

We deliver Phosphorus made in Europe



PHOSPHORUS RECOVERY FROM DRIED SLUDGE WITH REACTIVE EXTRACTION TO REMOVE IMPURITIES

5th ECSM, 08.10.19, Liège, Belgium

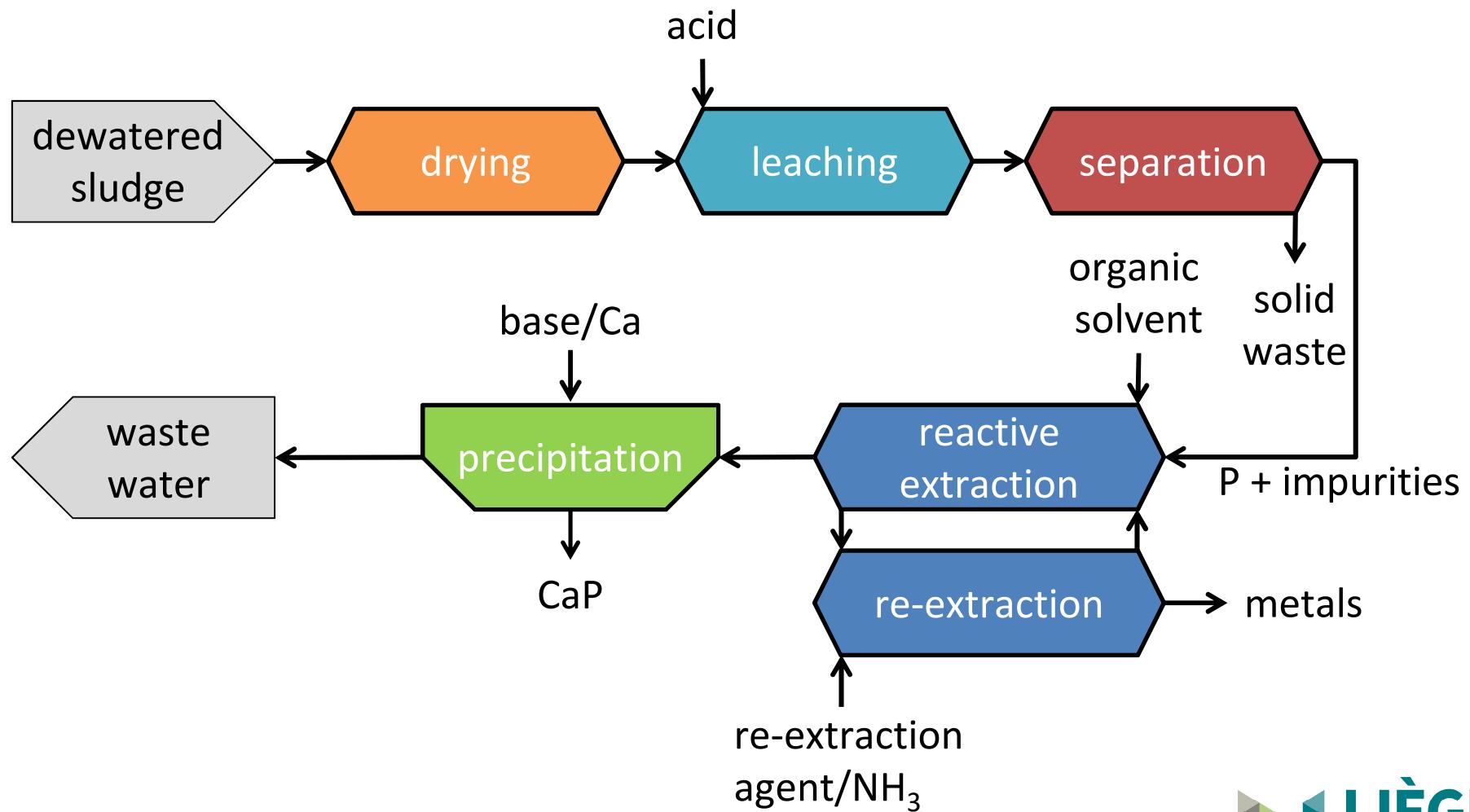
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PEPs - Department of Chemical Engineering, Université de Liège

agenda

- PULSE process concept
- process development
 - SLE modelling
 - cascaded option tree
- experimental results
- summary

