Researchers recovering metals and minerals from waste

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Scarcity of clean water is one of the most serious global challenges. In its spearhead programme, VTT Technical Research Centre of Finland developed energy-efficient methods for reuse of water in industrial processes and means for recovering valuable minerals and materials from waste for recycling. Rapid tools were also developed for identification of environmental pollutants.

When water and wastewater systems are developed in a comprehensive manner, it is possible to recover valuable metals and other materials and secure availability of clean water. Cleaning and treatment processes can also be linked to energy production, and the processes and urban structures designed in such a manner that wastewater treatment does not consume energy or cause extra costs.

"Wastewater treatment and waste treatment have mainly been implemented by legal necessity. Now we should modify our way of thinking so that we would be able to regard waste disposal sites and purification plants as sources or raw materials and energy. In the near future, technology has been refined far enough to allow such waste treatment plants to operate on their own," says Mona Arnold, Principal Researcher at VTT.

Recycling valuable minerals and materials

Demand has arisen for technologies capable of recovering even tiny

amounts of minerals from waste flows. Recovering them from municipal or mining wastewaters requires better recovery methods than those available today. VTT has developed extraction methods for metals and minerals from waste materials. Biological extraction methods by which metals are recovered from mining, metal and recycling industry waste by utilising microbes and chemical reactions are under testing stages and they are forcasted for market uptake within the next few years.

Other valuable elements can also be found from waste flows. For example, the food industry by-product flows contain biochemicals and proteins that can be utilised better than is currently possible, if only they could be effectively recovered from waste. One possibility is to use enzymes. VTT researchers developed an enzyme-assisted method by which feed products can be produced from side streams deriving from turnip rape processing in food industry.

Reducing energy consumption in water treatment

Treatment of water in purification plants and industrial facilities consumes vast amounts of energy. Usually water recycling and seawater desalination are based on the use of filtration membranes that consume energy. VTT developed intelligent membrane materials, reducing the need of purification, for filtration purposes.

Membrane solutions using only small amounts of energy were developed for water treatment purposes. VTT has collaborated with a university in Singapore to develop a method based on forward osmosis technology, by which metals and biocomponents can be recovered and concentrated from industrial process waters.

The pumping and distribution of water to consumers and industry also consumes major amounts of energy. The need for pumping can be minimised if the process water can be recirculated within the plant, and

the distribution network is made more effective by enhanced monitoring and location of leaks.

Sensors for identifying environmental hazards

The VTT spearhead programme also developed sensor technology for easy and rapid detection of pollutants. VTT indicators facilitate rapid identification of, for example, small but hazardous cyanobacterial toxin levels and phenolic, hormone-like compounds. There is need for such indicators in developing countries, suffering from lack of trained personnel and laboratories. The technology will be ready for production use within the next few years.

VTT developed new solutions in its spearhead programme Green Solutions for Water and Waste in 2011–2013.

The R&D aimed at enhanced cleantech industry competitiveness combined the VTT competencies in, for example, biotechnology, modelling, sensor technology, and energy technology.

Provided by VTT Technical Research Centre of Finland

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