ZERO-WASTE PHOSPHORUS RECOVERY FROM RICE HUSK POULTRY LITTER ASH

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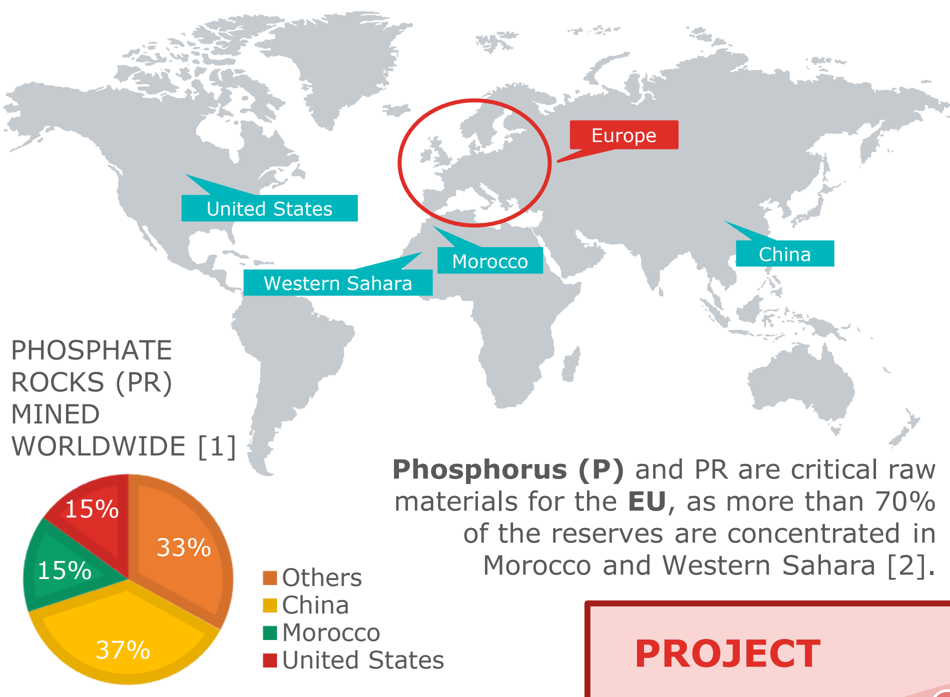
BACKGROUND



Phosphorus (P) and PR are critical raw materials for the **EU**, as more than 70% of the reserves are concentrated in Morocco and Western Sahara [2].

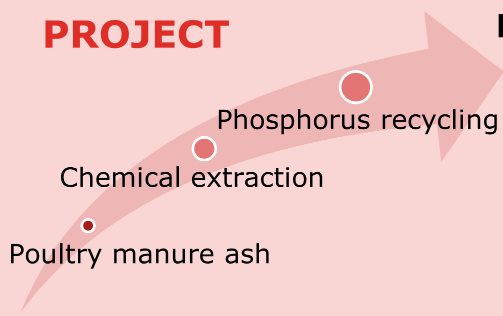
[1] USGS, *Mineral Commodity Summaries, Phosphate Rock* (2021).
[2] European Commission, *Study on the EU's list of Critical Raw Materials - Final Report* (2020).

GOALS

Poultry manure ash has characteristics similar to natural PR and it is suitable for wet-chemical extraction [3]. The recovered product could be supplied to the fertilizer industries and residues reused [4].

[3] L. Hermann, T. Schaaf, *Outotec manure, slurry, and sludge processing technology*, in: Phosphorus Recovery and Recycling, 403–417. Springer, Singapore (2019).
[4] L. Luyckx, G. H. J. de Leeuw, J. Van Caneghem, *Characterization of Poultry Litter Ash in View of Its Valorization*, Waste Biomass Valorization, 11, 5333–5348 (2020).

