DNS marķieru izmantošana Latvijas brūnā lāča populācijas monitoringā.**
Ģenētiskās analīzes veic izmantojot neinvazīvā ceļā ievāktus paraugus (mati, ekskrementi, siekalas, pēdu nospiedumi). Tas dod iespēju noteikt indivīda dzimumu, skaitu, pārvietošanos un uzturēšanos ilgumu Latvijas teritorijā. 2022. gadā ar molekulāri ģenētiskajām metodēm apstiprināti 16 dažādi indivīdi, no kuriem trīs konstatēti arī iepriekšējā pētījuma periodā (2018. – 2021.). Kopumā ar molekulāri ģenētiskajām metodēm apstiprināti vismaz 72 indivīdi (no tiem – 40 tēviņi un 12 mātītes), kas laikā no 2018. līdz 2022. gadam uzturējušies Latvijas teritorijā.

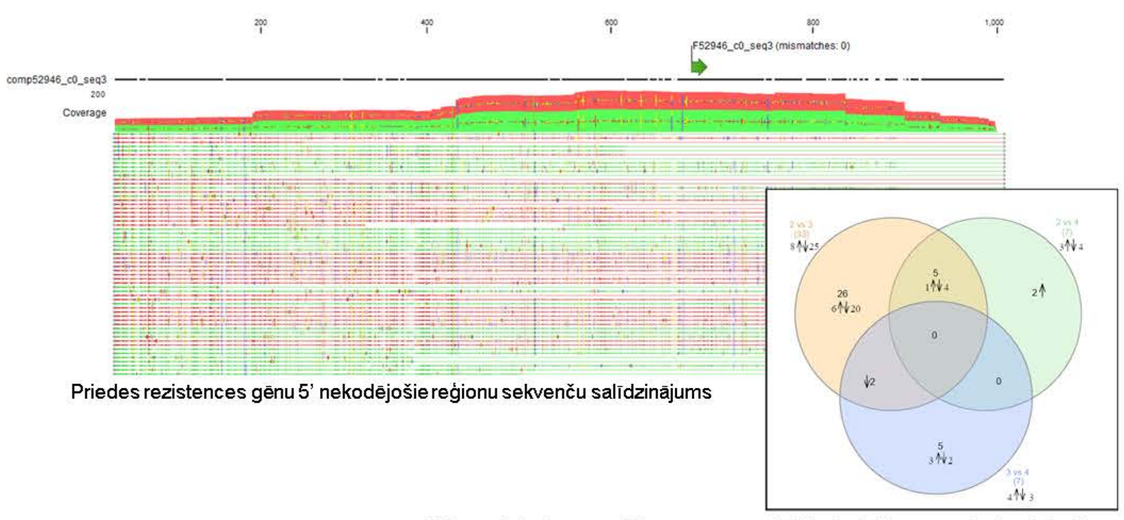
**Latvijas parastā ošu populācijas analīze.**
Izmantojot hloroplasta marķierus noskaidroja, ka vairākums audzes ir vietējās izcelsmes, jo sastopamākais haplotipa variants ir izplatīts Austrumeiropā un Skandināvijā.

Ķemeru nacionālā parka audzē atrasts Centrāleiropas haplotipa variants. Visticamāk, šīs audzes izcelsme ir no introducētiem ošu indivīdiem, kuri iestādīti Ķemeru sanatorijas teritorijā 19. gs.




## Genoma struktūras un funkciju pētījumi

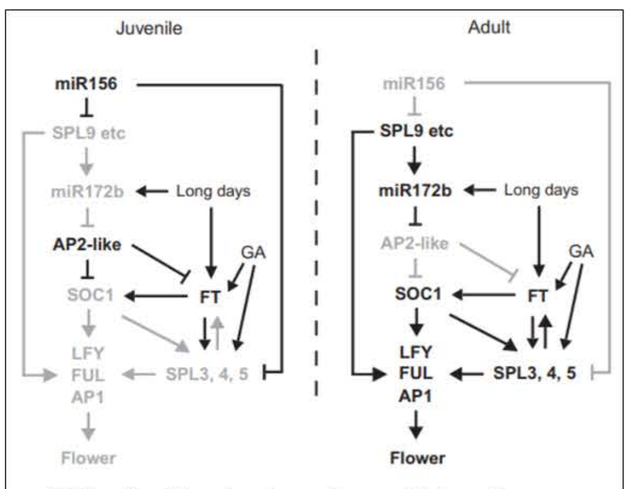
Parastās priedes genomiskie pētījumi ir saistīti ar izturību pret dažādām sēņu izraisītām slimībām, piemēram sakņu trupi, ko izraisa *Heterobasidion annosum*. Izmantojot genoma un transkriptoma sekvenēšanu identificējam priedes un sēņu gēnus, kuri tiek aktivizēti inficēšanas procesā. Analizējam gēnu reģionus, lai raksturotu regulējošos elementus.




Priedes rezistences gēnu 5' nekodējošie reģionu sekvenču salīdzinājums

Diferenciāli ekspresēti *H. annosum* gēni dažādos laikos pēc priedes inficēšanas

miRNS (19-24 nt garas nekodējošas RNS molekulas, kuras regulē gēnu ekspresiju) pētījumi tiek veikti, lai noskaidrotu miRNS un mērķa gēnu ekspresijas saistību ar bērza juvenilitātes pakāpi. Uz iegūto zināšanu pamata tiks izveidota efektīva bērzu juvenilitātes noteikšanas tehnoloģija mikropavairošanas laikā, kuru varēs izmantot bērzu selekcijas programmā ģenētiski augstvērtīga bērza reproduktīvā materiāla ieguvei.




miRNS un to mērķa gēnu ekspresijas modelis juvenilā un nobriedušā attīstības fāzē (Poethig 2013)

Āra bērza (*Betula pendula*) *in vitro* paraugi dažādās attīstības fāzēs

## Secinājumi

Ar ģenētiskiem un genomiskiem pētījumiem var atklāt zināšanas, kuras nevar iegūt ar citām metodēm. Tomēr sekmīgākie pētījumi apvieno dažādas pieejas un pētniecības jomas, iegūstot pilnīgāku raksturojumu. Molekulāri ģenētiskās analīzes ir nepieciešamas, lai precīzi raksturotu savvaļas sugas populācijas un ģenētisko resursu kolekcijas, un nodrošinātu to ilgtspējīgu saglabāšanu un izmantošanu. Genomiskie pētījumi sniedz fundamentālu informāciju par genoma struktūru un funkciju, kā arī par organisma mijiedarbību ar vidi un citiem organismiem.

## Kontaktinformācija

www.silava.lv, dainis.rungis@silava.lv (ORCID 0000-0001-5173-2912), +371 28344201

Pēcdoktorantūras pētniecības atbalsts:
V. Šķipars - Ar izturību pret slimībām saistītu parastās priedes gēnu darbību regulējošo DNS rajonu izpēte (1.1.1.2/VIAA/3/19/510)
M. Ramaneneka - Sakņu trupes sēnes *Heterobasidion annosum* transkriptoms agrīnā infekcijas stadijā (1.1.1.2/VIAA/4/20/686)

World Congress of Latvian Scientists

# Effect of horseradish pomace on pork quality during storage

**Lolita Tomsone, Zanda Kruma**

Department of Food Technology, Faculty of Food Technology, Latvia University of Life Sciences and Technologies, Jelgava, Latvia

## Introduction

« Horseradish leaves have been used since ancient times to prevent fresh meat from spoiling so quickly. They have great potential as a natural antioxidant source. By introducing this valuable raw material in meat processing, a potential cooperation between Latvian farmers and food manufacturers opens up.

« The aim of current research was to evaluate the effect of natural antioxidants present in horseradish leaf pomace on the quality of fresh minced pork during storage.

## Research Objective

« Horseradish leaf pomace powder (HLP) was obtained as a by-product after juicing. Fresh minced pork was obtained by SIA "Gaļas pārstrādes uzņēmums Nākotne".

« HLP was added to fresh minced pork at different amount, while meat without additives was used as a control:

| Sample designations | Amount of HLP, % |
|---|---|
| C | - |
| 1.5-HLP | 1.5 |
| 3.0-HLP | 3.0 |
| 6.0-HLP | 6.0 |

« The samples were packed in vacuum bags and stored in a refrigerator at +4±1 °C temperature.

