New process can reduce energy consumption of paper industry by 40 percent

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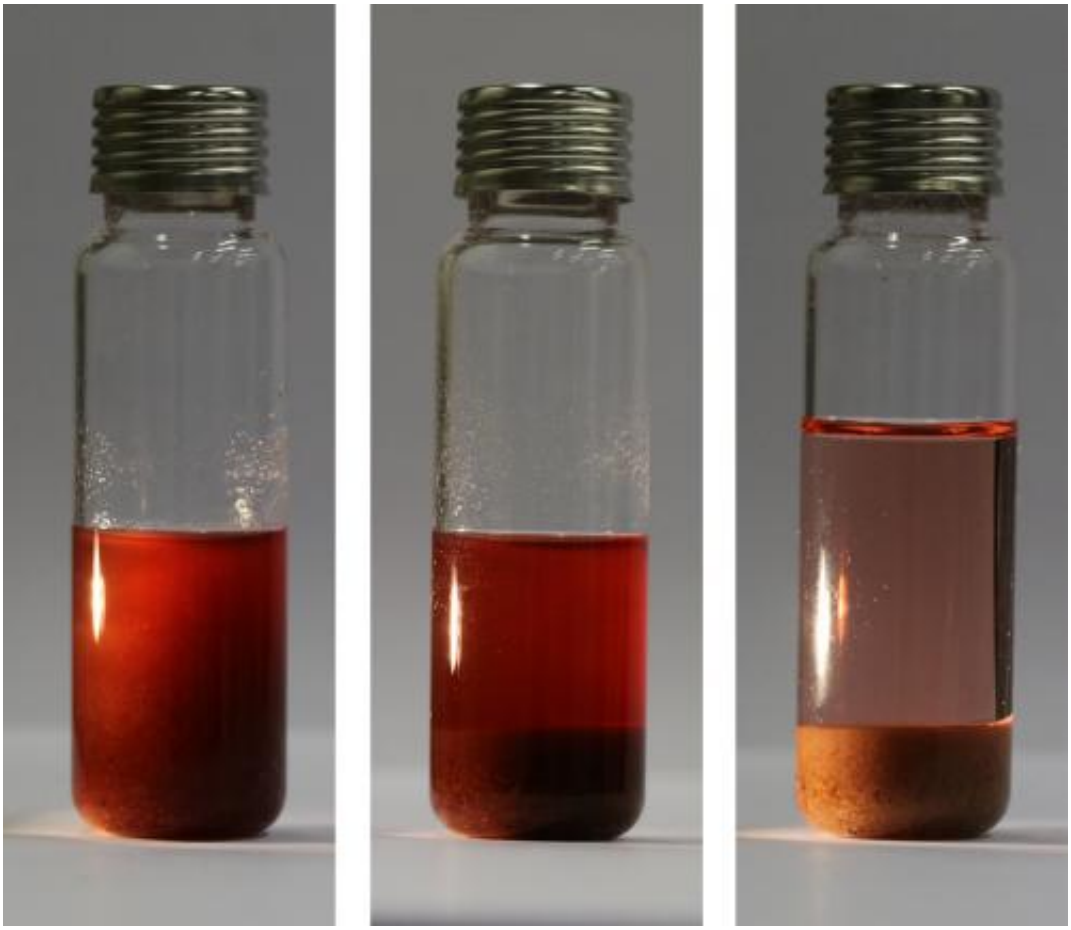


Softwood dissolved in DES. The lignine in the last bottle has been separated (the remaining pulp is at the bottom of the bottle). Credit: Eindhoven University of Technology

Eindhoven University of Technology (TU/e) signed an agreement last

week with 14 European paper producers for the further development of a breakthrough new solvent. This new solvent, developed by TU/e professor Maaike Kroon, will potentially enable the paper industry to make big energy savings in production and to use raw materials more efficiently. The European paper industry has high expectations of the new solvent. "This is a game changer, and it means the paper industry will look very different 20 years from now", said Henk van Houtum, chairman of VNP, the Royal Netherlands' paper and board association.

Kroon discovered that wood fibers easily dissolve in specific 'deep eutectic solvents' (DES). In the production of paper, the basic vegetable material (lignocellulose), such as wood chips or other biomass, has to be separated into lignine and cellulose. The cellulose is then used to make paper. The problem is that the two components are difficult to separate – the process still needs high pressures and temperatures, and it is costly to operate. Dissolving the wood chips has up to now not been an option because lignine is normally insoluble. But the new solvent, which Kroon has patented, makes this possible. As well as that the new solvent is entirely vegetable-based and biodegradable. Another advantage is that the new process produces very pure lignine, which the paper industry can use to develop new applications and markets such as making biodegradable plastics.

