

Cardoon roots valorization by combined microbial biotransformation for lactic acid production

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Most of the energy and of the industrially produced chemicals are derived from fossil resources. Considering the depletion of said resources and the environmental impacts correlated with their extraction and processing, non-fossil resources are being pursued as feedstock replacements. Cardoon, *Cynara cardunculus* L. from *Asteraceae* family, is a Mediterranean perennial plant, growing naturally in harsh habitat characterized by high temperature, salinity and drought. Interest in this crop has been growing in recent years because it has multiple uses and good and stable yields. The stem can be used as a source of lignocellulosic biomass for energy and paper pulp, the seed as a source of protein and edible oil as well as a source of oil for producing biodiesel, and the roots as a source of inulin. In particular, inulin can be used not only in food, feed, and pharmaceutical industries, but also as a substrate in industrial fermentation processes for expanding the field of applications. Our work is focused on the use of cardoon roots as fermentation substrate to obtain a sustainable process for lactic acid (LA) production. LA is a primary chemical platform with applications in the food, cosmetic, pharmaceutical and chemical industries. It has attracted considerable attention as a monomer for the production of the biodegradable polymer polylactic acid (PLA).

We present and comment our latest results related to the development of two fermentation strategies for the production of LA. On the one hand we can exploit the natural ability of the thermotolerant yeast *Kluyveromyces marxianus* to release the enzyme responsible of inulin hydrolysis to release fructose (exo-inulinase). On the other hand, we take advantage of the fructophilic yeast *Zygosaccharomyces bailii*, not able to produce inulinase but characterized by osmotolerance and acid tolerance, engineered for lactic acid production. Starting from these basis, we are evaluating pros and cons of adding the supernatant of the fermentation driven by *K. marxianus* to the inulin-based medium where *Z. bailii* will produce LA, versus a combined process driven by a synthetic consortium of the two yeasts.