« The samples were analyzed over time at 0, 4, 8, 12 and 18 days of storage. The following parameters were determined for the evaluation of quality changes:

| No | Indicators | Standard and methods |
|---|---|---|
| 1 | Total phenol content (TPC) | Li et al., 2006 |
| 2 | Antioxidant activity (DPPH) | Wang et al., 2003; Fratianni et al., 2010 |
| 3 | Peroxide value | Wheeler method |
| 4 | TBARS | Wu et al., 2019 |

## Results & Discussion

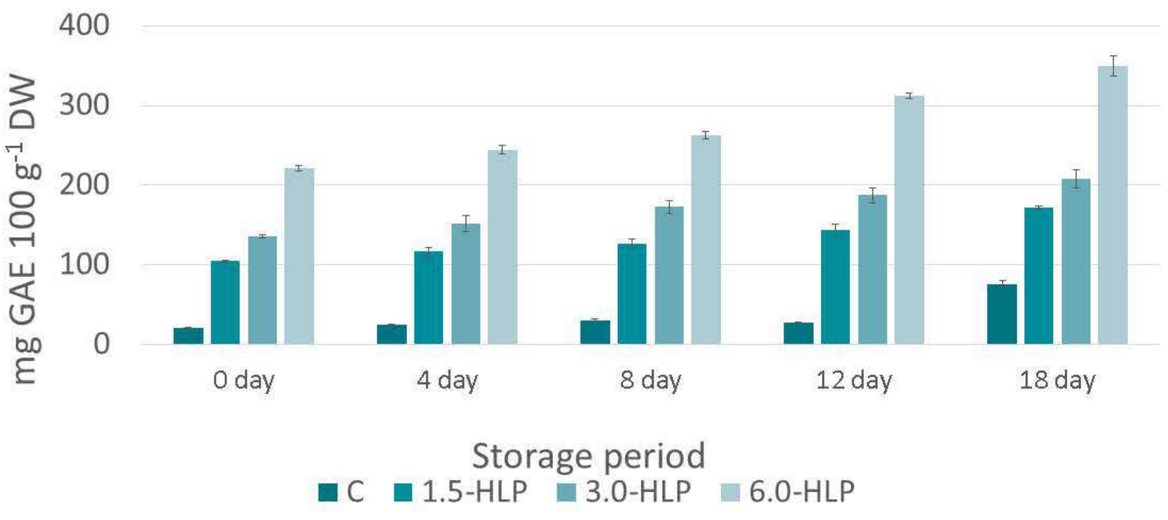



Fig.1. Changes in TPC in minced meat during storage

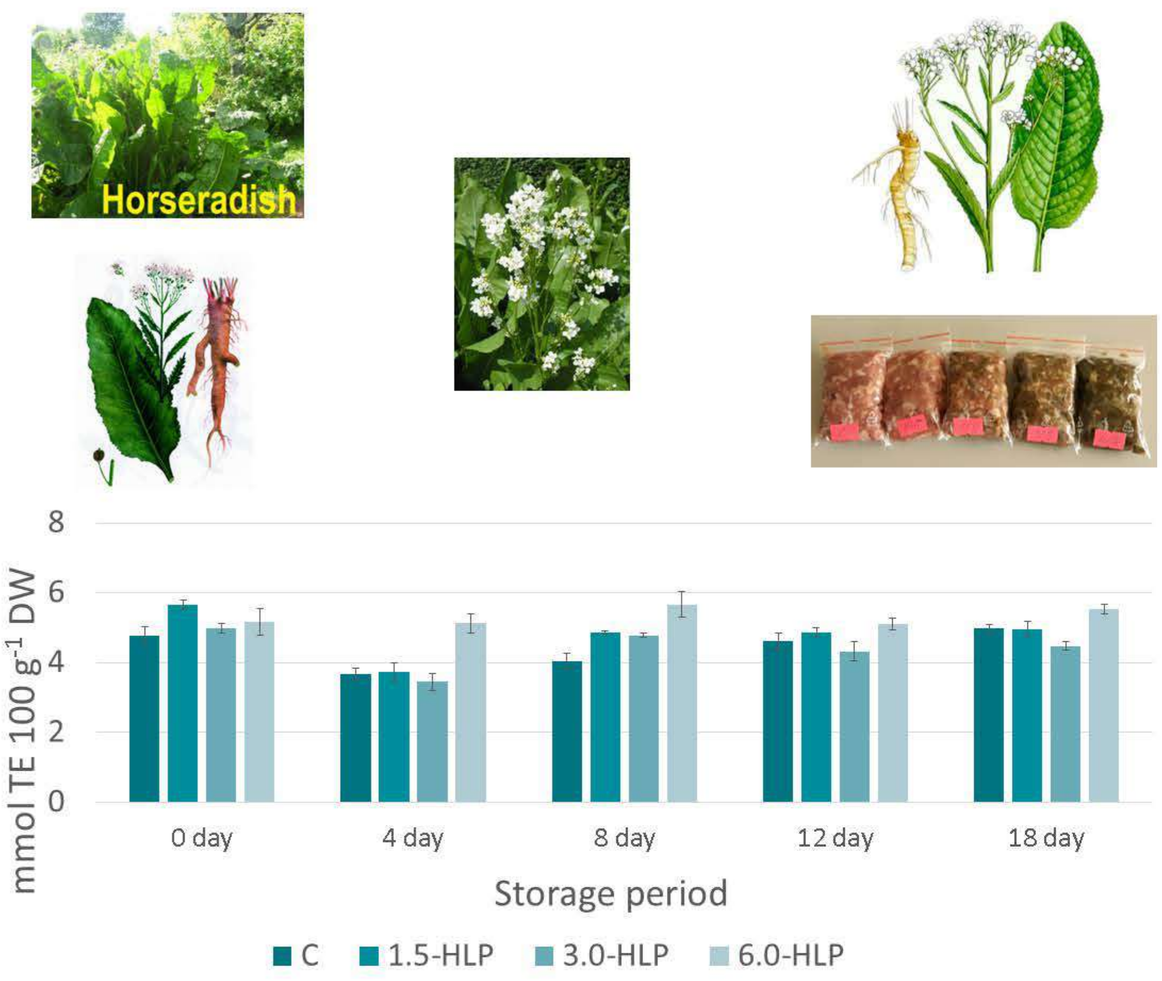



Fig.2. Changes in DPPH in minced meat during storage

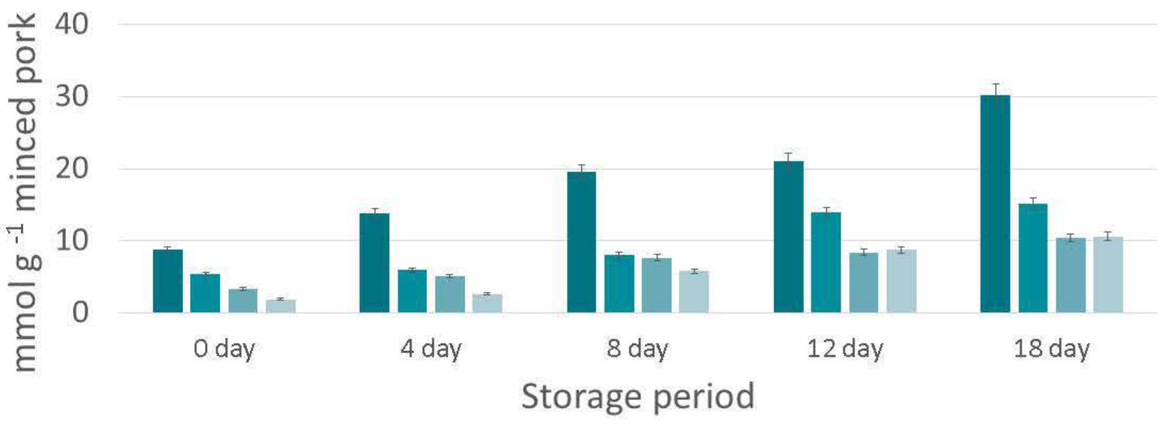



Fig.3. Changes in Peroxide value in minced meat during storage

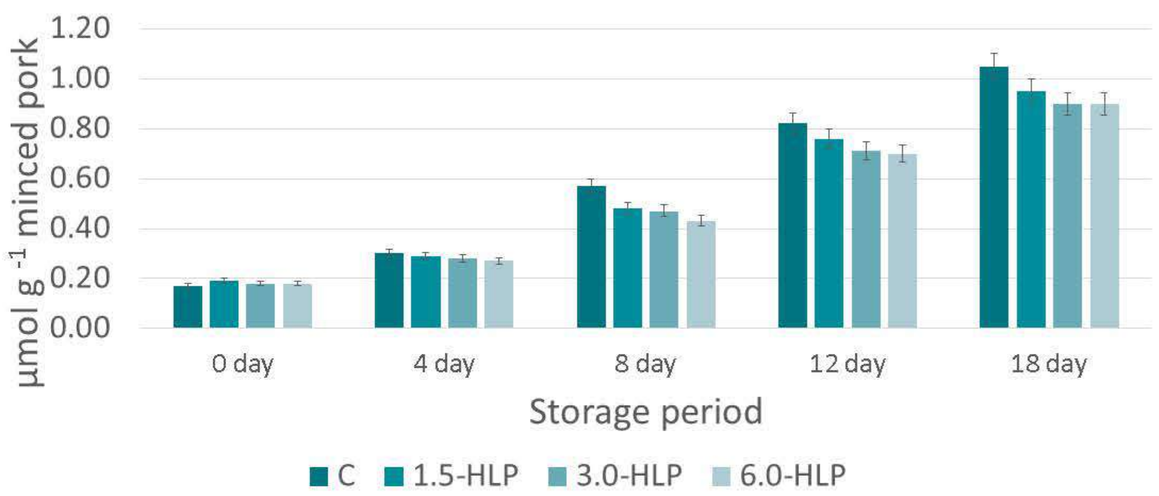



Fig.4. Changes in TBARS contents in minced meat during storage

## Conclusions

« In general, added HLP had a positive effect on minced pork during storage.