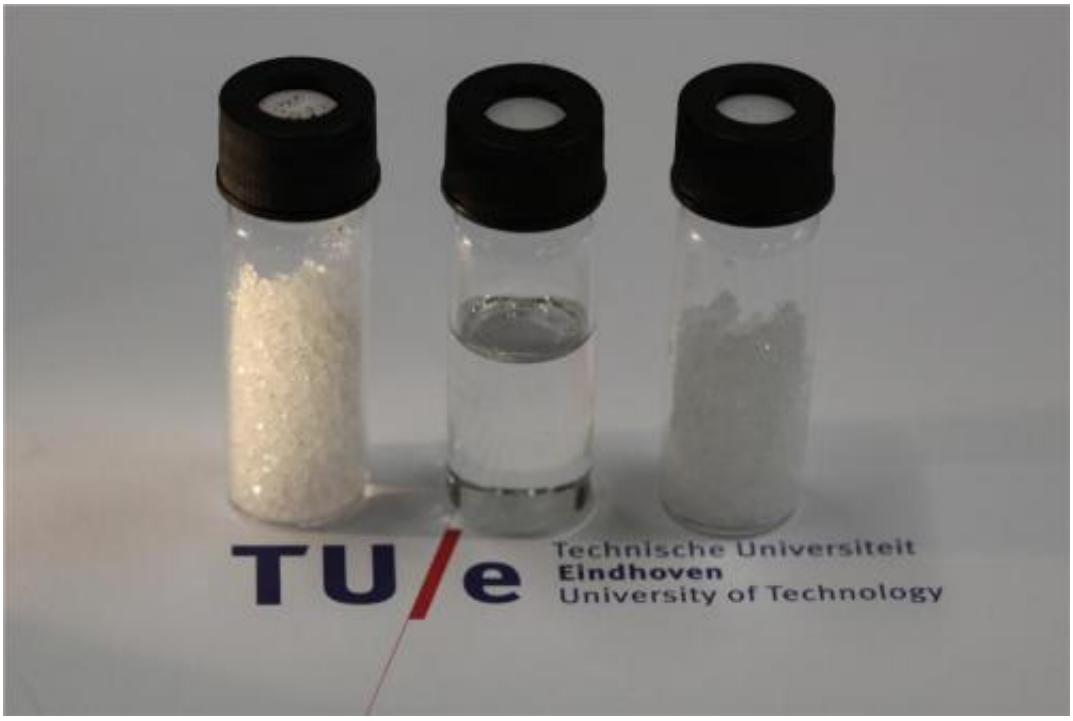
Paper production is energy-intensive, which is why the Dutch paper industry took the initiative in 2004 for its 'Energy Transition Paper Chain 2004-2020' plan which aims to halve energy consumption. The Confederation of European Paper industries (CEPI) is looking even further ahead, and intends to reduce CO_2 emissions by 80% before 2050. The industry has therefore focused strongly on innovation for a number of years, using natural raw materials in a high-tech process. In its search for breakthrough technologies, CEPI organized a competition last year to find the best new ideas. The winner was the 'deep eutectic solvents' which Kroon had already been working on for several years.

Henk van Houtum of the VNP expects that the solvent developed by Kroon will make a substantial contribution to meeting the industry's energy targets. He hopes that the use of DES will lead to at least 40% lower energy costs and 20% less CO_2 emissions.

Paper producer Sappi Maastricht. Credit: Sappi Maastricht.

TU/e signed a letter of intent last week with 14 European paper producers, including seven in the Netherlands, to continue development of the solvent. Kroon will use the funding from these companies to recruit two PhD candidates for a further four years of research at TU/e to prepare the way for the building of a pilot plant in the Netherlands. Kroon emphasizes that this is a very special agreement because it has been reached directly with the industrial companies, and does not rely on government financial support. It underlines the potential that the companies see in this development by the TU/e chemistry professor, and

the importance they place on quickly implementing it in practice. Large-scale applications are expected to be possible in around 15 years. The laboratory research will take another five to ten years, with a similar period being required for optimization in the pilot plant.



The two compounts that together form DES, at the left and right in the bottle. At the center they have been mixed which gives them a lower melting point, the essential characteristic of a DES. Credit: Eindhoven University of Technology.

Deep eutectic solvents were discovered in 2003 in the UK. They consist of a mixture of two compounds which, once they have been combined, have a much lower melting point than that of the individual components. Kroon believed that DES would make it possible to dissolve biomass, which formed the starting point for her present work. And it has indeed led to a process for dissolving lignine using different mixtures for specific types of wood.

Provided by Eindhoven University of Technology