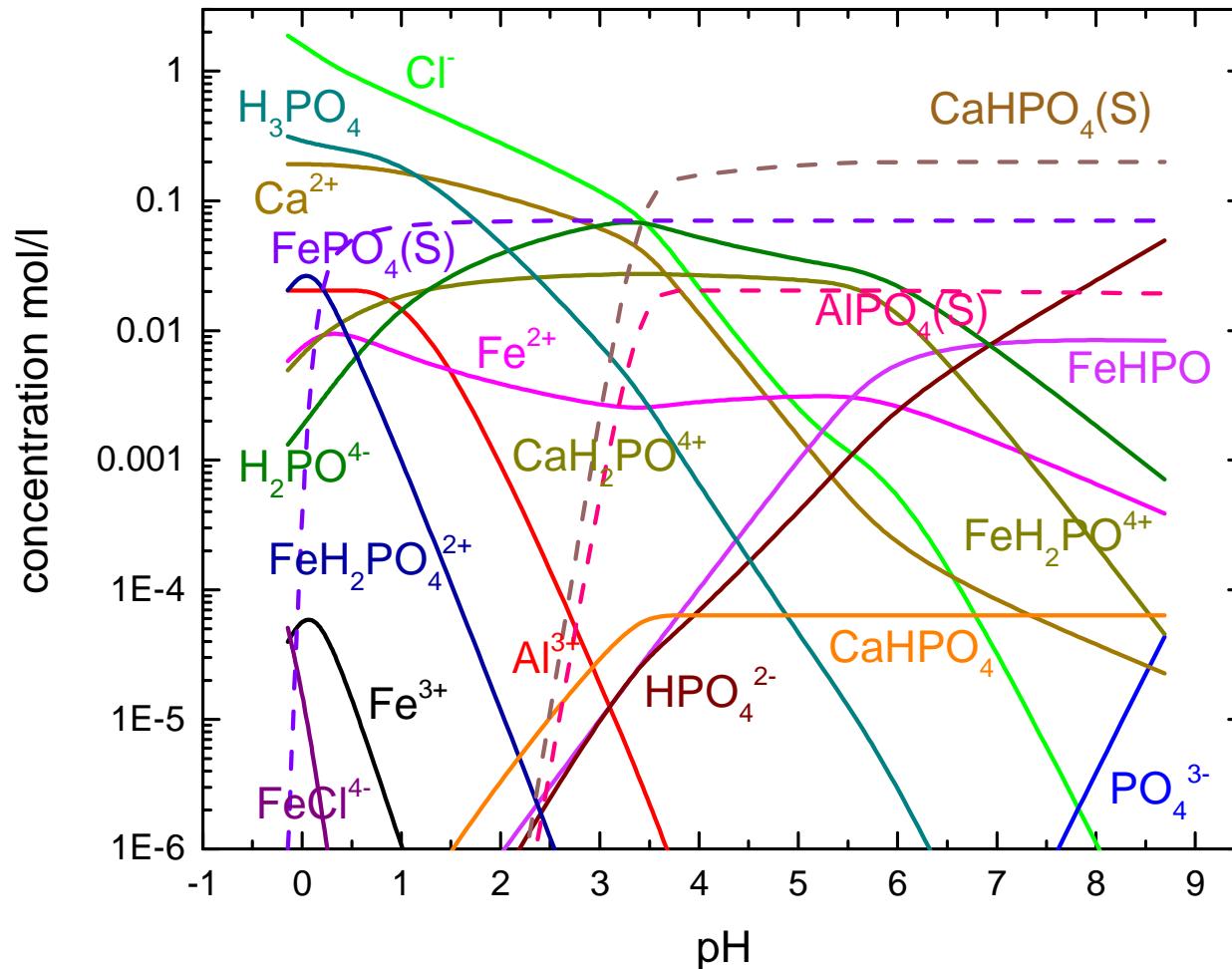
PULSE (Phosphorus University of Liege Sludge Extraction) process



