



RECOPHOS

AT A GLANCE

Title: Recovery of Phosphorus from Sewage Sludge and Sewage Sludge Ashes with the Thermo-Reductive RecoPhos Process

Instrument: FP7 Environment, Collaborative Project

Total Cost: 4,526,875.00 €

EC Contribution: 3,421,190.00 €

Duration: 36 months

Start Date: 01/03/2012

Consortium: 9 partners from 5 countries

Project Coordinator: Montanuniversitaet Leoben (AT)

Project Web Site: www.recophos.org

Key Words: Phosphorus recovery; white phosphorus; sewage sludge; sewage sludge ashes; thermo-chemical process; induction furnace; heavy metal removal; process simulation; plant safety; process modelling

Phosphorus is a key natural resource for agriculture and other industry sectors – but natural phosphate sources are getting scarce. The RecoPhos project is aimed at recovering this valuable resource from sewage sludge ash using a novel sustainable process.

THE CHALLENGE

Phosphorus is a key plant nutrient and a major economic factor – around 90% of the phosphorus produced annually are used in the fertiliser industry. Global demand is currently met by phosphate rock mined outside Europe in an environmentally harmful manner. These natural phosphate sources are getting scarce, resulting in an upward price development and making Europe strongly dependent on phosphate imports. The tapping of new sources of phosphorus is therefore imperative for European agriculture and the economy as a whole.

Sewage sludge is considered a very promising alternative to phosphate rock as it contains considerable amounts of phosphorus – the P-content in the sewage sludge produced in Europe could replace roughly up to 20 or 30% of the phosphate imports into the EU. Although many methods have been developed to recover phosphorus from sewage over the past years and decades, none has yet been realised at industrial scale due to the complex and costly processes involved and the low recycling rates achieved.

PROJECT OBJECTIVES

European universities, small and medium-sized enterprises and multi-national industry have joined forces in the RecoPhos consortium to develop a sustainable and highly efficient process for recovering phosphorus from sewage sludge ash.

Phosphorus recovery: RecoPhos is a thermo-chemical process involving the fractioned extraction of phosphate and heavy metals from sewage sludge ash at high temperatures under reducing conditions. The chemical principle of the core reaction is modelled on the “Wöh-

ler process”, in which phosphates react with carbon and silicon dioxide in a furnace and is reduced to phosphorus. The RecoPhos process follows a novel approach by using the innovative InduCarb retort, where a coke bed is heated inductively, and the reduction of the phosphorus contained in the sewage sludge ash takes place in a thin melt film on the surface of the coke particles. The reduced phosphorus can evaporate from the film without significantly reacting with other elements and can subsequently be retrieved either as white phosphorus or oxidised into phosphoric acid.

Valuable secondary materials for industry: A special advantage of the RecoPhos process is that it not only transforms a problematic waste with high heavy metal content into valuable phosphorus but also produces several streams of secondary raw materials that can be used in other industrial applications. Such materials include an iron alloy, a silicate slag for use as a binder in cement industry and a high calorific syngas for thermal energy generation.

Use of waste materials in the process: The process will enable optional use of waste materials as heat sources, reducing agents or additives, including dried sewage sludge, foundry ash, waste salts or meat-and-bone meal. Concepts to recover a maximum of the heat of the high-temperature process will be developed.

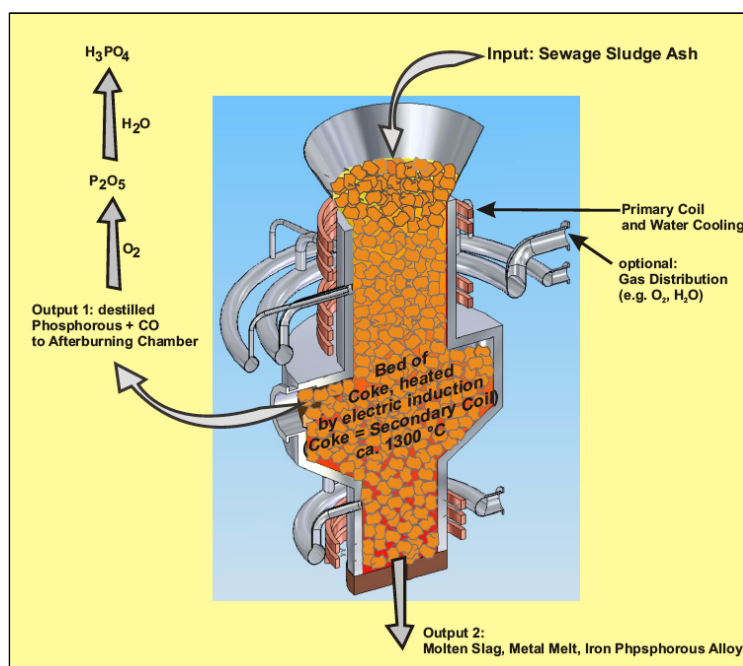
METHODOLOGY

The RecoPhos process will be developed using lab-scale experiments and state-of-the-art modelling and simulation methods to investigate the thermodynamic and chemical processes taking place within the reactor. The simulations and experiments will provide the basis for the implementation of a fully operational bench scale reactor and the design of a pilot scale plant. The economic, environmental and social impact of the RecoPhos process will be investigated in a market study and a Life Cycle Assessment.

EXPECTED RESULTS

The RecoPhos process is designed to

- enhance the purity of the phosphorus recovered through application of the innovative InduCarb technique
- increase the efficiency of phosphorus recycling through generation of usable by-products, use of waste materials and heat recovery
- reduce Europe’s dependence on phosphate imports
- counteract the depletion of natural phosphate sources



PROJECT PARTNERS		COUNTRY
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