« 3% HLP can be mentioned as an optimal amount.

« However, more in-depth experiments are needed in this direction.

## Contact Information

lolita.tomsone@llu.lv

## References

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**Acknowledgments**. This study was supported by SIA "Gaļas pārstrādes uzņēmums Nākotne".

World Congress of Latvian Scientists

# Evaluation of *Taxus baccata* L. vitality and growing conditions in Slitere National park

Anna Lele
Inga Straupe
Solveiga Luguza
Ieva Erdberga

Latvia University of Life Sciences and Technologies

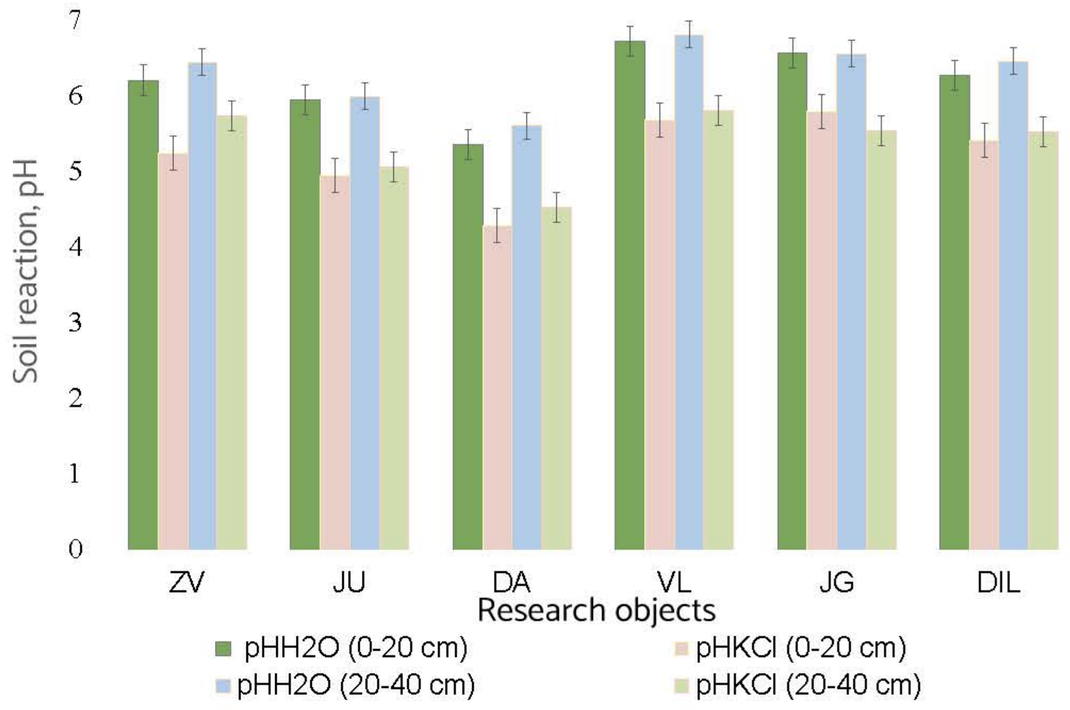
## Introduction

« *Taxus baccata* L. is a autochthonic species, distributed in most countries of Europe. Due to climate change, urbanisation and convencial forestry the natural distribution range of the species is decreasing. The largest authochton populations (85%) of *T. baccata* in Latvia occures in Slitere National Park, where it is considered a relic of the Atlantic flora. *T. baccata* is distinguished by its high ecological plasticity and eminent vitality. Distribution is limited by specific edaphic and climatic conditions – it requires alkaine soil, mild oceanic climate and warm winters. Nontheless, the vitality of the species can be decreased by prolonged shading, damages and other unfavourable growing conditions. To determine necessery growing conditions, 3 forest stands with anthropogenic plantations and 3 autochthon provenances of *T. baccata* were selected for the study.

## Research Objective

« *T. baccata* is endangered and protected species in Latvia. Local research of the ecology of the species is crucial to ensure one of the objectives of sustainable forestry – the conservation of biodiversity. In order to ensure the protection of the species, it is necessary to examine and understand the main factors affecting the growth, developement and natural regeneration of *T. baccata*.

## Results & Discussion




« Higher density index of the forest stand decreased the distribution of *T. baccata*, however, the dimensions of *T. baccata* individuals were satisfactory. The dimensions of crown were evaluated; increase of the crown volume intensifies obtaining and exploiting solar energy and vice versa, therefor increasing the vitality of the tree. Larger dimensions were in more open forest stands, where the light conditions were suitable. *T. baccata* had a high ability to adapt to different soil conditions (3,36-7,02), but it was mainly distributed in pHKCl=5,41± 0,3 – 5,79 ± 0,5 in the upper layer of soil. Using Ellenberg indicator values for vegetation analysis, vital similarities were found in terms of soil and light conditions.

## Conclusions

« The foremost growth results *T. baccata* shows in dense forest stands, however, stand density and full canopy closure negatively impacts the distribution of the species. The main factors negatively impacting the vitality of *T. baccata* are insuficient light conditions and damages caused by herbivores. Soil reaction in the upper layer of soil (0-20 cm) is most cruical: distribution is limited by favourable edaphic conditions.



## Contact Information

anna9lele@gmail.com, inga.straupe@lbtu.lv, solveiga.luguza@lbtu.lv, ieva.erdberga@lbtu.lv.

Latvia University of Life Sciences and Technologies

Pasaules latviešu zinātnieku kongress

# Latvijas ārstniecības augi kā iedvesmas avots farmaceitiem

**Valērija Razživina[1,2], Maija Dambrova[1,2], Osvalds Pugovičs[1], Solveiga Grīnberga[1], Inga Sīle[1,2]**

[1] *Latvijas Organiskās sintēzes institūts*
[2] *Rīgas Stradiņa universitāte*

## Ievads

Daba ir iedvesmojusi farmaceitus gadsimtiem ilgi, sākot ar vēsturiskajām liecībām par ārstniecības augu lietošanu, kas atrodamas tautas medicīnas pierakstos.

## Pētījuma mērķis

Pētījuma mērķis bija izpētīt latviešu tautas medicīnā minēto ārstniecības augu nepārbaudītās aktivitātes, noteikt izvēlēto augu ķīmiskā sastāva profilu, kā arī izvērtēt augu audzēšanas apstākļu ietekmi uz fitokomponentu koncentrācijām augu ekstraktos un bioloģisko aktivitāti.

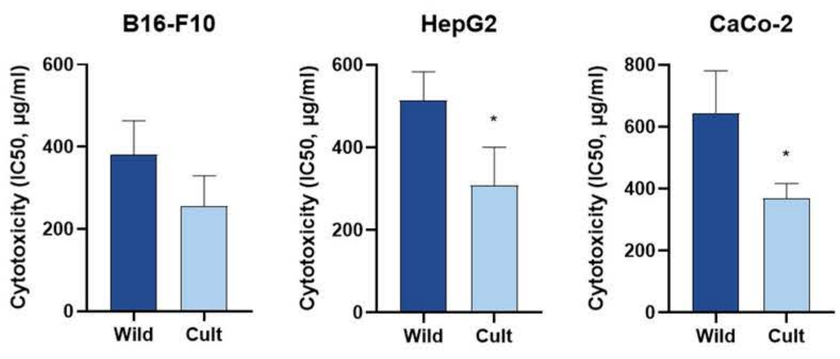
**5 genotipi**
**Savvaļā** augušie un **kultivēti** augi