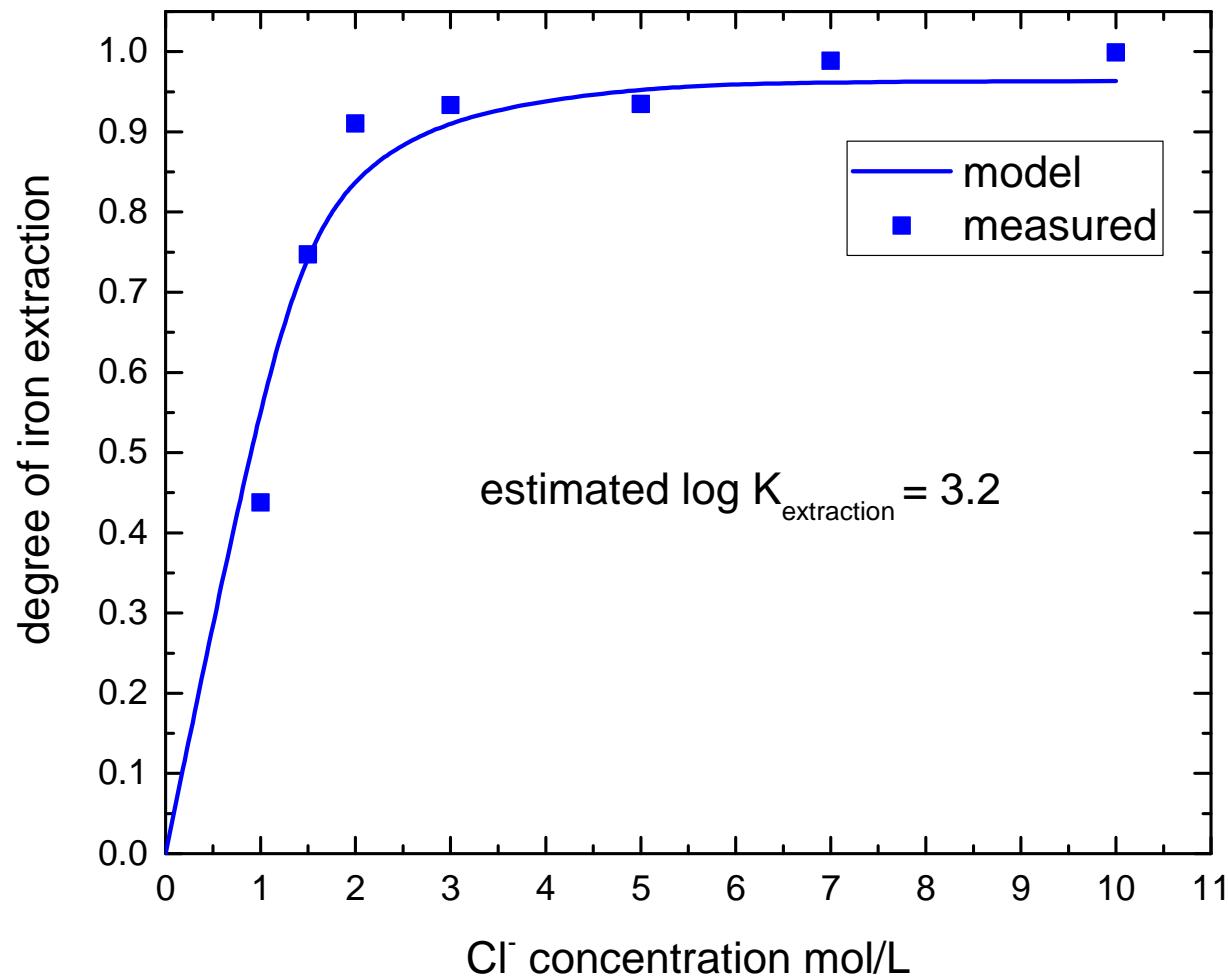
solid-liquid-liquid equilibrium

- aqueous phase speciation:
 - mass balance
 - law of mass action
 - charge balance
- solid precipitation:
 - saturation index
- activities instead of concentration to account for ionic interactions
- degree of reactive extraction with organic solvents
- evaluation of model parameters by data fitting

