

Phosphorous extraction from by-products and industrial wastes

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Background

Phosphorous (P) is an element mainly used as a fertilizer, in fact, it is involved in the process of photosynthesis and is essential for crop growth. It is mainly extracted from phosphate rock, the reserves of which are, however, becoming depleted; phosphorus has been on the list of 'critical raw materials' since 2017.

Objectives

The aim of the research project is to produce inorganic fertilizers through the treatment of phosphorus-rich by-products and industrial waste that are currently disposed in landfills.

Methodologies

Recovery and chemical-physical characterization of by-products and industrial wastes through chemical analysis (different techniques) and X-ray powder diffraction and quantitative phase analysis (XRPD-QPA).

The thermochemical microwave (MW) treatment at controlled power or temperature allows the activation of exchange reactions which let the passage of the P in the soluble phase and the loss of many unwanted metals inside a fertilizer.

The samples before treatment are mixed with a reducing agent and a saline additive, and arranged inside a crucible which is placed in a refractory chamber (equipped with a susceptor) inside the MW (fig. 1)

The treated samples undergo a second chemical analysis and XRPD-QPA. Furthermore, a solubility test, using water or suitable solutions for agricultural use, is conducted to verify the solubility of the product.

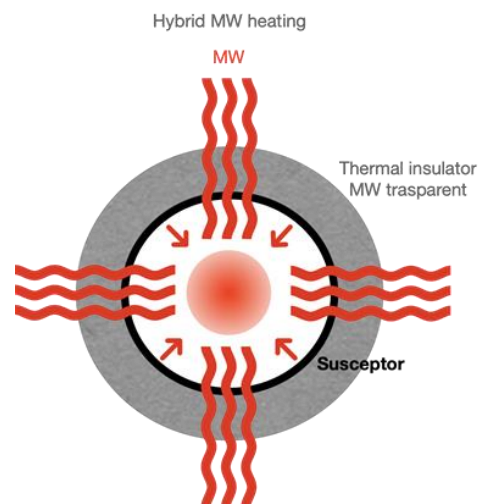


FIGURE 1. MW REFRACTORY CHAMBER SCHEME

Expected Results and Impact

Thermochemical MW treatment is a highly sustainable extraction methodology for phosphorous recovery. Producing fertilizers from materials currently stored in landfills would enable the implementation of a circular economy for P used in agriculture, greatly limiting the extraction of the raw material.