Phosphorus Stewardship in Industrial Applications

European Sustainable Phosphorus Platform

1st EU Raw Material Week

1st December 2016, Brussels
Phosphorus Recycling Initiatives in a multi-sector P Company

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Senior Research Scientist
- Products & Technologies
- Managing risks: SEVESO, H&S, Quality, Environment, Food Safety, etc.
- Rational Use of (raw) Materials & Energy (CO$_2$, LCA, wastes, ...
2015 KEY FIGURES

- B2B
- Shift from laundry and dishwashing
- Source > 400 kT rock and > 100 kT(P₂O₅) MGA

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R&D projects’ focus:

- Energy
- Precision Farming / Agriculture
- Specialities
- P Technology

→ P Recovery

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About **20** specific studies:

- Mostly B2B related
- From partners, customers and others
- Confidential

06/2014 → today
Biomass $\rightarrow$ energy $\rightarrow$ ashes

End of life $\rightarrow$ second life

- Ashes
- Spent reagents
- Waste water treatment
- Municipal sludges
- Industrial sludges
- Food sector
Incorporating... with constraints

- Into existing units (integrated processes)

If one coughs, another sneezes!
Incorporating... with constraints

- Win win situation
  - overall profitability
  - over the complete chain (materials, logistics, process costs, wastes, etc.)

Risk assessment
Risks

- Quality of our productions
  - Safety and environmental issues

- For our installations: often (too) low $P_2O_5$
  - Reagents & Energy
  - Maintenance
  - By-products & Wastes
  - Water balance
  - etc.
Each product requires its own evaluation:

- Nature of products and by-products
- Physical aspects and properties
- Quantities, time, localisation
- P-content and impurities
- Variability
Phosphoric acid

Spent acids recycling since Y2K

Variability according to the source (process, etc.)

Drift regarding the specs
(metals such as Na & Mg, heavy metals, organic matters)
Phosphoric acid

RECOVERY OF SPENT ACIDS

\[ \approx 100 \text{ kT of spent acids in 15 years} \]
Phosphoric acids

Some discarded cases:
Incompatibility with
• process
• materials resistance
• raw materials specs
• internal client specs
• final products specs
Phosphoric acids

Currently, 4 recent projects approved by R&D

- 4 out of 7
- other Departments: approval pending

- metal surface treatment
- water treatment

- DE, BE
Phosphate salts

1. **Calcium phosphate**
   Substituing calcium phosphate for phosphate rock (> 400 kT)
   Actually, 2 R&D projects still running (NL)

2. **Struvite**
   Risk of market overflow due to municipal P recovery
   A convenient raw material for a combined production of phosphoric acid and NP-fertilisers?

3. **Others**
   Currently, 2 R&D projects running (FR, DE)
Stats and Summary

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Logistics, pricing</td>
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<tr>
<td>Carbon and organic matters</td>
<td>3</td>
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<tr>
<td>Heavy metals</td>
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<tr>
<td>Other metals</td>
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<tr>
<td>Much too low $P_2O_5$ content</td>
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<tr>
<td>Contact person retired</td>
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<tr>
<td>OK</td>
<td>6</td>
</tr>
<tr>
<td>Still running</td>
<td>5</td>
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Additional hurdles

Legislation & Regulations  Croesus’ Myth  Acceptance & Reputation
Additional hurdles

- Legislation & Regulations
  - Waste, by-product
  - Transportation, border crossing
  - Fertilisers Directive
  - ...

- Croesus’ Myth
  - Will my residue become a gold mine?
Additional hurdles

- Acceptance & Reputation
  - For the general public, P is the environmental enemy (after the excesses of its use in 60-70’s)
  
  - Is P replacement in laundry really a green solution in case of Circular Economy?
  
  - Are we ready to change 40 years of communication about P in order to support the Circular Economy?
Additional hurdles

- Acceptance & Reputation
  - The «Lavoisier Syndrome»: P from my waste into my plate again? How good does one accept it?

- An organic threat: bioactive molecules
  - drugs, hormones, endocrine disruptors, etc.
  - from municipal sludges, pharmaceutical industrial waste, manures from intensive farming, etc.

Is there any other solution than a thermal process?
Introspective conclusions

Obvious limits of our current approach
- Existing processes → investments required
- Risk assessment studies → tedious, costly

Internal debate
- Dedicated unit ?
- Specific new technologies ?
Win win win conditions

- A high(er) P-content allows a reliable recovery with operating technologies
- A low P-content means investments to close the loop

Today the P recovery is more expensive than the phosphate rock. A sustainable solution should take this into account...
Thank you for your attention