Evaluation of alkaline hydrogen peroxide pretreatment and enzymatic hydrolysis in an integrated 1st and 2nd generation bioethanol production from sugarcane

Junqueira, T. L.[1,2], Dias, M. O. S.[1,2], Rabelo, S. C.[1], Jesus, C. D. F.[1], Rossell, C. E. V.[1], Maciel Filho, R.[1,2], Bonomi, A.[1]

1 - Laboratório Nacional de Ciência e Tecnologia do Bioetanol (CTBE), Brazil,
2 - Faculdade de Engenharia Química, Universidade estadual de Campinas (UNICAMP), Brazil

In Brazilian large scale bioethanol autonomous plants, sugarcane juice is destined to ethanol production, while sugarcane bagasse is used as fuel in the boilers to generate process vapor and electricity. However, the increase in the world demand for ethanol as well as the interest for the integral use of sugarcane have motivated the utilization of lignocellulosic materials for ethanol production. Since bagasse is already available at the plants, its use as raw material seems very attractive, together with a fraction of the sugarcane trash recovered from the fields.

In the second generation bioethanol production, pretreatment and hydrolysis processes have been thoroughly studied. However, most optimization was carried out dissociated from other process steps, generally aiming high sugar recovery and low enzymatic load. These objectives are usually achieved with increased reaction time and reduced solids content, which are not desired in an industrial process due to the large volume of equipments.

In this work, integrated 1st and 2nd generation bioethanol production was simulated with Aspen Plus for different conditions of pretreatment and hydrolysis. For 2nd generation bioethanol production, alkaline hydrogen peroxide pretreatment and enzymatic hydrolysis were considered. Results showed that the integrated analysis allows a better understanding of impacts of pretreatment and hydrolysis conditions in the whole process, indicating that the optimum conditions for an operation may not be the same when the whole process is taken into account. This study is especially important to guide experimental research towards process feasibility.