Synergistic treatment of sewage sludge incineration ash and concrete slurry wastewater for recovery of phosphorus and usable water

Yohannes L. Yaphary and Sam Fong Yau Li

Department of Chemistry, National University of Singapore, 3 Science Drive 3, Singapore 117543, Singapore

The traditional wet method of recovering P from sewage sludge incinerator ash (SSIA) requires a lot of water and chemicals (such as acids and alkalis for further P extraction and precipitation), which has negative effects on the environment and the economy. Here, we reduce them by using concrete slurry wastewater (CSWW) as a water and alkali source, which results in a pH 7 P recovery of over 90%. The P product complies with inorganic fertilizer requirements because it includes around 12% P and minimal metal impurities. The product, which was formed at pH ~4 and largely converted to hydroxyapatite crystal (HAp) at higher pH, was found to consist of HAp and amorphous $CaHPO_4$, according to powder X-ray diffraction and chemical equilibrium calculations. To save water, the supernatant was used in later P extraction cycles. In accordance with the zero-waste concept, by-products were evaluated for hazards and recycled into cementitious materials. This study is a prime example of how P recovery from SSIA and cementitious material manufacture work together to turn waste into useful resources.