

Wood goes high-tech

November 7 2017

Wood could potentially replace petrol in chemistry and concrete in construction, according to studies conducted under the National Research Programme "Resource Wood." They show how precious chemical compounds can be extracted from wood, how its usability as a building material can be improved, and how forest management can be optimised.

Wood is not just a conventional material, it also has great innovation potential as a high-tech component and raw material for chemistry. This is one of the conclusions of the National Research Programme "Resource Wood" (NRP 66), which is nearing its end after five years of research.

Research participating in NRP 66 have developed new construction methods and analysed [forest management](#) in Switzerland. "Analysing a natural resource such as [wood](#) requires a global and integrative approach," says Martin Riediker, president of the steering committee of NRP 66. "We were able to gain an overview of the situation and identify numerous promising ways for improving the exploitation of wood. Innovation will play a key role in this context."

Replacing petrol with wood

Organic chemistry has to come to terms with the finite nature of oil and carbon, the fossil resources on which it relies. Plant biomass is a realistic alternative, as several NRP 66 projects have shown. Research teams at EPFL, ETH Zurich and the University of Applied Sciences of

Northwestern Switzerland (FHNW) developed new procedures to transform the main components of wood - cellulose and lignin - into aromatic compounds and other intermediate products that are of importance for the chemical industry. Sviatlana Siankevich at EPFL co-founded the start-up Embion in order to turn the newly acquired knowledge into marketable products.

The projects of NRP 66 spanned the entire spectrum from basic research to application. Michael Studer from Bern University of Applied Sciences succeeded in improving fermentation processes of beech wood for the production of ethanol, a commonly used fuel. The construction of a pilot site in the canton of Jura is under discussion with an industry partner and a wood supplier. François Maréchal at EPFL developed an IT tool to establish the best layout for a bio-refinery. Relying on a numerical model, Tilman Schildhauer from the Paul Scherrer Institute was able to optimise the production of biogas.

A traditional yet innovative material

"To have a future, wood has to reinvent itself," Martin Riediker says. "It is viewed as a classy material, but we need to better exploit its innovation potential as a high-tech component." Ingo Burgert at ETH Zurich has succeeded in inserting a polymer into the cellular walls of wood to make it more water-repellent and stable for use as a [building material](#); his co-workers have founded the start-up Swiss Wood Solutions aimed at marketing new wood-based materials. Working in the opposite direction, a project team led by Christoph Weder at the Adolphe Merkle Institute in Fribourg inserted cellulose extracted from trees into polymers with the aim of improving their mechanical properties.

Heiko Thoemen from Bern University of Applied Sciences improved manufacturing processes for layered boards in which a plastic foam is enclosed by two wooden panels, commonly used components of

prefabricated flat-pack furniture. At the University of Applied Sciences for Engineering and Architecture in Fribourg, Daia Zwicky has developed a lightweight wood-concrete by partially replacing sand with sawdust.

The programme emphasised the importance of knowledge and technology transfer between research, industry and public authorities, notably by conducting 17 workshops on specific topics. The results have been impressive: intensive knowledge transfer with more than 200 external professionals, the creation of three start-ups, and numerous declarations of intent to continue collaborating in the areas of research and development.

One of the key recommendations of NRP 66 is to establish a "Biorefinery competence centre" and a "Technical centre for Swiss wood innovation." The programme also calls for the development of a Swiss bioeconomy strategy in which wood takes its deserved place.

"Exploiting forests makes sense in terms of ecology and biodiversity as it can stabilise CO2 emissions for decades and diminish the greenhouse effect," Martin Riediker says. "We have a very emotional, even intimate, relationship with wood. It is the material of which old furniture and the chalets of our childhood are made. But wood can do even more. There is a lot of know-how in the areas of construction and innovation in Switzerland. The people involved in these sectors need to collaborate closely to maximise the benefits of this natural and renewable resource."

Provided by Swiss National Science Foundation

Citation: Wood goes high-tech (2017, November 7) retrieved 20 March 2024 from <https://phys.org/news/2017-11-wood-high-tech.html>

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