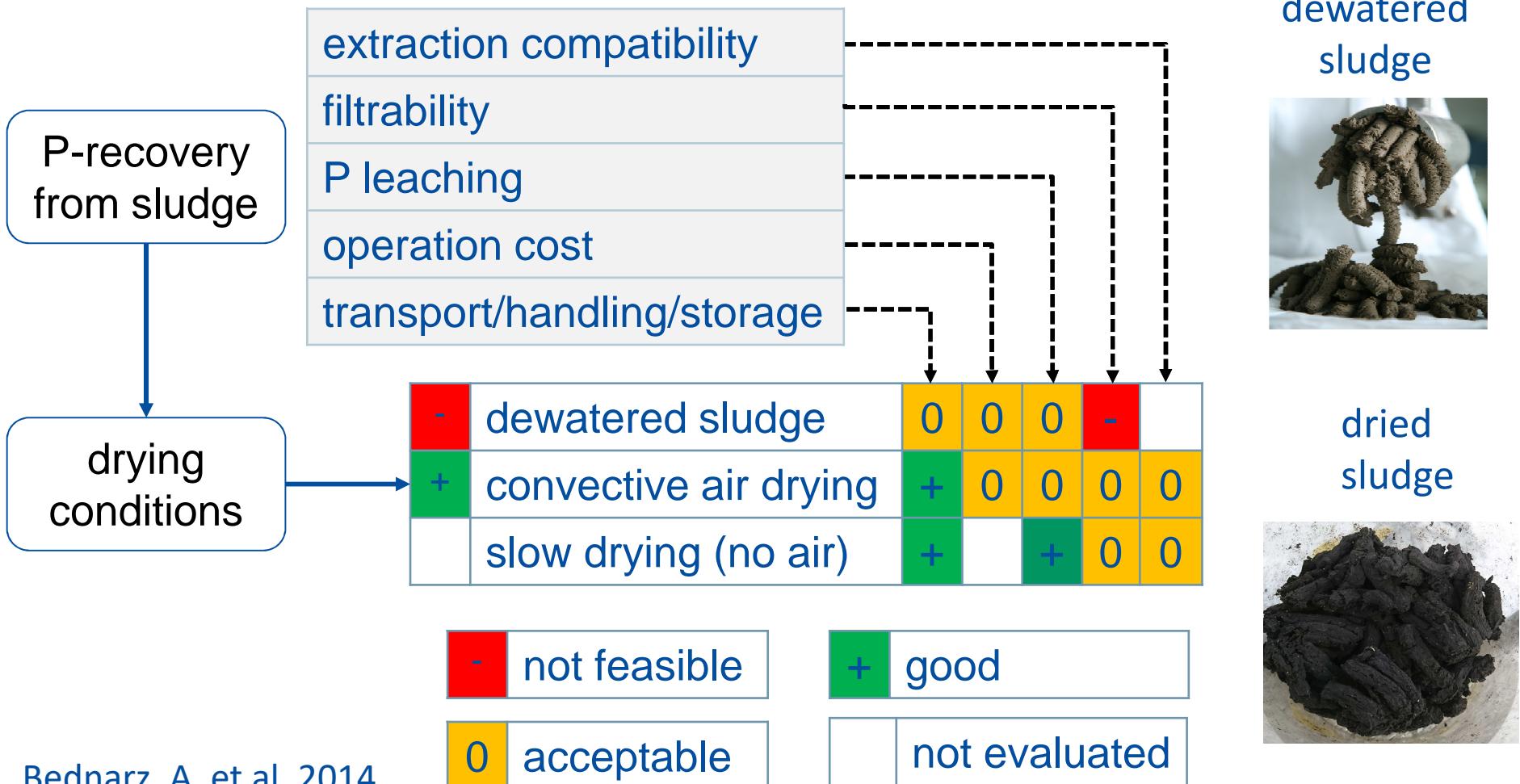
solid-liquid-liquid equilibrium



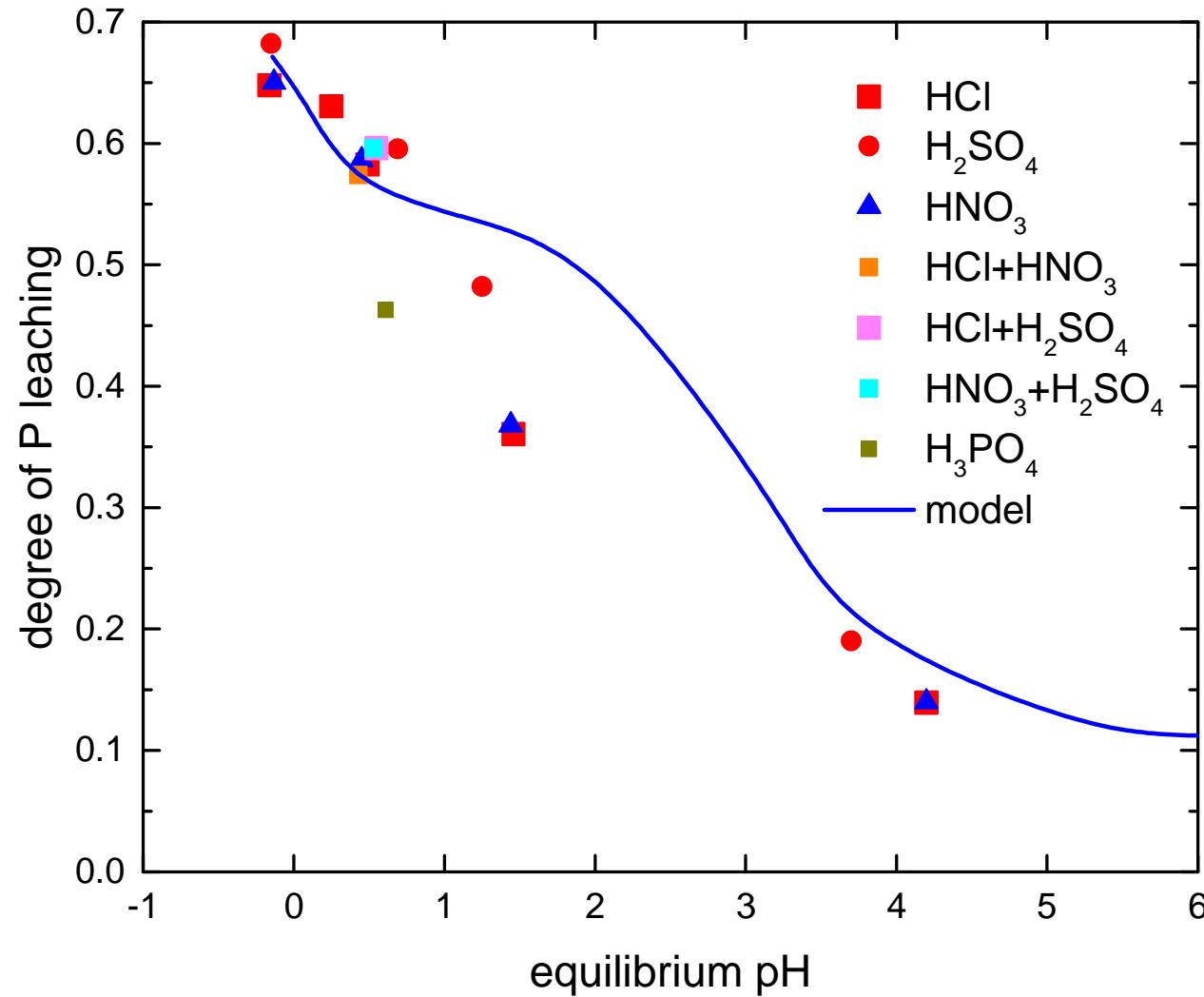
solid-liquid-liquid equilibrium



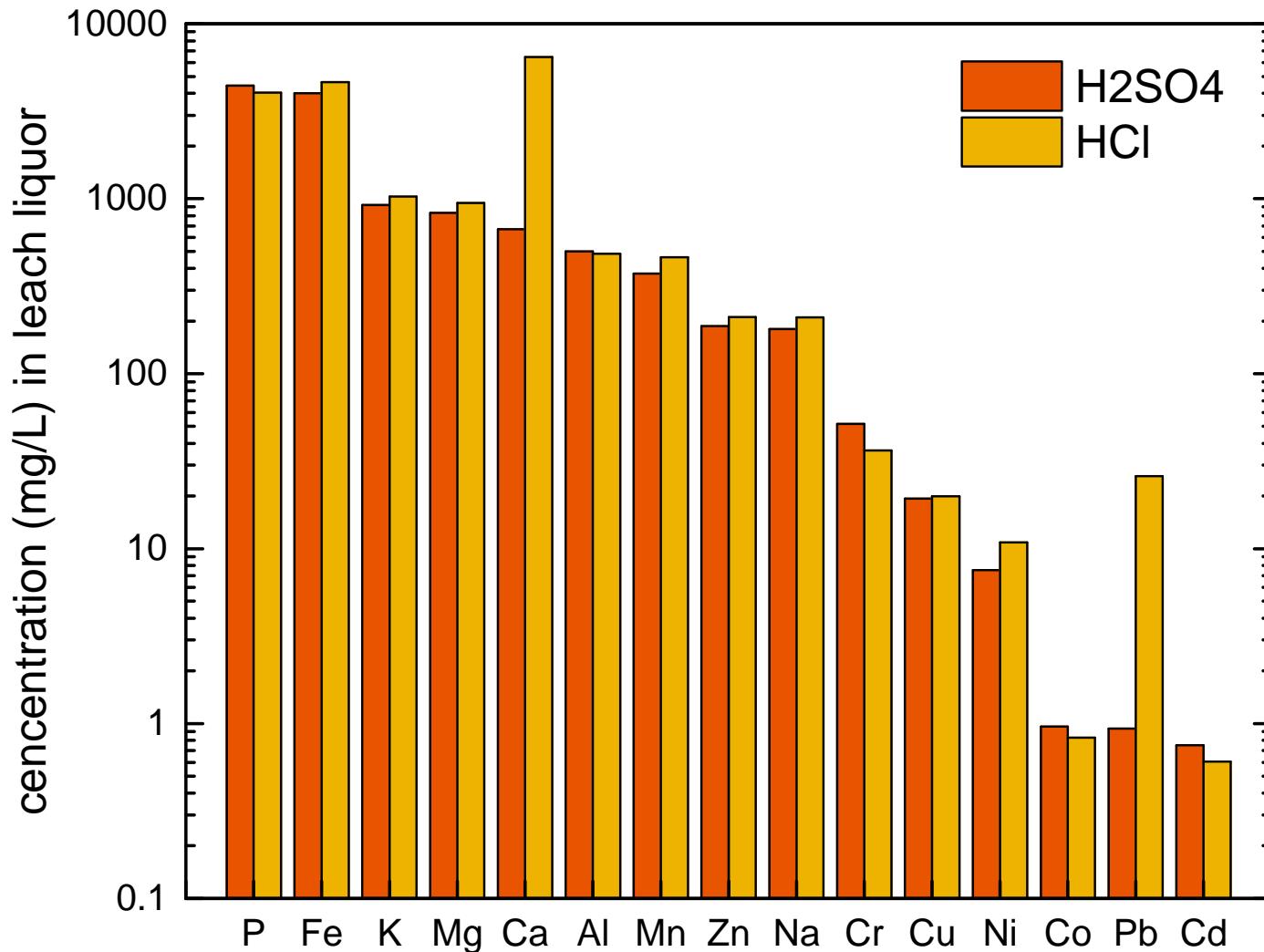
cascaded option tree: drying



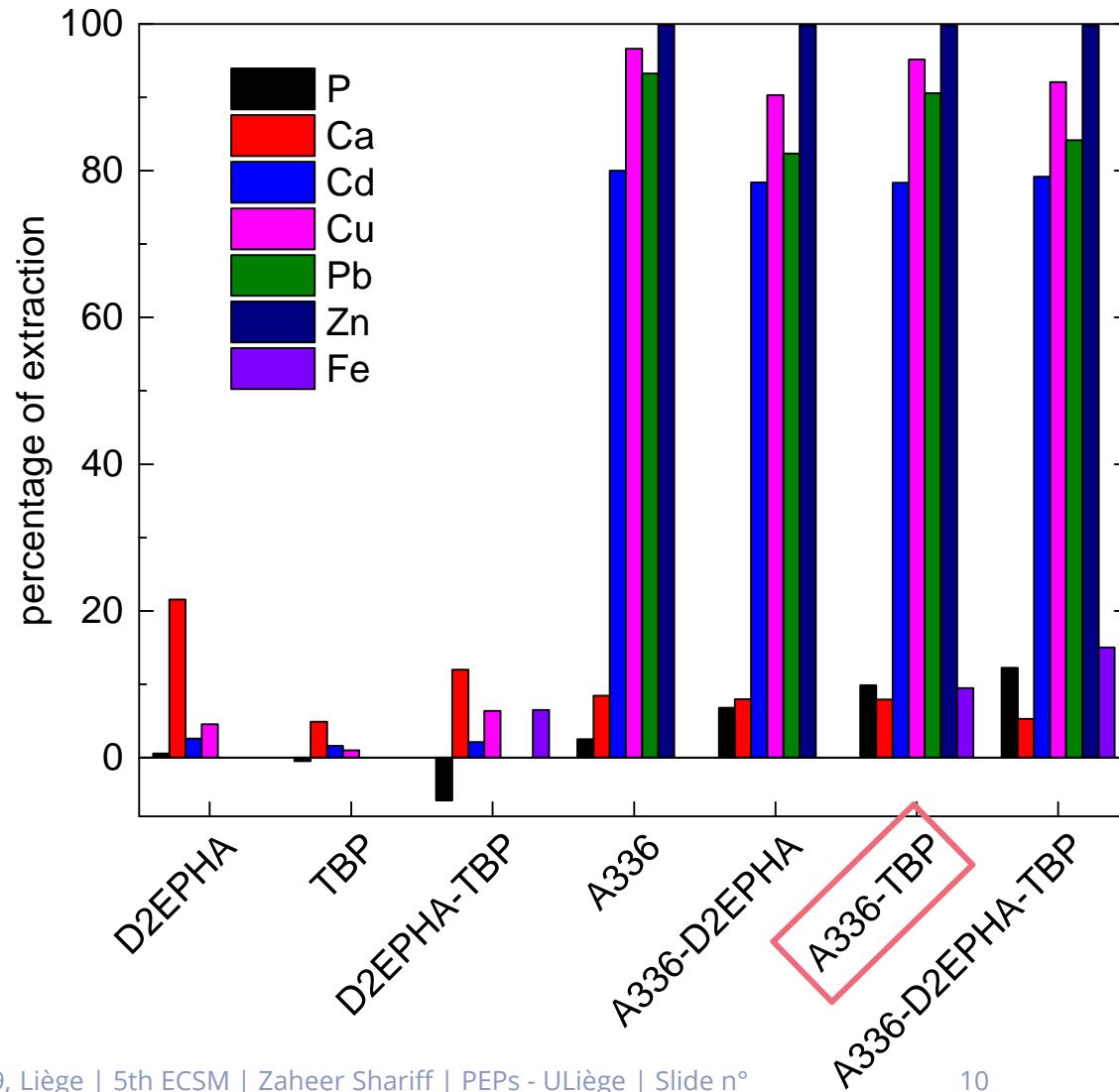
P leaching- different acids and pH



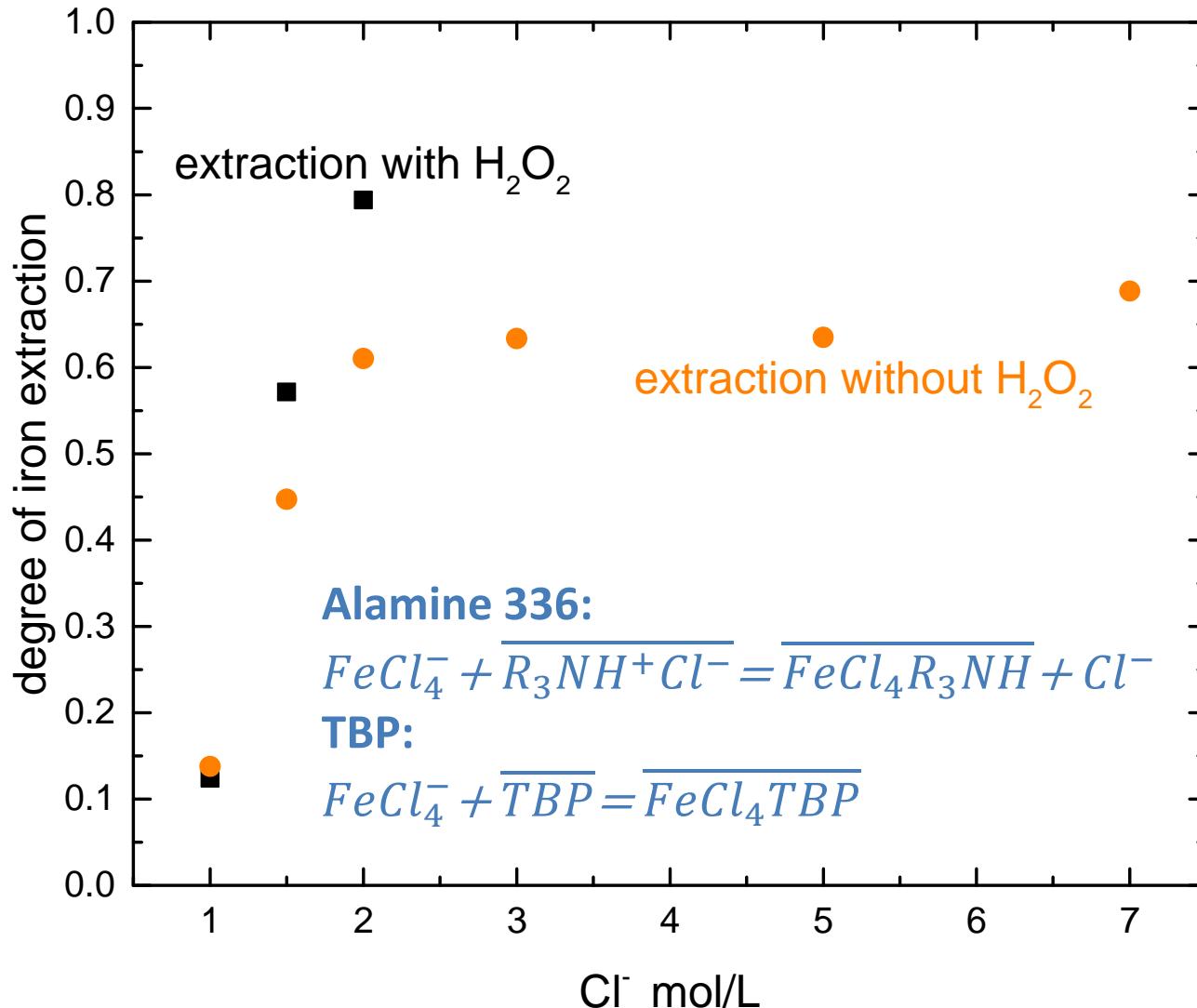
sludge leach liquor



