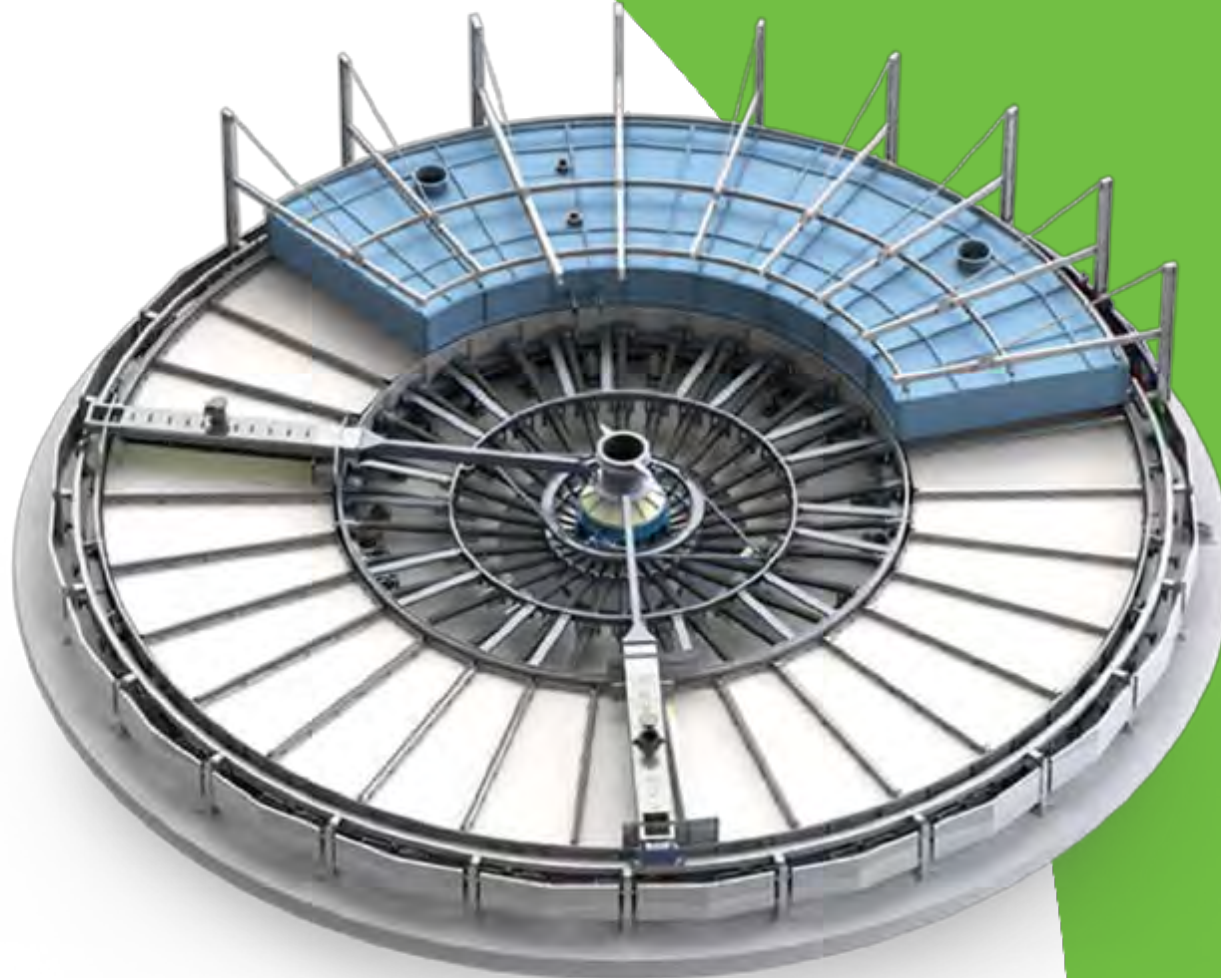




Results of the trials campaigns made with phosphate recovered with the **PULSE** process

