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FCT FACULDADE DE CIÊNCIAS E TECNOLOGIA UNIVERSIDADE NOVA DE LISBOA

Chemistry Department and Life Sciences Departament

Green Approach to Residues Valorization

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Biocatalysis & Bioenergy

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Objectives

Many different lignocellulosic residues are produced annually (Figure 1). Following the ***biorefinary*** concept, the aim of this work is the development of a sustainable green process using hot compressed water (HCW).

Lignocellulosic wastes can be valorized through the production/extraction of several products, such as reduced sugars, lipids produced with oleaginous yeasts that use such sugars as carbon sources, biopolymers, carotenes, etc.

The versatility of this technology that aligns principles of chemical engineering and biotechnology, leads to the production of added-value products with potential applications in agro-food, cosmetics and pharmaceutical industries.

Figure 1: Different lignocellulosic residues studied in this work.

Methodology

HCW hydrolysis experiments are carried out using a semi-continuous flow apparatus described in Figure 2. The apparatus works in three main stages: stage 1, pre-heating; stage 2, hydrolysis in packed bed reactor; stage 3, product recovery.

The hydrolysis experiments are performed at different temperatures depending on the target product.

Different oleaginous yeast strains from the PYCC- Portuguese Yeast Culture Collection (CREM) are used to produce lipids using the hydrolisates as carbon sources (Figure 3 and 4).

Sc-CO_2 extraction is performed to extract carotenes and several other added-value products. Target products are identified and quantified by HPLC analysis.

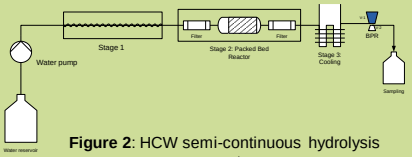

Figure 2: HCW semi-continuous hydrolysis apparatus.

Figure 3: Hydrolisates.

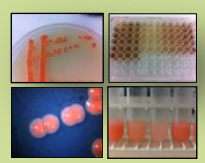

Figure 4: Pigmented oleaginous yeasts .

Expected Results

The key challenge is to manipulate hydrolysis reaction parameters so as to drive the conversion of lignocellulosic biomass into added-value products while avoiding their degradation.

Both cellulose and hemicellulose can be utilized by microorganisms when hydrolyzed into their main monomers (glucose, mannose, xylose, etc.).

Screenings are performed in order to evaluate the potential of several yeast strains to assimilate complex mixtures and accumulate lipids (Figure 5).

This study demonstrates that HCW hydrolysis offers a viable alternative for the hydrolysis of biomass (Figure 6).

Figure 5: Lipid bodies accumulation.

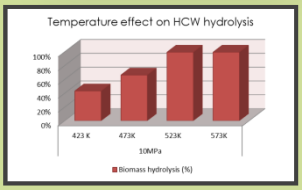

Figure 6: Paper mill sludge HCW hydrolysis – Temperature Effect.

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