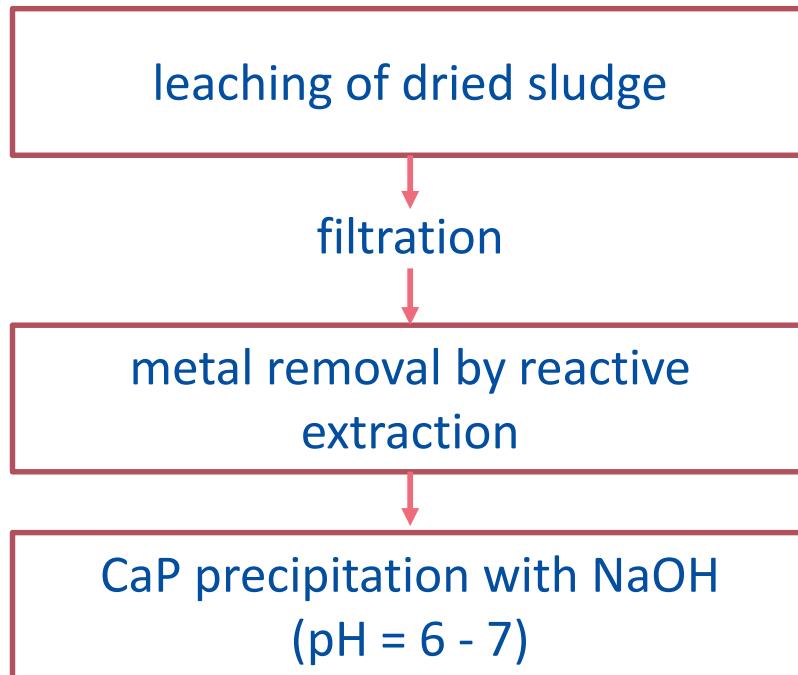
reactive extraction with HCl conc. 1mol/L



reactive extraction of Fe with A336 + TBP



PULSE product



Comp.	Conc.
P_2O_5	29.2%
CaO	21.7 %
Total C	6 %
Al_2O_3	2.61 %
MgO	1.84 %
Fe	0.325 %
Mn	10800 ppm
Cr	1530 ppm
Cu	294 ppm
Ni	51.6 ppm
Pb	38,8 ppm
Zn	8.97 ppm
Cd	0.735 ppm
Hg	0.054 ppm

summary

- no significant difference between P leaching from wet or dry sludge
- P leaching depends only on pH and not on the type of acid
- extraction of metals at low pH only achieved with Alamine 336
- metals concentration in product is within the limits set by the EU fertilizer regulations except in case of Cr

acknowledgements



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 - Prayon S.A., Belgium

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University of Applied Sciences and Arts Northwestern Switzerland
School of Life Sciences



references

- <http://www.nweurope.eu/projects/project-search/phos4you-phosphorus-recovery-from-waste-water-for-your-life/>
- Doetsch, P., Pinnekamp, Johannes, Montag, D., Rath, W., Grömping, M., 2010. Rückgewinnung von Pflanzennährstoffen, insbesondere Phosphor aus der Asche von Klärschlamm (Abschlussbericht PASCH). Institut für Siedlungswasserwirtschaft der RWTH Aachen, Aachen.
- Bednarz, A., Rüngeler, B., Pfennig, A., 2014. Use of Cascaded Option Trees in Chemical-Engineering Process Development. Chem. Ing. Tech. 86, 611-620.