P-245 - BIOETHANOL PRODUCTION FROM WHOLE SLURRY OF HYDROTHERMALLY TREATED BREWER´S SPENT GRAIN AT HIGH SOLID LOADINGS

Tânia Pinheiro[1]; Eduardo Coelho[1]; Aloia Romaní[1]; Lucília Domingues[1]

1 - Center of Biological Engineering of the University of Minho

Background

Brewer's spent grain (BSG) represents about 85% (w/w) of brewing by-products, being a potential low-cost feedstock for ethanol production. In works aiming at converting this residue to ethanol, up to 22 g/L of ethanol were produced, with yields varying between 23 and 81% [1]. However, such values are still far from satisfactory for biofuels production. In order to make bioethanol production economically feasible, ethanol titers must surpass the 40 50 g/L barrier, to reduce distillation costs to acceptable values [2]. To attain this, ethanol production solely from BSG must explore the whole fractions of sugar rich BSG, resort to high solid loadings and maintain high process efficiencies throughout the unit operations.

Method

BSG from craft beer industry was mixed with water (25 % of solids) and submitted to autohydrolysis treatment at 160 ºC for 5 min in a pressurized stainless reactor. Whole slurry (liquid and solid phases) from autohydrolysis was employed as substrate for ethanol production by enzymatic saccharification using Cellic Ctec2 (Novozymes) at 50°C and 200 rpm followed by fermentation in Erlenmeyers fitted with air locks at 30°C and 150 rpm.

Results & Conclusions

BSG had 32.1 ± 1.9 g of glucan/ g of raw material, which where fractioned during pre-treatment. 60% of glucose in BSG was solubilized to the liquid phase during pre-treatment and 40% remained in the solid, from which about 70% were retrieved through enzymatic saccharification. Overall, with pretreatment and saccharification it was possible to obtain 57.7 g/L of glucose, representing 70.6% glucose yield. Fermentation of the whole fraction of pretreated BSG allowed a final ethanol titer of 42.27 ± 0.03 g/L at 94.0 ± 0.6% yield. Therefore, ethanol production from BSG was attained at high ethanol titers without compromising process efficiency, representing an attractive and economically feasible solution for bioethanol production.

References & Acknowledgments

Authors acknowledge the Portuguese Foundation for Science and Technology (FCT) under the scope of UID/BIO/04469/2013 unit and COMPETE 2020 (POCI-01-0145-FEDER-006684), the Project RECI/BBB-EBI/0179/2012 (FCOMP-01-0124-FEDER-027462) and BioTecNorte operation (NORTE-01-0145-FEDER-000004) funded by European Regional Development Fund under the scope of Norte2020 - Programa Operacional Regional do Norte. Authors acknowledge Fermentum-Engenharia das Fermentações Lda. for providing the raw materials used.

[1] S. Wilkinson, K. A. Smart, and D. J. Cook, "Optimising the (Microwave) Hydrothermal Pretreatment of Brewers Spent Grains for Bioethanol Production," J. Fuels, 2015;

[2] G. Zacchi and A. Axelsson, "Economic evaluation of preconcentration in production of ethanol from dilute sugar solutions," Biotechnol. Bioeng., vol. 34, no. 2, pp. 223–233, 1989.