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Science for Environment Policy

Closing the water cycle: new wastewater treatments are tested

Industries, such as paper production, require large amounts of water which can drain vital supplies of fresh drinking water. Researchers working towards the ultimate goal of 'closing the cycle' by reusing industrial water onsite have now identified innovative new treatments for wastewater from a paper mill.

Good management of water resources is an essential part of European environmental policy, particularly under new pressures, such as climate change. In research carried out under the EU Aquafit4Use[1] project, scientists compared new methods of wastewater treatment for production of water that is 'fit for use' in the industrial process.

In the paper mill studied, wastewater usually undergoes anaerobic and aerobic treatments before being clarified and discharged into the river. The researchers tested nine further treatment methods for wastewater using combinations of different technologies. These included high-speed filtration to remove solids; nanofiltration to remove some salts and organic compounds; 'softening' (the addition of lime to eliminate calcium and alkalinity by precipitation); techniques to remove organic compounds from the water and, finally, some evaporation techniques to minimise waste and produce high quality water.

These technologies are important to ensure that the water quality is suitable for effective reuse in the mill. For example, low calcium content is required to prevent calcium residues building up on the machinery and low chloride content is also preferable to avoid corrosion.

After laboratory tests, the best sequence of processes for treating wastewater was found to be anaerobic treatment, followed by aerobic treatment, high-speed filtration, softening and nanofiltration. Results demonstrated that the softening step had a significant positive effect. Wastewater that had been softened moved through the nanofiltration membrane at a rate almost twice as high as unsoftened water. It also had a higher conversion rate, i.e. the flux of 'cleaned' water compared to the flux of water treated by nanofiltration was higher, which produces more treated water for reuse. The use of this softening pre-treatment also avoids the use of acids on the nanofiltration step.

The researchers conclude that initial laboratory results are promising, but highlight that the best test of the different types of treatment will be the seven pilot tests currently being conducted onsite. These will determine whether the treatments examined in the laboratory will prove efficient, reliable and cost-effective at the larger scale, and could have important implications for reusing and recycling water in industry.