Circular economy: from industrial sidestreams to nutrient-rich zeolites for agricultural use

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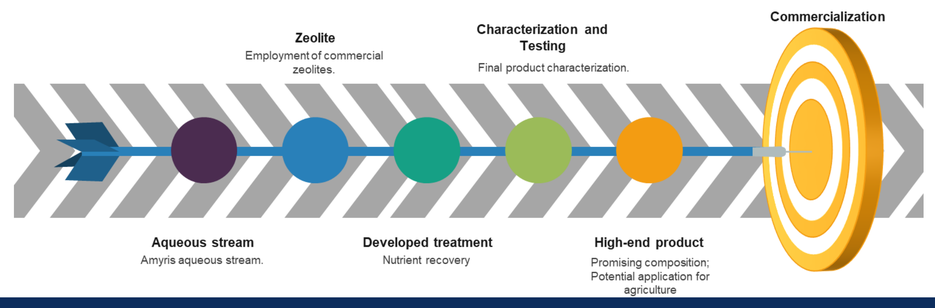
Introduction

Amyris, Inc. (Nasdaq: AMRS) is a leading synthetic biotechnology company, producing high-value ingredients through sugarcane fed yeast fermentation. This fermentation process originates a high volume of an aqueous side stream, rich in nutrients and minerals with high potential for valorization. A potential application of these coproducts is in agriculture for fertirrigation. However, this practice involves the risk of soil salinization and over fertilization. Thus, a solution for recovering interesting components and more efficiently using this aqueous side stream in agriculture is required.

Objectives

The objective of this work was to develop a process for the recovery of nutrients and minerals from Amyris fermentations aqueous sidestreams, obtaining a high-value agricultural fertilizer for agriculture, in the scope of circular economy concept.



Methods

Amyris aqueous streams were treated with zeolites for minerals removal, using a simple, cheap and chemical-free process developed within this project. The, final product, loaded zeolites, were fully characterized in terms of composition (**Figure 1**).

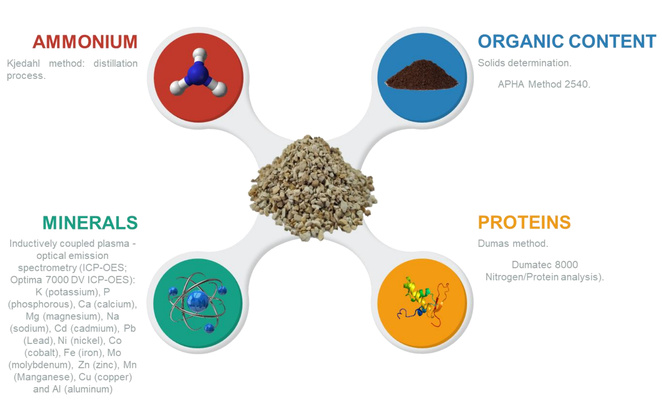


Figure 1 – Final product and analysis performed.

Loaded zeolites' effect on plants growth and development was tested by germination, eco-toxicity and performance assays (**Figure 2**).

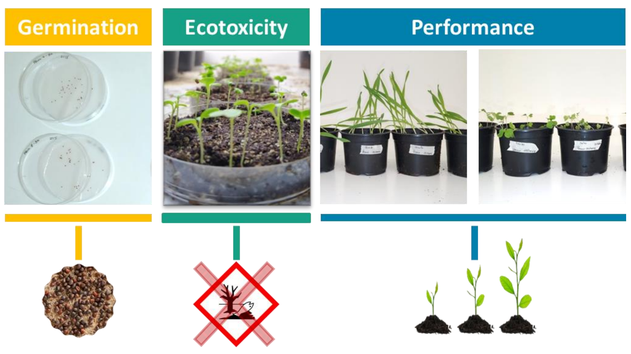


Figure 2 – Assessment of loaded zeolites' effect on plants.

Results

Loaded zeolites composition in soluble components is in line with the commercially available benchmark loaded zeolites for agricultural application (**Figure 3**).

Main strengths of the developed product have been identified:

- Mineral rich;
- Important nutrients for planting cultures:
  - Potassium;
  - Phosphorus;
  - Nitrogen (ammonium).

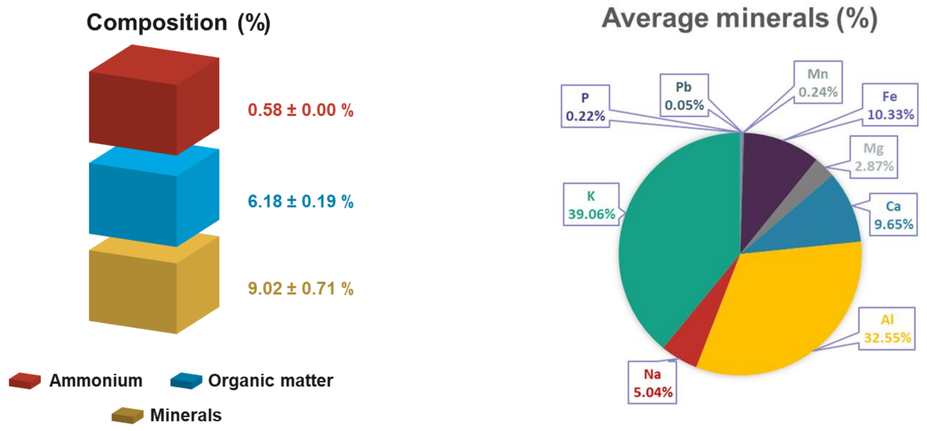


Figure 3 – Loaded zeolites soluble fractions composition (*left*) and available minerals' profile (*right*).

Assays on plants main results:

- Loaded zeolites are not ecotoxic (89.3% growth).
- Positive preliminary performance assays' results.

Conclusions

- Successful valorization of Amyris aqueous stream through the production of a potential ingredient for agricultural application;
- Environmentally friendly alternative to the current disposal of these sidestreams;
- Successful development of a high-end product with a viable application and commercialization;
- Development of a product with value added characteristics.

Acknowledgements

This research was funded by Amyris Bio Products Portugal Unipessoal Lda and Escola Superior de Biotecnologia—Universidade Católica Portuguesa through Alchemy project-Capturing high value from industrial fermentation bio products (POCI-01-0247-FEDER-027578). We would also like to thank the scientific collaboration under the FCT project UID/Multi/50016/2019.