**Pielietojums etnomedicīnā:**
Caurejas, acu problēmu un ādas slimību ārstēšanai

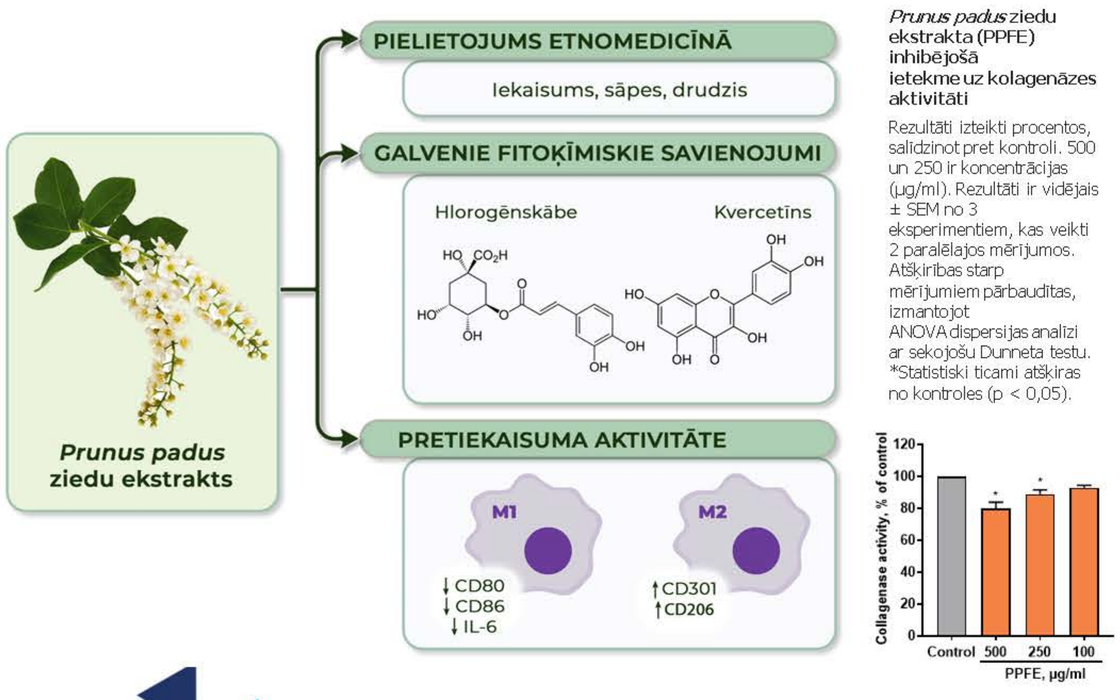
*Chelidonium majus*
Lielā strutene

**Alkaloīdu saturs (µg/g sausa materiāla) savvaļā augušas un kultivētas *C. majus* 70% etanola ekstraktos**

| Savienojums | Vidējais alkaloīdu saturs (n=5) | |
|---|---|---|
| | Savvaļas 2019 | Kultivēts 2020 |
| Sangvinarīns | 2 ± 2 ↓ | 13 ± 4 ↑ |
| Heleritrīns | 4 ± 1 ↓ | 17 ± 7 ↑ |
| Helidonīns | 64 ± 35 ↓ | 252 ± 133 ↑ |
| Koptizīns | 138 ± 36 ↓ | 143 ± 32 ↑ |
| Berberīns | 9 ± 7 | 13 ± 8 |
| Allokriptopīns | 5 ± 3 ↓ | 12 ± 7 ↑ |
| **Kopējais saturs** | **222** | **450** |




Citotoksiskās aktivitātes atšķirības kultivētu un savvaļā audzētu *C. majus* ekstraktiem B16-F10, HepG2 un CaCo-2 šūnu līnijās, kas noteiktas ar MTT testu. Rezultāti ir vidējais ± SD (n=5). Atšķirības starp mērījumiem tika pārbauditas, izmantojot Manna–Vitnija U-testu. *Statistiski ticami atšķiras no savvaļā audzētās *C. majus* ($p < 0,05$).




***Prunus padus* ziedu ekstrakta (PPFE) inhibējošā ietekme uz kolagenāzes aktivitāti**

Rezultāti izteikti procentos, salīdzinot pret kontroli. 500 un 250 ir koncentrācijas (µg/ml). Rezultāti ir vidējais ± SEM no 3 eksperimentiem, kas veikti 2 paralēlajos mērījumos. Atšķirības starp mērījumiem pārbauditas, izmantojot ANOVA dispersijas analizi ar sekojošu Dunneta testu. *Statistiski ticami atšķiras no kontroles ($p < 0,05$).




## Secinājumi

Tautas medicīnas pierakstos minēto augu pārbaude sniedz pierādījumus par etnofarmakoloģiskās informācijas pamatotību un attiecīgo augu sugu komerciālās ražošanas potenciālu.

## Kontaktinformācija

valerija@osi.lv
+371 29169951
Aizkraukles iela 21, Rīga

## Metodes

Izvelēto augu ekstraktu fitoķīmiskā analīze tika veikta, izmantojot šķidruma hromatogrāfijas-masspektrometrijas metodes. Izmantojot *in vitro* un *ex vivo* metodes tika pārbaudīta augu ekstraktu citotoksicitāte un pretiekaisuma aktivitāte.

## Rezultāti

Tika noteikti *Glechoma hederacea*, *Chelidonium majus* un *Prunus* padus ekstraktu fitoķīmiskie profili un bioloģiskā aktivitāte. Kultivēšana uzrādīja būtiskas atšķirības *C. majus* ekstraktu fitoķīmiskajā sastāvā un palielināja citotoksisko aktivitāti. Tika konstatēts, ka *G. hederacea augos* polifenolu savienojumu saturu vairāk ietekmē ievākšanas laiks nekā audzēšanas vieta un apstākļi. *P. padus* ziedu ekstraktam piemita spēcīgas pretiekaisuma īpašības.

**3 genotipi**
**Savvaļā** augušie un **kultivēti** augi **Ziedēšanas** un **veģetatīva** fāze

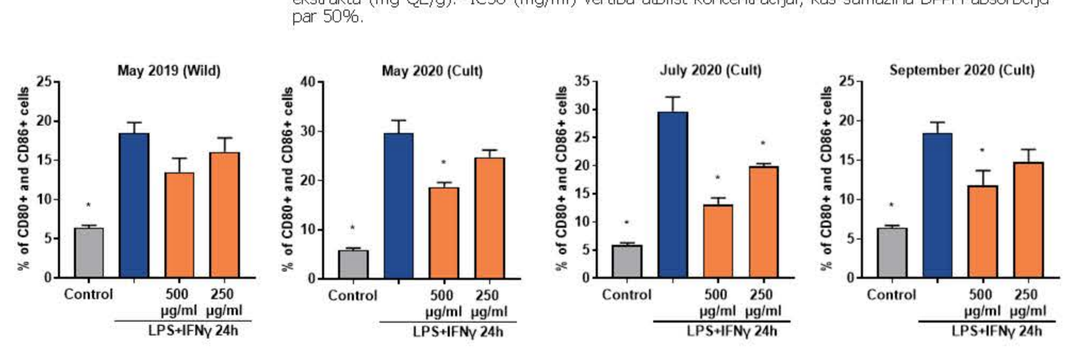
**Pielietojums etnomedicīnā:**
Urīndzenoša, gremošanu veicinoša, vielmaiņu aktivizējoša

*Glechoma hederacea*
Efeju sētložņa

**Kopējais fenolu daudzums, kopējais flavonoīdu daudzums un DPPH antiradikālās aktivitātes noteikšana *G. hederacea* ekstraktos.**

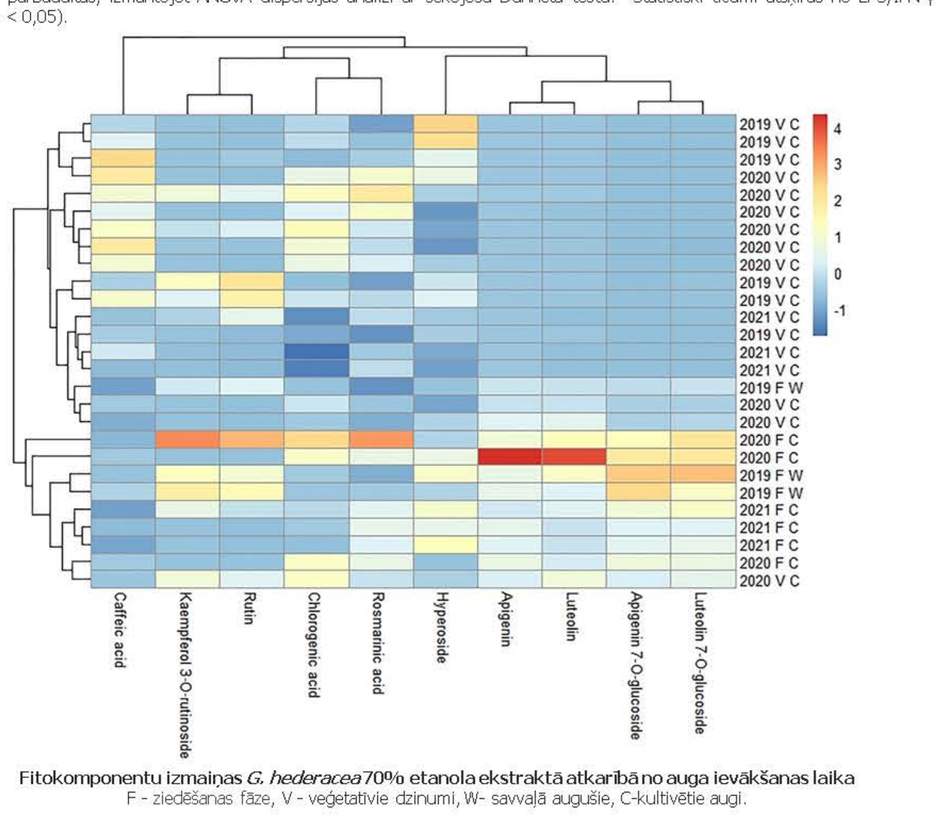
| Auga paraugs | Ražas novākšanas fāze | Kopējais fenola savienojumu daudzums (mg GSE/g liofilizēta ekstrakta)[a] | Kopējais flavonoīdu daudzums (mg QE/g liofilizēta ekstrakta)[b] | IC50 vērtība DPPH antiradikālajai aktivitātei (mg/ml)[c] |
|---|---|---|---|---|
| Ievākts savvaļā | | | | |
| Maijs 2019 | 1. raža (ziedēšanas fāze) | 56.46 ± 2.44 | 22.96 ± 2.75 | 0.71 ± 0.05 |
| Kultivēts | | | | |
| Jūlijs 2019 | 1. raža (ziedēšanas fāze) | 58.61 ± 0.80 | 29.19 ± 1.17 | 0.55 ± 0.02 |
| Augusts 2019 | 2. raža (veģetatīvie dzinumi) | 79.52 ± 2.02 | 26.48 ± 2.66 | 0.44 ± 0.03 |
| Maijs 2020 | 1. raža (ziedēšanas fāze) | 67.91 ± 3.62 | 41.67 ± 0.19 | 0.49 ± 0.05 |
| Jūnijs 2020 | 2. raža (veģetatīvie dzinumi) | 59.27 ± 2.98 | 26.12 ± 2.10 | 0.55 ± 0.02 |
| Jūlijs 2020 | 3. raža (veģetatīvie dzinumi) | 94.57 ± 2.93 | 25.45 ± 1.03 | 0.33 ± 0.02 |
| Septembris 2020 | 4. raža (veģetatīvie dzinumi) | 87.87 ± 0.02 | 24.84 ± 1.20 | 0.34 ± 0.02 |
| Askorbīnskābe | | - | - | 0.04 ± 0.001 |

