**Spruce needles can keep the vegoburger fresh and tasty**

Compounds extracted from spruce needles can preserve food without artificial chemicals, and even enhance the taste.

In the forests of the Baltic Sea region, tonnes of spruce needles quietly pile up as forestry by-products. Traditionally, they’ve been treated as waste or burned for low-value energy.

But now these needles can be transformed into powerful natural ingredients for the next generation of plant-based meat.

”At first glance, spruce needles might seem like an unusual food ingredient” says Alvija Šalaševičienė, the Director of KTU Food Institute.

”But look closer, and you’ll find they’re full of natural bioactive compounds - antioxidants, vitamins, and plant chemicals that can fight harmful bacteria, protect against spoilage, and even boost nutrition.”

Within the project CEForestry, the researchers of Kaunas University could isolate compounds known for their strong antimicrobial and antioxidant properties - shikimic acid, proanthocyanidins, and other polyphenols.

The process starts in the lab. Spruce needles are carefully washed, dried, ground, and then treated using green extraction technologies—methods designed to keep the process eco-friendly. The leftover needles were put through solid-state fermentation with beneficial lactic acid bacteria. The result was two different spruce-based products:

* A concentrated extract full of natural antioxidants and antimicrobials.
* A fermented spruce powder with a milder taste and extra health-promoting properties.

To test the real-world potential, the team partnered with Bimala LTD, a lituanian producer of plant-based meat. Spruce extracts were blended into a standard meat analogue recipe and tested in different amounts.

A tasting panel tried each version and the spruce-enhanced products didn’t just pass - they impressed.

* At 5% concentration, the chemical extract gave the plant-based meat a pleasant, slightly herbal flavour and improved texture.
* The fermented extract at 1.5% added a subtle umami note while delivering natural preservation benefits.

Then came the challenge of storage. Could these natural additives really keep food safe for longer? Samples were vacuum-packed and stored at 3°C for seven weeks. The results were striking, no dangerous bacteria were detected in any spruce-treated samples during the entire storage period.

However, an analyze from Aalto University conludes that many stages of extraction combined with low yields means that the technical and economic feasibility is assessed to be too challenging for industrial scale applications with business potential.

”We agree with Aalto University that, for now, the extraction of shikimic acid from spruce needles is not economically viable for industrial use, says Alvija Šalaševičienė.

”At the same time, we would like to note that spruce needles contain not only shikimic acid but also other bioactivecompounds, which could be valuable from a nutritional point of view and may have potential for future applications.”



Alvija Šalaševičienė, the Director of KTU Food Institute. Photo: KTU.

Read more on the [CEForestry homepage.](https://interreg-baltic.eu/project/ceforestry/#output-16)

Scientific publications:

1. Klavins, Linards & Zommere, Alise & Kviesis, Jorens & Krims-Dāvis, Kristaps & Ozola, Melita & Mačionienė, Irena & Levinskaitė, Loreta & Žvirgždas, Jonas & Paškevičius, Algimantas & Klavina, Laura & Salaseviciene, Alvija & Klavins, Maris. (2025). Short path to bioactivity: chemical profiling and bioactive potential of lipophilic Norway spruce (Picea abies) extract fractions. Wood Science and Technology. 59. 10.1007/s00226-025-01671-5.

2. Gaizauskaite, Zydrune & Klavins, Linards & Almonaityte, Karolina. (2025). Optimised extraction of bioactive compounds from spruce needles for sustainable applications. Waste management (New York, N.Y.). 201. 114784. 10.1016/j.wasman.2025.114784.

3. Klavins, Linards & Almonaityte, Karolina & Salaseviciene, Alvija & Zommere, Alise & Spalvis, Kaspars & V.-Gaile, Zane & Korpinen, Risto & Klavins, Maris. (2023). Strategy of Coniferous Needle Biorefinery into Value-Added Products to Implement Circular Bioeconomy Concepts in Forestry Side Stream Utilization. Molecules. 28. 7085. 10.3390/molecules28207085.