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Hydrophobic Deep Eutectic Solvents promise to play key role in making paper industry more sustainable

PhD research carried out as part of the PROVIDES project has recently resulted in promising new sustainable hydrophobic Deep Eutectic Solvents (DESs). These hydrophobic DESs could successfully replace chemical solvents in the paper recycling process in order to remove transition metal ions such as iron and manganese from paper pulp. Coordinated by ISPT, the industry-driven PROVIDES project focuses on developing environmentally friendly alternatives to chemical solvents in the European pulp and paper industry. It is financially supported by 20 industrial partners.

“We first discovered hydrophobic DESs in 2015,” explains PhD student Dannie van Osch. “Until then, all known DESs had been hydrophilic, which means they dissolve in water, making them unsuitable for removing contaminants from paper pulp, which consists of 95% to 99% water. The discovery of hydrophobic DESs was therefore a crucial breakthrough in my research.”

The hydrophobic DESs currently consist of various ratios of decanoic acid and lidocaine. “Decanoic acid is a plant-based substance, which makes it very suitable for use in an environmentally friendly solvent,” says Dannie. “We have now proven that these sustainable DESs successfully extract transition metal ions, significant contaminants in used paper, from water. And it only takes five seconds! Another major advantage is that these DESs are extremely easy to prepare. Furthermore, tests have shown that it is highly likely that the DESs can be reused, which will make them even more economical. The project will now focus on using this ground-breaking discovery for the main challenge in environmentally friendly recycling: removing inks and stickies.”

Alfons Koelen, Senior Development & Innovation Engineer at DS Smith, is the industrial leader of the PROVIDES subproject that focuses on removing contaminants from used paper. “As one of Europe’s largest paper and board recyclers, we are very excited about the discovery of hydrophobic DESs,” he says. “Our process water contains several contaminants, such as sticky materials and fatty acids. These are difficult to remove in a cost-effective way, and are causing problems in the paper production process. Thanks to the discovery of the hydrophobic DESs, it will soon be possible to remove these contaminants out of our process using cost-effective and sustainable chemistry.”

About the PROVIDES project

Green alternative

Deep Eutectic Solvents (DESs) are nature-based, renewable, biodegradable, low-volatile and cost-effective. When used for producing high-quality cellulose fibers in paper-making applications, they are extremely energy efficient, particularly because they do not require high temperatures. They offer a groundbreaking new method for the pulping of many different lignocellulosic materials for producing chemical pulp, pure lignin and other chemicals.

PROVIDES consortium

The PROVIDES consortium consists of 20 industrial partners in the pulp and papermaking chain, complemented by ISPT as coordinator, and Technical University Eindhoven, University of Aveiro, University of Twente, CTP and



ISPT

**Institute for Sustainable
Process Technology**

VTT as knowledge partners. Consortium partners come from all over Europe: Austria, Belgium, Finland, France, Germany, the Netherlands, Portugal, Sweden and Switzerland.

PhD research

As part of the PROVIDES project, four PhD students are carrying out research in close collaboration with the industrial partners from the pulp and paper industry. These projects focus on the use of DESs for the recycling of paper, lignocellulose fractionation and recovery processes. An article on hydrophobic DESs was recently published in [ChemComm](#).

About ISPT

The Institute for Sustainable Process Technology unites industry, universities, research organizations and SMEs in order to accelerate innovation and ultimately transform process technology into a green, clean, efficient endeavour. In addition to developing knowledge, the Institute fosters the demonstration and application of new technologies. More information: www.ispt.eu.

About DS Smith

DS Smith is a leading provider of corrugated packaging in Europe, operating across 36 countries. The company employs more than 26,000 people. In order to support its corrugated packaging operations, DS Smith has a recycling business that collects used paper and corrugated cardboard, from which the company's paper manufacturing facilities make the recycled paper used in corrugated packaging.



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