Rezultāti ir vidējais ± SEM no 3 eksperimentiem, kas veikti 2 paralēlajos mērījumos. [a]Kopējais fenola savienojumu daudzums izteikts kā gallusskābes ekvivalents uz gramu liofilizēta ekstrakta (mg GSE/g). [b]Kopējais flavonoīdu daudzums izteikts kā kvercetīna ekvivalents uz gramu liofilizēta ekstrakta (mg QE/g). [c]IC50 (mg/ml) vērtība atbilst koncentrācijai, kas samazina DPPH absorbciju par 50%.




**Makrofāgu (BMDM) polarizācija par M1 fenotipu un analīze ar plūsmas citometriju**

Šūnu virsmas marķieru CD80 un CD86 ekspresija analizēta ar plūsmas citometriju 24 h pēc BMDM stimulēšanas ar ekstraktu (250 µg/ml un 500 µg/ml) un LPS/IFN-γ. Rezultāti ir vidējais ± SEM no 3 eksperimentiem, kas veikti 2 paralēlajos mērījumos. Atšķirības starp mērījumiem pārbauditas, izmantojot ANOVA dispersijas analizi ar sekojošu Dunneta testu. *Statistiski ticami atšķiras no LPS/IFN-γ kontroles ($p < 0,05$).




Fitokomponentu izmaiņas *G. hederacea* 70% etanola ekstraktā atkarībā no auga ievākšanas laika
F - ziedēšanas fāze, V - veģetatīvie dzinumi, W- savvaļā augušie, C-kultivētie augi.

## Pateicības

Pētījums veikts ERAF projekta "Inovatīvi risinājumi pavasara savvaļas ārstniecības un aromātisko augu audzēšanas tehnoloģijās un izmantošanā" (Nr. 1.1.1.1/18/A/043) ietvaros, sadarbībā ar Vides risinājumu institūtu un SIA "Field and Forest" (Ilva Nakurte, Ieva Mežaka, Laura Kaļāne, Jevgenijs Filipovs, Alekss Vecvanags, Arta Kronberga).

Latvijas Organiskās sintēzes institūts

Rīgas Stradiņa universitāte

World Congress of Latvian Scientists

# Non-standard approaches for studies of Scots pine genome in context of disease resistance

**Vilnis Šķipars, Adam Vivian-Smith**
Latvian State Forest Research Institute "Silava"; Norwegian Institute of Bioeconomy Research

## Introduction

Forests are one of Latvia's most important resources. The dominant tree species in large areas is Scots pine. Our long-term goal is to reduce the economic losses caused by Scots pine root rot. In order to achieve the goal, we have focused on genetic research. After identifying genes with importance in resistance to this disease, we focused on the study of the DNA regions regulating the activity of these genes.

Since the Scots pine genome is poorly studied, this task is not easy and it was necessary to develop non-standard approaches to study it specifically in the regions upstream of the genes involved in resistance. In the poster we provide an overview of experimental approaches to study these genomic regions.

## Research Objective

Using various methods (listed below) to obtain information on the regulatory DNA regions of genes involved in resistance against pine root rot.

Methods:

- multiplex linear DNA amplification in combination with high-throughput sequencing
- modified terminal transfer amplification and sequencing (TTAS) method
- pine genome sequencing with low coverage for the study of target sequences

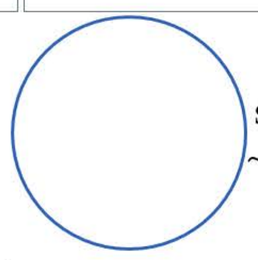
## Approach I

Extract HMW DNA

Make sure it's HMW

Multiplex linear DNA amplification

Circular ligation of ssDNA molecules




Enzymatic degradation of remaining ssDNA

Circular ligation of products that long is possible but with **low** efficiency

RCA with specific primers

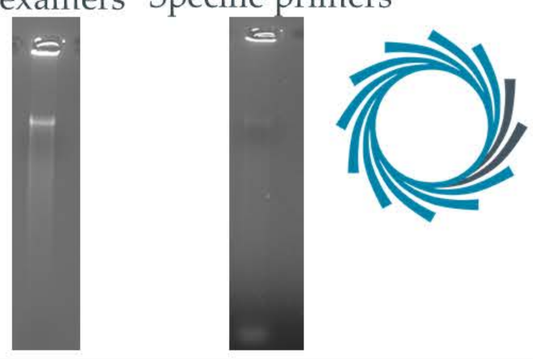

Preparation for Ion Torrent and Oxford Nanopore sequencing

Fragmentation + Swift BIOSCIENCES

**Accel-NGS® DNA Library Kit for the Ion Torrent™ Platform**

Amplification of RCA product

Hexamers Specific primers



Result

2 out of 100 targeted sequences identified. Rest of the sequences from Scots pine but not what expected. Despite low efficiency, in principle the method is working and, with optimization, results could be improved.

## Approach II

Extract HMW DNA

Make sure it's HMW

Singleplex linear DNA amplification

Product shouldn't be visible

Modified TTAS method

Jiang et al., 2019

https://doi.org/10.1007/s13238-018-0540-9

Oxford Nanopore sequencing result

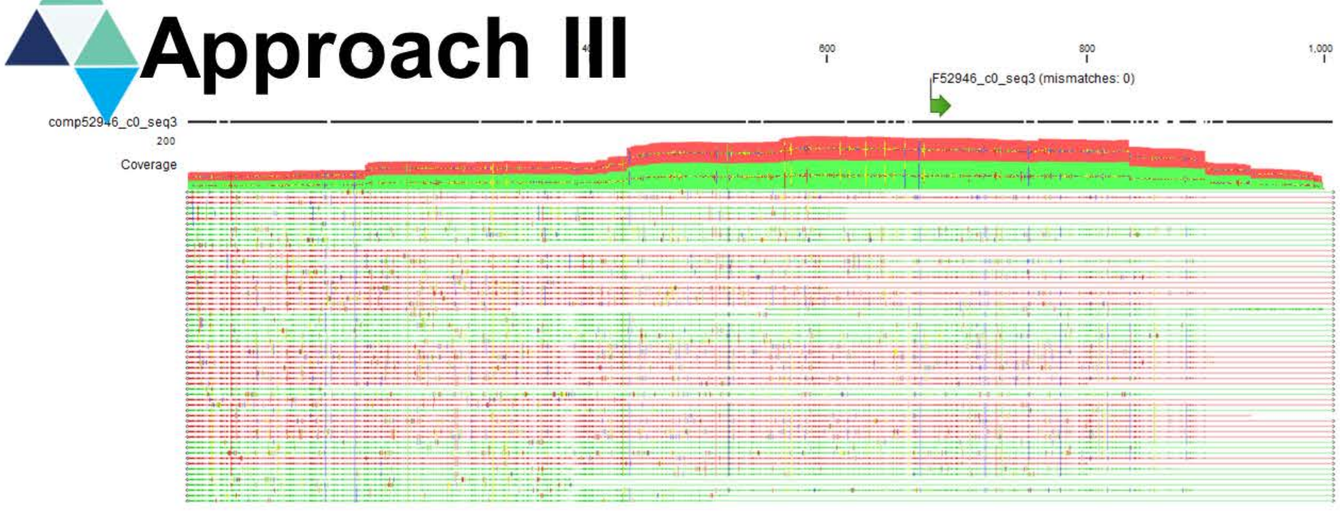
Primer binding sites found in sequences but adjacent sequences don't match the reference (transcriptome from Wachowiak et al., 2015) used for primer design

## Conclusions

Whole genome sequencing, even with very low coverage, we have obtained new scientific information that is useful in the analysis of the DNA regions regulating the activity of genes involved in resistance meaning that such approach is feasible and productive.