23/09/2021 | Phos4You



Introduction : Prayon Group

Prayon and the Circular Economy

Valorization of the final product of the PULSE process

Conclusion and perspectives

Prayon Group – Key Figures

TOTAL EMPLOYMENT WORLDWIDE

1,139

PRAYON GROUP JOBS*



* according to equity method

NUMBER OF JOBS ACROSS OUR 4 PRODUCTION SITES

ENGIS

688

Belgium

PUURS

168

Belgium

LES ROCHES

138

France

AUGUSTA

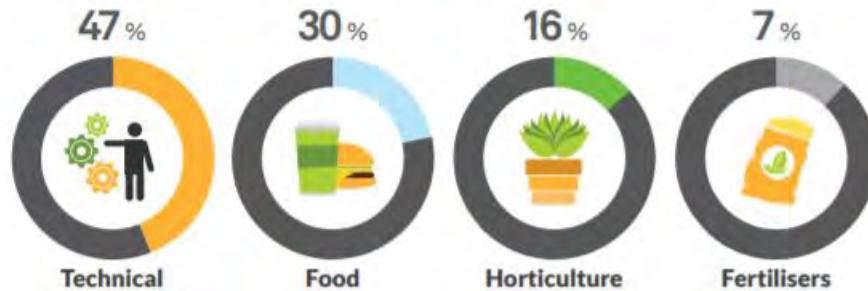
112

United States

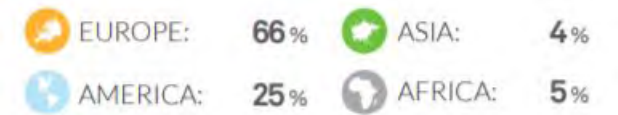
Prayon Group – Key figures



TURNOVER BREAKDOWN BY MARKET



TURNOVER PER CONTINENT

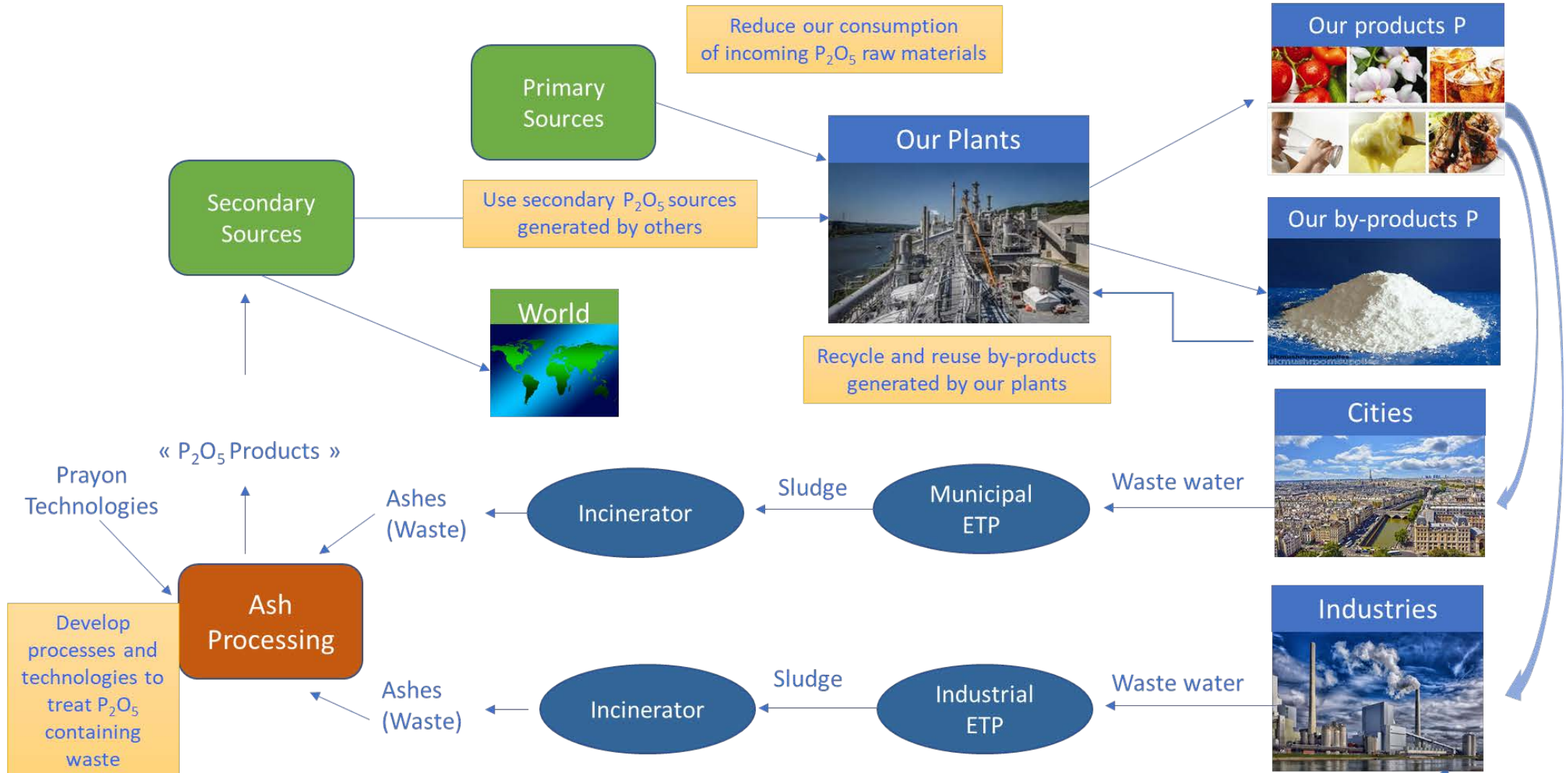


RESEARCH & DEVELOPMENT*

10,2 MILLION

* in euros for Prayon S.A.

Prayon and the Circular Economy



Prayon and the Circular Economy

Valorization of secondary sources of phosphate in our existing plants:

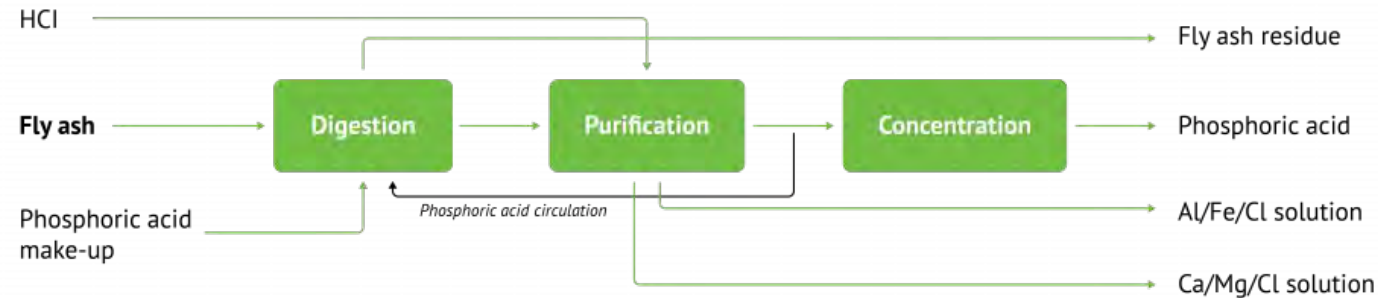
- ❑ In the production of Phosphoric Acid :
 - ❑ Replacement of phosphate rock
$$\text{Ca}_3(\text{PO}_4)_2 + 3 \text{H}_2\text{SO}_4 + 6 \text{H}_2\text{O} \rightarrow 2 \text{H}_3\text{PO}_4 + 3 \text{CaSO}_4 \cdot 2\text{H}_2\text{O}$$
 - ❑ Quality of the acid (especially heavy metals content), viscosity...
 - ❑ Different purification steps (solvent extraction...) to reach food grade quality.
 - ❑ But is the product allowed as a raw material for the production of food grade acid ?
 - ❑ Quality of the gypsum (color, organic material, chemical specifications) is also a point of attention.

- ❑ In the production of fertilizers (way that was tested with the final product coming from the PULSE process)
 - ❑ Granulated ammonium phosphates (NP « 12/27 »)
 - ❑ Attention for the concentration in P_2O_5 and solubility,
 - ❑ Respect of the specifications in As, Cd and heavy metals.

