A NOVEL APPROACH FOR EFFICIENT EXTRACTION OF P FROM ASHES GENERATED FROM BIOWATE INCINERATION

Guozhu Ye[1*], Elsayed Mousa[1], Bruno Valentim[2], Georgeta Predeanu[3], Hayati Olgun[4], Barbara Białecka[5], Elza Bontempi[6], Luminița-Georgeta Popescu[7]

[1] *Swerim AB, Aronstorpsvägen 1, 974 37, Luleå, Sweden*

[2] *Department of Geosciences, Environment and Spatial Plannings, Faculty of Sciences, Earth Science Institute-Porto Pole, University of Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal*

[3] *National University of Science and Technology POLITEHNICA Bucharest, Research Center for Environmental Protection and Ecofriendly Technologies, 1-7 Gheorghe Polizu Str., 011061 Bucharest, Romania*

[4] *Ege University, Solar Energy Institute, 35100 Bornova, Izmir, Turkey*

[5] *Department of Environmental Monitoring, Central Mining Institute – National Research Institute, Katowice, Plac Gwarków 1, 40-166 Katowice, Poland*

[6] *INSTM and Chemistry for Technologies Laboratory, University of Brescia, Via Branze 38, Brescia, 25123, Italy*

[7] *Constantin Brâncuși University of Targu Jiu, Engineering Faculty, 30 Calea Eroilor, Târgu Jiu, Gorj County, Romania*

Abstract

The EU phosphorus need is dependent on imports from Kazakhstan (71%), Vietnam (18%), and China (9%). Due to its economic importance and supply risk, the EU included phosphorus (P) and phosphate rocks (PR) in the "2020 List of critical raw materials (CRM) for the EU". One of the most sustainable options to secure future P supply within the EU is P recovery from the food production and consumption chain. A substantial P-source is the biowastes from the poultry litter. For example, with more than 375 million laying hens in the EU, which excrete between 0.10 and 0.45 kg P_2O_5 per chicken/year, one may estimate that there are about 16,350-73,575 tons of P available only in the hens' manure, which corresponds to about 10-15% of all P needed in the EU and UK. Incineration of this biowaste will enrich the P content by 6-7 times to P-rich ashes and at the same time produce green energy. This approach has been extensively investigated in an ongoing ERA-MIN3 project, PHIGO. The project aims to optimize the incineration step and to develop a sustainable technology for efficient P-extraction from the P-rich ashes, thereby enabling the closing of the P-loop in the EU P-strategy.

The PHIGO P-extraction concept has been developed and proven on a laboratory scale. Several preliminary pyrometallurgical tests have been carried out, and the results show that a P-recovery rate of over 85% P can be achieved. The recovered P-products have been characterized and their potential applications tested, e.g., fertilizer. The remaining inert material after the P-thermal extraction mainly consists of Ca_2SiO_4, which can be a degreasing additive in shaping mixtures and replacing raw clay.

This paper will highlight the major outcomes of the project with a focus on the P-extraction approaches. The developed P-extraction concept of the PHIGO project is based on experiences from the metal extraction processes. The obtained P can be recovered as element P (as white phosphorus) or fertilizer together with recovered K. The thermochemistry behind the PHIGO P-extraction concept, the experiment setup, and the test procedure will be described and discussed. The utilization of the obtained P-products will also be discussed.

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