We consider the other methods useful for species with simpler genomes.

## Approach III




## Contact Information & funding

vilnis.skipars@silava.lv, ERDF fund No. 1.1.1.2/VIAA/3/19/510

SILAVA NIBIO

Pasaules latviešu zinātnieku kongress

# Latvijas brūnās un Latvijas zilās šķirnes govju ilgmūžības vērtējums

**Lāsma Cielava, Daina Jonkus**

Latvijas Biozinātņu un tehnoloģiju universitāte; Dzīvnieku Zinātņu institūts

## Ievads

- Vecā tipa Latvijas brūnās (LB) un Latvijas zilās (LZ) govju šķirnes izceļas ar ilgmūžību, pielāgošanās spēju dažādiem ārējās vides apstākļiem, kā arī augstu piena tauku un olbaltumvielu saturu.
- Tomēr jau vairākus gadu desmitus šīs šķirnes ir iekļautas vietējo apdraudēto šķirņu sarakstā to nelielā īpatņu skaita dēļ.
- Lai saglabātu Latvijas lauksaimniecības dzīvnieku bioloģisko daudzveidību un uzsvērtu šķirnes vērtīgās īpašības, ir svarīgi pētīt to produktivitāti un produkcijas kvalitāti ietekmējošos faktorus.

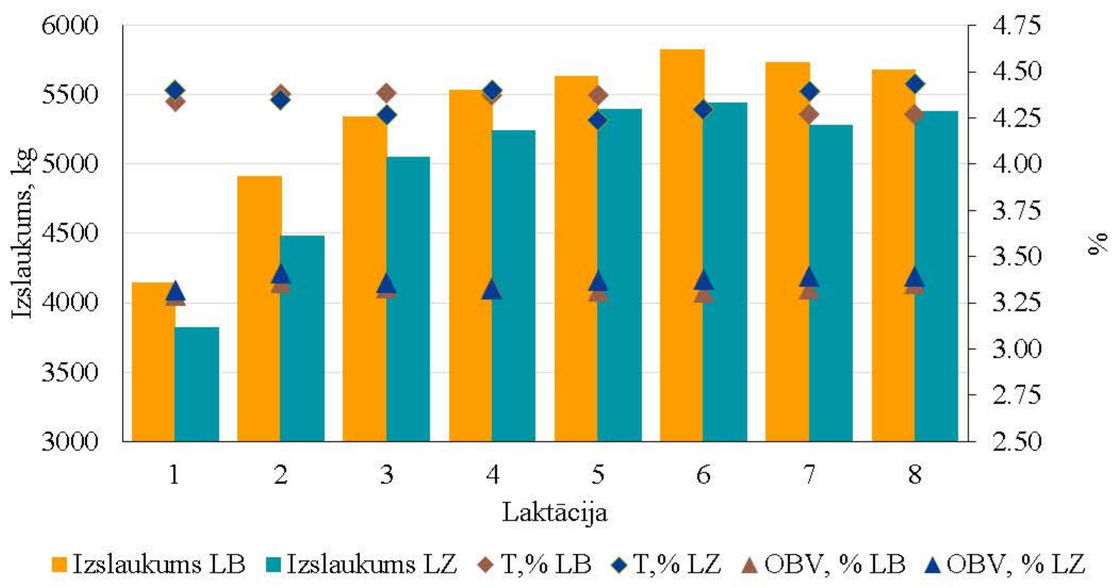
## Pētījuma mērķis

- Pētījuma mērķis bija vērtēt kā mainās govju piena produktivitāti raksturojošie rādītāji, palielinoties to vecumam.
- Pētījumā iekļauta informācija par piena produktivitāti un kvalitāti 4729 noslēgtās standartlaktācijās (2245 LB un 2484 LZ šķirnei) laika posmā no 2004. – 2018. gadam.
- Atsevišķi izdalītas 117 LB un 72 LZ šķirņu govis, kas noslēgušas vismaz 7 standartlaktācijas.
- Datu bāze sagatavota no Lauksaimniecības Datu centrā uzkrātās pārraudzības informācijas.
- Piena produktivitātes raksturošanai izmantots enerģētiski koriģētais piens.

## Rezultāti un diskusija

**Latvijas brūnās un Latvijas zilās šķirnes govju piena produktivitāte un kvalitāte**

| Pazīme | Šķirne | |
|---|---|---|
| | Latvijas brūnā (N=2245) | Latvijas zilā (N=2484) |
| Izslaukums, kg | 5075.6±25.04 | 4901.8±25.31 |
| Olbaltumvielu saturs, % | 4.47±0.01 | 4.30±0.01 |
| Tauku saturs, % | 3.38±0.01 | 3.37±0.01 |
| Enerģētiski koriģētais piens, kg | 5351.4±26.70 | 5060.7±26.71 |
| Somatisko šūnu skaits, tūkst. $mL^{-1}$ | 225.0±6.91 | 201.7±6.51 |




**Latvijas brūnās un Latvijas zilās šķirnes govju produktivitāte dažādās laktācijās** (T – tauku saturs, OBV – olbaltumvielu saturs)

Vecā tipa Latvijas brūnās (LB) un Latvijas zilās (LZ) šķirņu govis laika posmā no 2004. – 2018. gadam vienā standartlaktācijā spējušas saražot 5075.6 un 4901.8 kg piena. Pētot katru šķirni atsevišķi, secinājām, ka LB šķirnes govīm bijis ne tikai augstāks izslaukums, bet arī tauku un olbaltumvielu saturs pienā nekā LZ šķirnes govīm. Vērtējot govju ilgmūžību, novērojām, ka LB šķirnes govīm piena produktivitāte palielinājusies līdz 6. laktācijai pēc tam iegūtā piena daudzums samazinās. Arī LZ šķirnes govīm vērojama līdzīga tendence, piena produktivitātei 6. laktācijā sasniedzot 5440.9±134.01 kg un, jau nākošajās laktācijās samazinoties. Tauku un olbaltumvielu saturs LB un LZ govju pienā būtiski pieaug līdz 4. laktācijai

## Secinājumi

Vecā tipa Latvijas brūnās un Latvijas zilās šķirņu govis izceļas ar augstu piena tauku un olbaltumvielu saturu, bet tām ir arī augstākas pielāgošanās spējas jauniem apstākļiem (turēšanas sistēmai, barības devai), kas šo dzīvnieku izmantošanu piensaimniecībās padara efektīvāku. Turklāt šo šķirņu izmantošana ganāmpulkos nodrošina bioloģiskās daudzveidības saglabāšanos Latvijas laukos.

## Kontaktinformācija

lasma.cielava@lbtu.lv; daina.jonkus@lbtu.lv

Pētījums veikts ZM projekta (Nr. S447) "Nacionālajā gēnu bankā uzkrātā Latvijas vietējo apdraudēto dzīvnieku šķirņu bioloģiskā materiāla gēnu bankas papildināšana un izpēte" ietvaros.

LATVIJAS BIOZINĀTŅU UN TEHNOLOĢIJU UNIVERSITĀTE

Pasaules latviešu zinātnieku kongress

**Valērijs Ņikuļins**

International Association for Promoting Geoethics biedrs
SIA «Geo Consultants»

# Iespējas palielināt sabiedrības izpratni par radiācijas bīstamību

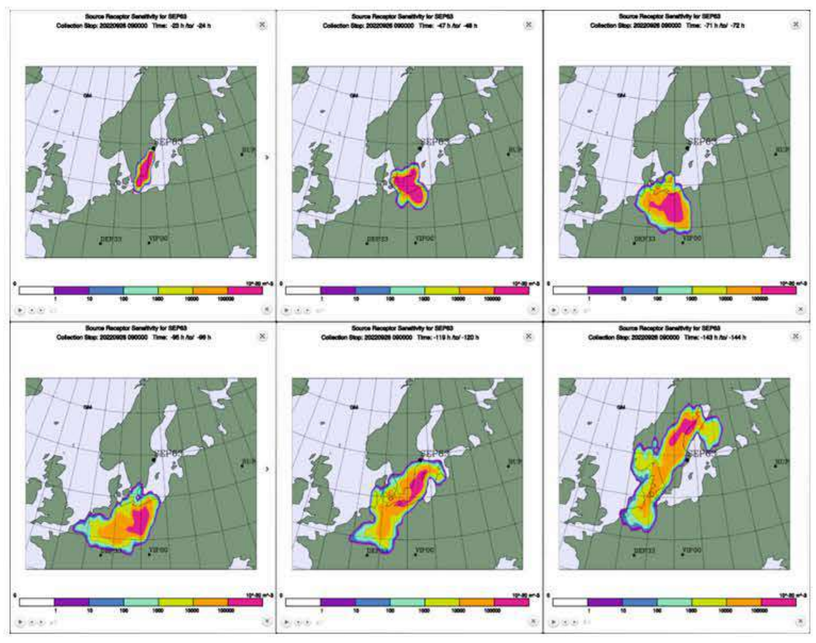
## Ievads

« Radiācijas līmeņa uzraudzība ir svarīga sabiedrības drošībai. VVD RDC ietvaros Latvijā ir izveidota radiācijas monitoringa sistēma. Tā sniedz informāciju tikai par radiācijas situāciju Latvijā. Bet Baltijas reģionā ir vairākas atomelektrostacijas, radioaktīvo materiālu saglabāšanas vietas un citi objekti, kur var izmantot radioaktīvos materiālus. Šie objekti var būt potenciāla radiācijas apdraudējuma avoti antropogēnu un dabisku iemeslu dēļ. Šis pētījums - projekts ir veltīts iespējai palielināt sabiedrības izpratni par radiācijas situāciju Baltijas reģionā. Īstenojot šo projektu, ir iespējams veikt preventīvus pasākumus, lai samazinātu iespējamo radiācijas apdraudējumu Latvijas teritorijā.

