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Nutrient recovery gains momentum

In Amersfoort, Netherlands, the Dutch Waterboard Vallei & Veluwe plans to recover both energy and nutrients at its wastewater treatment plant – enough to achieve energy self-sufficiency and generate revenues from 900 tons of fertilizer.

Nutrient recovery is gaining momentum in North America and Europe as water utilities have begun to recognize the significant benefits – economic and environmental – of recovering nitrogen and phosphorus from wastewater resources. Recently, full-scale nutrient recovery plants have launched in Canada, England, Netherlands, and the United States. Research initiatives, including pilot studies, are underway in Canada, Denmark, and elsewhere to explore commercial opportunities and other methods to extract and recycle phosphorus from treated municipal wastewaters.

Nutrient pollution is one of the biggest environmental problems of the 21st century, according to the United Nations Environment Program. Excess nitrogen and phosphorus from agricultural runoff (e.g. fertilizer, animal manure), human sewage, and industrial emissions are major sources of nutrients in surface water, which causes algal bloom. Eutrophication, the accumulation of nutrients in an ecosystem, renders bodies of water – fresh and salt water – devoid of the oxygen necessary to sustain aquatic and marine life. Destroying ecosystems and local economies based on commercial and recreational fishing, this anoxic/hypoxic effect has created massive low-oxygen dead zones in coastal environments. Dead zones have been observed in the Baltic Sea, Black Sea, Mediterranean Sea, Chesapeake Bay (USA), Gulf of Mexico (USA), and in many other coastal locations in South America, China, Japan, and Southeast Asia. The problem is getting worse, not better.

An in-depth report by the European Commission's 7th Science for Environmental Policy on "Sustainable Phosphorus Use," released in October 2013, notes that a range of actions could reduce phosphorus losses to surface waters. These responses include: use less phosphorus on land and reduce soil erosion; optimize use of fertilizer and manure; and recover and recycle phosphorus.

Reduction, recovery, and reuse of phosphorus are particularly important given that phosphorus rock reserves, the key ingredient of fertilizer, are limited. Ninety percent of phosphate reserves are located in only five countries: Morocco, China, Algeria, Syria, and Jordan. Price volatility is a concern; since 2007 the price has increased by 500 percent. The report concludes that an integrated approach is necessary to reduce the loss (waste) of phosphorus on a global scale, and that rising market prices alone will not drive further reductions.

Benefits, such as operational cost savings and revenue opportunities, are also driving utilities to explore innovative ways to reduce nutrients in discharges, required by law. A new technology, developed by Ostara Nutrient Recovery Technologies of Vancouver, Canada, recovers nitrogen and phosphorus and produces fertilizer from sewage on a large scale. The process further reduces nutrient loss due to leaching and runoff. Already, Ostara has nine nutrient recovery facilities operating in Canada, United Kingdom, and the United States. Two more installations are planned for the US city of Chicago and Amersfoort, Netherlands by 2015.

Last August, Canada's first commercial nutrient recovery facility opened up at a wastewater treatment plant in Saskatoon, Saskatchewan. The facility uses Ostara's Pearl 2000® process to recover phosphorus and nitrogen from the wastewater stream for use in Crystal Green®, a slow-release fertilizer. By removing polluting nutrients, the technology helps the city meet nutrient discharge limits, avoid operational issues caused by the build-up of struvite scale in plant equipment, while earning revenue from the fertilizer.

Struvite is a concrete-like mineral deposit that chokes process equipment and increases operation and maintenance costs. Struvite formation is a common challenge in plants using biological nutrient removal and anaerobic digestion processes. Ostara says its system recovers 75 percent of phosphorus and 10 percent of nitrogen from the wastewater stream before they accumulate in plant equipment at the Saskatoon facility.

On November 6, Thames Water and Ostara officially launched the UK's first commercial nutrient recovery facility at Slough Sewage Treatment Works with much fanfare. Britain's largest water and sewerage company, Thames Water expects the US$3.3-million nutrient recovery reactor will save $328,000 per year, which it has until now spent on chemical dosing to clear pipes of struvite at the Slough facility. In addition, the reactor is expected to produce 150 tons per year of fertilizer that will generate revenue.

During WEFTEC® 2013, the Water Environment Federation's 86th Annual Technical Exhibition & Conference, held on October 5-9, in Chicago, Illinois, USA, Executive Director David St. Pierre of the Metropolitan Water Reclamation District of Greater Chicago (MWRD) announced plans to install Ostara's technology at the Stickney Water Reclamation Plant, working in partnership with the global consultancy Black & Veatch. Designed to treat 5.5-million cubic meters of wastewater per day, the Stickney plant, once equipped with a nutrient recovery facility, could produce between 10,000 to 15,000 tons of Crystal Green fertilizer annually. The MWRD says the nutrient reduction facility will greatly reduce its nutrient load to the Mississippi river basin, in turn, reducing its effect on hypoxia in the Gulf of Mexico. Environmental advocate Robert F. Kennedy Jr., who spoke during the press conference, added that the application of Crystal Green fertilizer reduces nutrient loss because it is highly water-insoluble and releases nutrients in response to plant demand.

In Amersfoort, Netherlands, the Dutch Waterboard Vallei & Veluwe plans to recover both energy and nutrients at its treatment plant. The facility will produce enough energy to treat all wastewater from the city (150,000 persons equivalent) and produce 900 tons of fertilizer. Green energy produced from biogas (digestion enhanced with thermal pressure hydrolysis) will power the entire treatment facility with a surplus of an estimated two million kWh, enough for 600 homes, supplied to the national power grid throughout the year. Main contractor SH+E Group is working with Grontmij, Hegeman, and Ostara to complete the project by 2015.