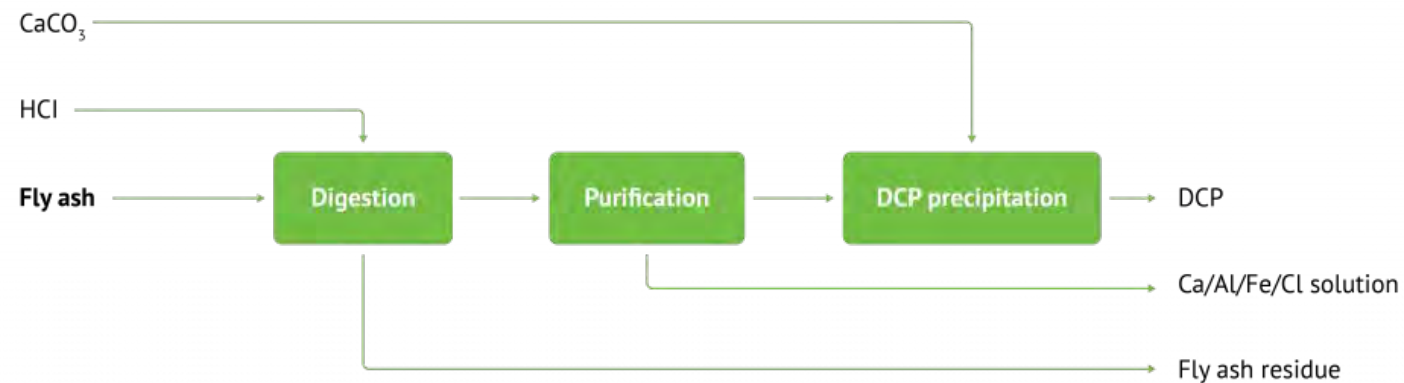
Prayon and the Circular Economy

Our new technologies for the valorization of fly ashes

Phosphoric acid production

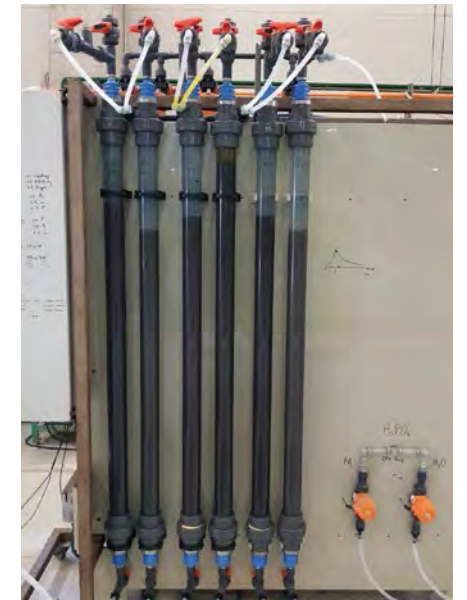


Calcium phosphate production



Prayon and the Circular Economy

Our pilot and semi-industrial plant (Technophos)



Prayon and the Circular Economy

Conclusion:

- Prayon is an integrated producer, with possibilities of valorization of recycled phosphate at different steps of the process.
- The feasibility of the production of purified phosphoric acid (technical grade) from fly ashes has been proven at pilot scale.
- Our knowledge of the market allows us to find the best destination for the final products.

Next steps:

- Validation of the production of phosphoric acid from fly ashes on a semi-industrial scale.

Valorization of the PULSE final product

Typical analysis of the product:

Al₂O₃ %	As ppm	C Total %	CaO %	Cd ppm	Cl ppm	Cr ppm
2-14	7-11	3-10	14-27	0,5-2,7	0,3%-18,6%	94-686
Cu ppm	F %	Fe %	K %	MgO %	Na %	Ni ppm
153-583	0-0,1%	0,4-4%	0,1-0,5%	0,1-0,7%	0-5,3%	17-36
P₂O₅ SE %	P₂O₅ T %	Pb ppm	SiO₂ %	SO₄ %	TOC	Zn ppm
1%	16-34%	27-71	0,1-0,6%	0,5-0,7%		24-66



- Washing improves the quality (higher P₂O₅, lower Cl)
- Not allowed as a raw material in our phosphoric acid production
- Not adapted to our new technologies for the valorization of ashes (high concentration in organic material)
- Could be integrated in a production of fertilizers

Valorization of the PULSE final product

Comparison with the main European Specifications for fertilizers (2022)

	EU Legislation (maximal concentrations)	PULSE product (average)
As	< 40 ppm	8,2
Cd	< 60 mg/kg P ₂ O ₅	5
Cu	< 600 ppm	321
Ni	< 100 ppm	26,2
Pb	< 120 ppm	49,7
Zn	< 1500 ppm	39,4

Valorization of the PULSE final product

Integration in the production of granulated NP « 12/27 »:

- Neutralization of phosphoric acid with gas ammonia
- PULSE product (ground) is added to the mixture after reaction
- Final treatment in granulator



Valorization of the PULSE final product

Conclusion

- The final product of the PULSE process meets the European requirements for fertilizers.
- Integration of this product in the production of granular ammonium phosphates is technically possible.
- Solubility of the P_2O_5 could be an issue for some customers

Perspectives

- Improve the removal of aluminum .
- Replace calcium by ammonia to increase the solubility.
- Use the product as a raw material for the production of TSP.
- The product is hard and need to be ground. Is there a possibility of improvement of this property?

Thank you for your attention

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Enriching **daily life**
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