Šo mērķi var sasniegt, izmantojot pieejamo informāciju no starptautiskajām organizācijām. Starp šādām organizācijām ir EURDEP, CTBTO.

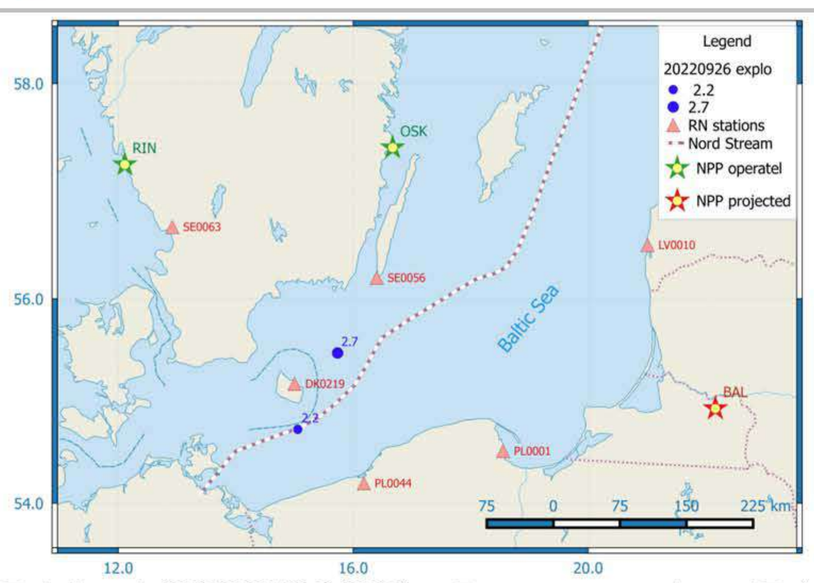
## Pētījuma mērķis

« Šī pētījuma mērķis ir ierosināt projektu, lai izveidotu brīdinājuma sistēmu par iespējamiem radiācijas apdraudējumiem, kas var rasties pierobežas teritorijās.

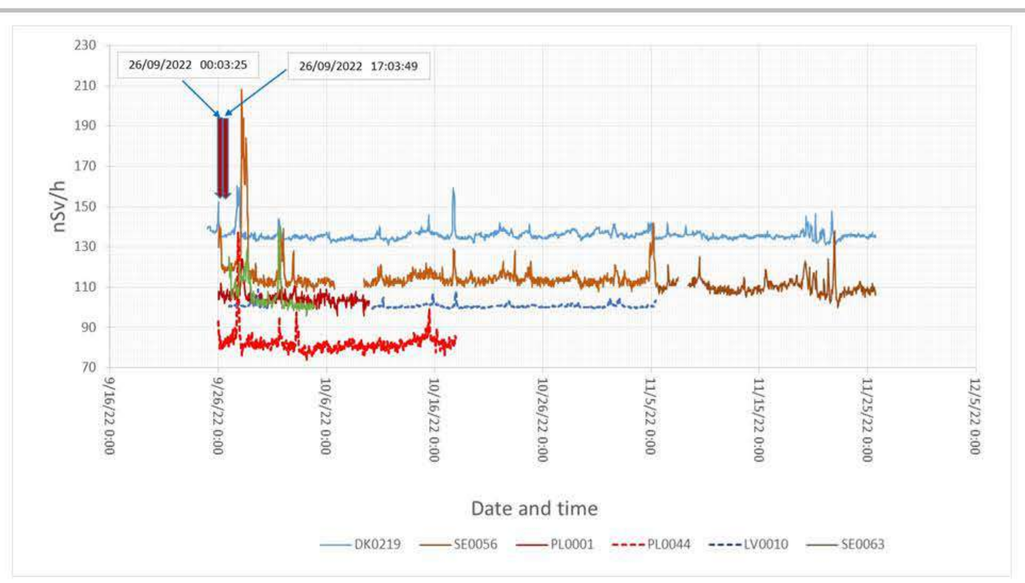


Radiācijas situācijas modelis sprādzienu laikā pēc Stokholmas RN stacijas (CTBT) datiem

## Rezultāti un diskusija




Sprādzieni (2022/09/26) gāzes cauruļvadā *Nord Stream* un radiacijas kontroles stacijas



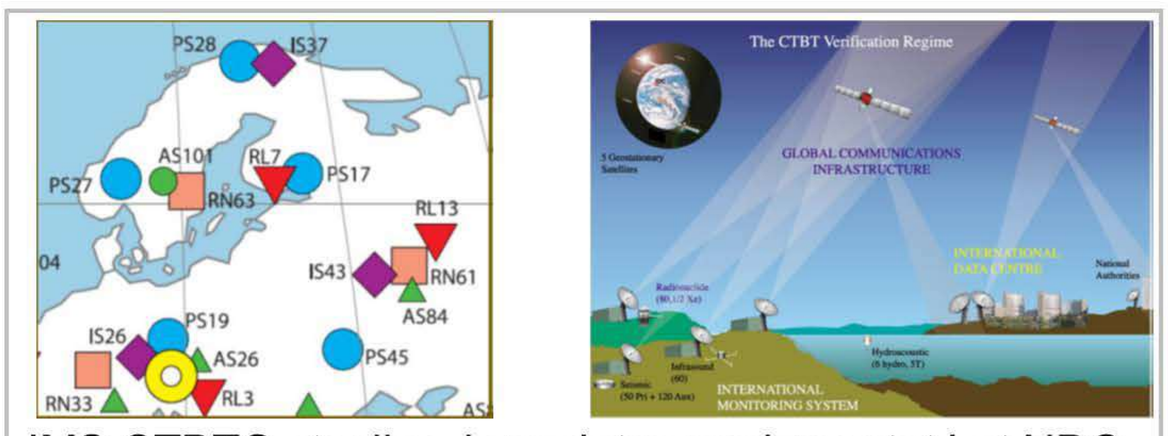

Radiācijas līmeņa izmaiņas EURDEP tīkla stacijās

« Gan EURDEP, gan CTBTO dati var būt primāri svarīgi radiācijas starojuma brīdinājuma sistēmā. EURDEP dati ir pieejami. Pilns CTBTO datu kopums sastāv no seismiskiem, infraskaņas, hidroakustiskiem un tiešā radionuklīdu datiem. Tas ir pieejams, ja ir izveidots Nacionālais datu centrs (NDC). Sniegts piemērs pieaugošās radiācijas situācijas Baltijas reģionā. Baltijas reģionā ir vairākas atomelektrostacijas, radioaktīvo materiālu saglabāšanas vietas un citi objekti, kur varbūt izmantot radioaktīvos materiālus. Šie objekti var būt potenciāla radiācijas apdraudējuma avoti antropogēnu un dabisku iemeslu dēļ. Radiācijas briesmas var rasties Ukrainas atomelektrostacijās karadarbības rezultātā utt.

## Secinājumi

« Tādējādi Latvijas NDC izveide būtiski palielinās sabiedrības izpratni un brīdinājuma efektivitāti par radiācijas situāciju.

Latvijas NDC var izmantot datu kopu: CTBTO, EURDEP un VVD RDC, lai analizētu un laicīgi brīdinātu par radiācijas pēdas kustību no ārpus Latvijas. Tas ļaus iegūt informāciju par radiācijas situāciju kaimiņvalstīs un palielināt sabiedrības izpratni par radiācijas draudiem.




IMS CTBTO stacijas, kuru datus var izmantot Lat NDC.

