Environmental Engineering and Management Journal

March 2012, Vol.11, No. 3, Supplement, S75
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

Sub-session 2.2.
Organic waste and effluent biorefinery

Main lecture

BIOTECHNOLOGY FOR SUSTAINALBE SUPPLY AND USE OF PHOSPHORUS

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Abstract

Phosphorus (P) is one of the most critical elements in the biological building blocks and plays a crucial role in the cellular energy metabolism of all living organisms. P has been regarded as the life's bottleneck or the ultimate limiting factor for the amount of life on Earth. P is used as a raw material in a wide variety of manufacturing industries. For instance, it is used in iron phosphate coatings in automobile industry, etching agents for aluminium line pattern substrates for liquid crystal panels and integrated circuit devices, and flame retardants for a variety of industrial products. More importantly, P is an essential element of fertilizer for agriculture and biomass production. Today, P is mostly obtained from mined rock phosphate which is a non-renewable resource. Approximately 17.5 million tons of P is mined in the world every year, and approximately 85% of the mined P is used as fertilizer for agricultural purposes. However, securing the sufficient quantity of high-quality rock phosphate at a reasonable price is becoming more and more difficult, because of the global shortage and increased P demand. For the sustainable resource management, increased attention has been paid to a closed P cycle on Earth. However, P recycling has never been realized on a large scale, mainly because of economical reasons. Among emerging issues on P recycling are the quality, quantity, cost, and market of recovered P. To tackle these issues, we have recently developed an innovative technology for P recovery using amorphous calcium silicate hydrates (A-CSHs) as inexpensive adsorbents. Importantly, the A-CSHs can be produced using unlimitedly available resources such as calcium carbonate and silicate. This technology allowed us to create a new business model for P recycling. Namely, a cement company manufactures A-CSHs at low costs, carries them to a P recovery site (e.g. wastewater treatment plant) using agitating trucks, and takes out P-binding A-CSHs to a fertilizer company. The recovered A-CSHs can be directly used as by-product phosphate fertilizer. To fully realize P recycling, the P Recycling Promotion Council of Japan (PRPCJ) was established as a nationwide association under the support of four important ministries of Japan in 2008. In this talk, our current efforts to develop phosphate refinery technology will be presented.