PROJECT

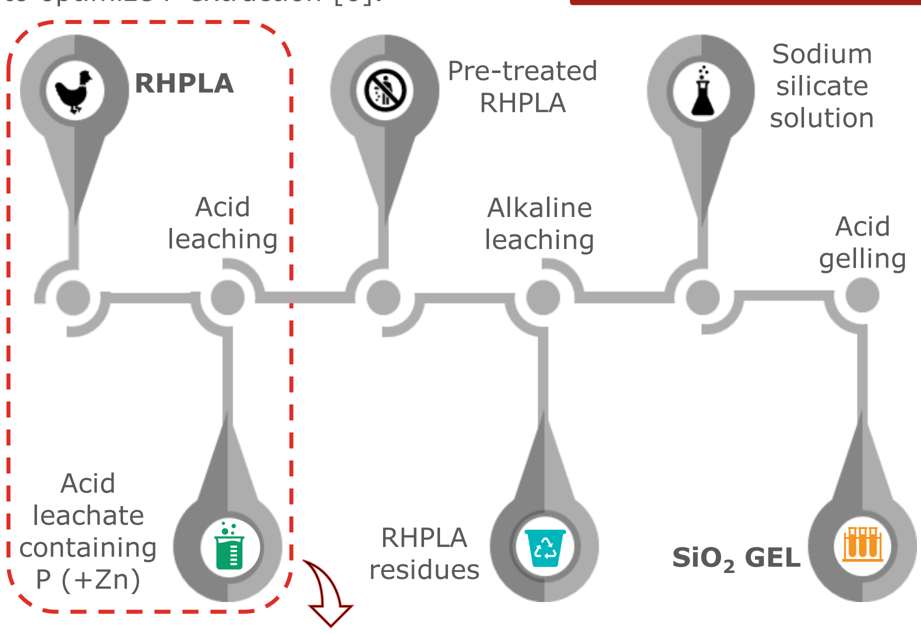


DEASPHOR

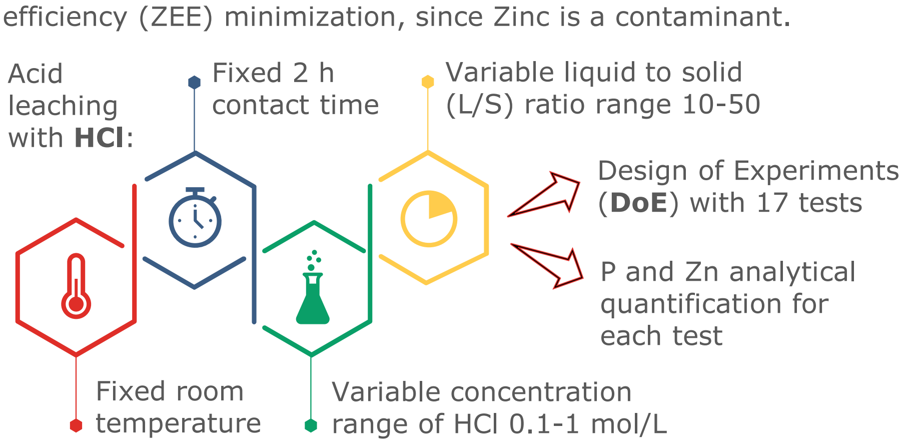
Design of a product for substitution of phosphate rocks

MATERIALS AND METHODS

The proposed zero-waste recovery process [5] and the parameters used to optimize P extraction [6].



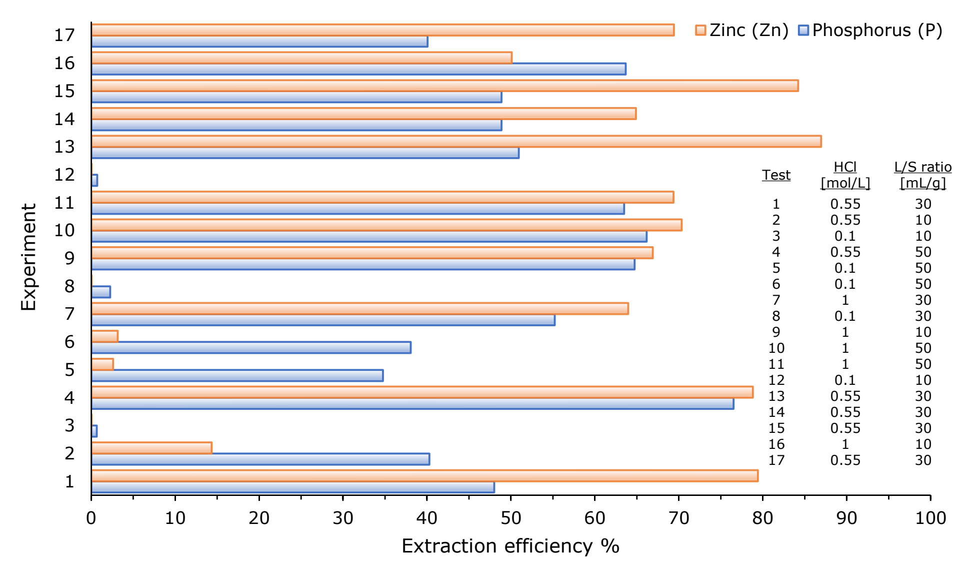
AIM: P extraction efficiency (PEE) maximization and Zn extraction efficiency (ZEE) minimization, since Zinc is a contaminant.



[5] L. Fiameni et al., *Simultaneous amorphous silica and phosphorus recovery from rice husk poultry litter ash*, RSC Advances, 11, 8927–8939 (2021).
[6] L. Fiameni et al., *Phosphorous and silica recovery from rice husk poultry litter ash: A sustainability analysis using a zero-waste approach*, Materials, 14, 6297 (2021).

RESULTS AND DISCUSSION

Figure shows PEE, ZEE and operating conditions adopted for each test. Results were used for statistical optimization.



Test	HCl [mol/L]	L/S ratio [mL/g]
1	0.55	30
2	0.55	10
3	0.1	10
4	0.55	50
5	0.1	50
6	0.1	50
7	1	30
8	0.1	30
9	1	10
10	1	50
11	1	50
12	0.1	10
13	0.55	30
14	0.55	30
15	0.55	30
16	1	10
17	0.55	30

- The best operating conditions suggested by DoE optimization are 0.34 mol/L HCl concentration and 50 L/S ratio to allow a PEE equal to 61.3% and a ZEE equal to 44.2%.
- Alongside, sustainability analysis has shown that adopting HCl 1 mol/L and L/S ratio equal to 10, with the only requirement of having **a minimum P content of 10% in the starting RHPLA**, would be the most sustainable process. In this case PEE would be about 65%, but without considering ZEE.

ONGOING WORKS

Precipitation of P product from acid leachate, via alkaline titration

RHPLA residues tested as binder in construction materials

Preliminary adsorption tests with recovered SiO_2 for removal of drugs from wastewater

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