## Kontaktinformācija

Dr.geol., seismologs, ģeofiziķis, Valērijs Ņikuļins, e-pasts: seismolat@gmail.com

Pasaules latviešu zinātnieku kongress

# Pētījumos balstītas zināšanas nozarei: no jaunām izejvielām līdz blakusproduktu paplašinātai izmantošanai

Dalija Segliņa, Pawel Gornas, Vitālijs Radenkovs, Karina Juhņeviča-Radenkova, Inta Krasnova, Danija Lazdiņa, Georgijs Baškirovs, Inga Mišina, Elise Sipeniece

Dārzkopības institūts

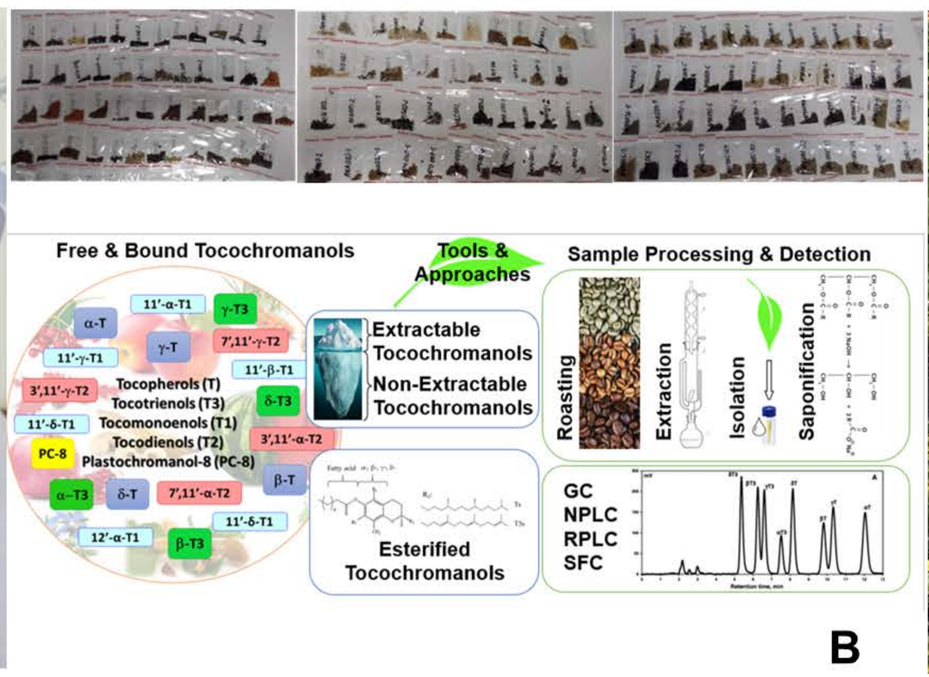
## Ievads

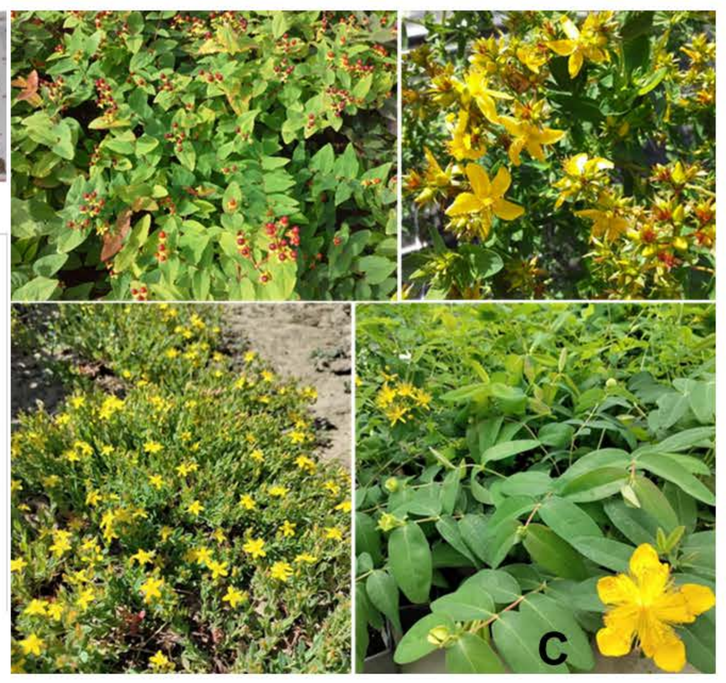
- Augļu, dārzeņu un graudaugu pārstrādē radītie blakusprodukti satur ievērojamu daudzumu cilvēka organismam nozīmīgus bioloģiski aktīvus savienojumus. Enzimātiskā hidrolīze paplašina blakusproduktu izmantošanas iespējas pārtikas ražošanā.
- Pēdējos gados pieaug pētnieku interese par dažādo E vitamīna formu (tokoferolu, tokotrienolu) bioloģiskajām funkcijām. Tokotrienolu iegūšanai no dabas resursiem ir tehnoloģiska, uztura un medicīniska rakstura nozīme, īpaši ņemot vērā to antioksidantu un veselību veicinošo īpašību potenciālu.
- Divšķautņu asinszāle (*H. perforatum*) saistījusi zinātnieku interesi kā potenciāls pretaudzēju līdzeklis un antidepresants, augā ir identificēti vairāk nekā 100 dažādi bioloģiski aktīvi metabolīti.

## Pētījuma mērķis

- Izvērtēt izejvielu/blakusproduktu ķīmisko sastāvu; izstrādāt jaunus sinbiotiskus pārtikas produktus ar augstu pievienoto vērtību un funkcionalitāti.
- Piedāvāt alternatīvus tokotrienolu avotus no divdīgļlapu augu dzimtām, izmantojot taksonomijas pieeju un zaļās tehnoloģijas, sākot no ekstrakcijas un beidzot ar identificēšanu.
- Audzēt un pārbaudīt vairāk nekā 25 asinszāļu (*Hypericum*) sugu 50 genotipus dažādos vides apstākļos, novērtējot to ietekmi uz tokotrienolu koncentrāciju augu materiālā; pētīt "zaļo" šķīdinātāju izmantošanu un paņēmienus savienojumu iegūšanai un attīrīšanai.

## Rezultāti un diskusija

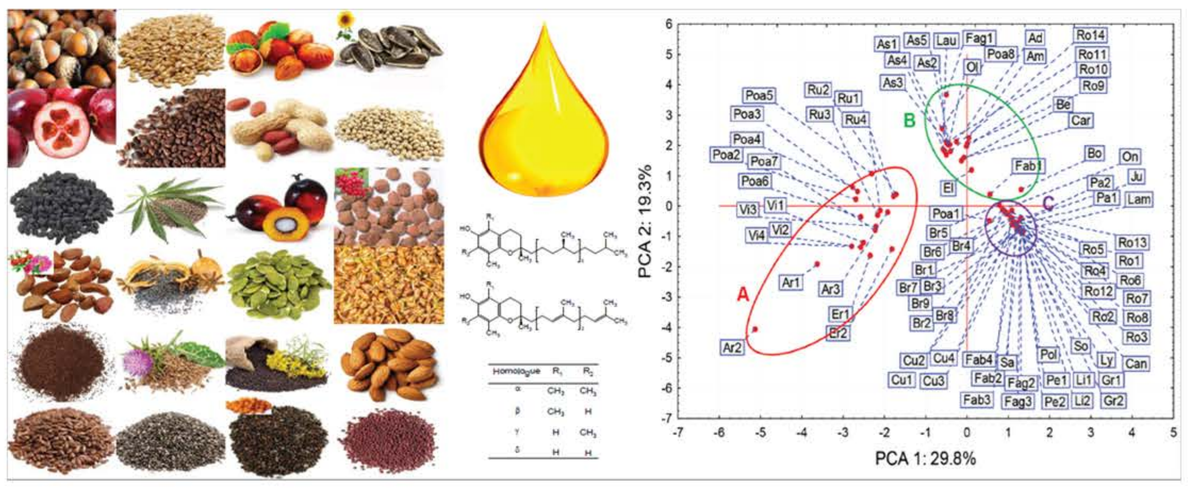




- Pētījumā veikta augu valsts blakusproduktu apstrāde, izmantojot enzimātisko hidrolīzi kā bioprocesu, ar mērķi atbrīvot savienojumu saistītās formas, depolimerizēt garās ķēdes, un, līdz ar to paaugstināt to potenciālo bioloģisko pieejamību (PostDoc Nr. 1.1.1.2/VIAA/1/16/201).
- Pētīta taksonomiskā pieeja un divdīgļlapju dzimtas augi kā alternatīva tokotrienolu un citu dabā reti sastopamu prenilipīdu avots; pētījumā analizētas vairāk nekā 6000 augu sugu sēklas (B) (Izp-2020/1-0422).
- Pētīts tokohromanolu uzkrāšanās process dažādās Hypericum spp. augu daļās; noteikti agronomiskie faktori un atlasītas piemērotākās *Hypericum* sugas, genotipi, kas rada lielu biomasu un augstu tokotrienolu koncentrāciju augu materiālā (C) (Izp-2021/1-0651).

## Secinājumi

- Izstrādātas inovatīvas tehnoloģijas, radīts jauns funkcionāls pārtikas produkts ar paaugstinātu šķiedrvielu saturu un probiotiskām baktērijām (A).
- Pētījums demonstrēja zaļo tehnoloģiju pielietošanas iespējas tokohromanolu ekstrakcijā un analīzē.
- Pierādīts, ka *Hypericum* ģints augi ir bagāti ne tikai hidrofiliem, bet arī lipofiliem bioloģiski aktīviem savienojumiem, kas palielina šo sugu medicīnisko/farmaceitisko potenciālu.




## Kontaktinformācija

dalija.seglina@llu.lv; pawel.gornas@llu.lv; vitalijs.radenkovs@llu.lv

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