Improved yeasts for production of fuels and chemicals from renewable resources

Raissa R. Pessoa, Bárbara G. Paes, Ana C. S. Antunes, Najana Alves, Paula F. Franco and João R. M. Almeida

Embrapa Agroenergy, Brasília, Brazil
joao.almeida@embrapa.br

Lignocellulosic biomass, which is rich in pentose and hexose sugars, and crude-glycerol waste of biodiesel industry, are two inexpensive and abundant substrates that can be used for production of fuel and chemicals. Indeed, several microbial strains have been identified and developed for production of fuels and chemicals from these substrates. In this context, we isolated and selected new and publicly known yeast strains to characterize and improve genetically, so that they can produce fuels and chemicals from pentose sugars and crude glycerol from the biodiesel industry. Initially, approximately 500 yeast strains were screened for growth in micro-titer plates containing either xylose or glycerol as the only carbon source. To evaluate the tolerance of the strains towards contaminants of the substrates they were also evaluated for growth in sugarcane bagasse hydrolysate and crude glycerol from a biodiesel industry. Based on these results, we were able to identify yeast strains for evaluation under fermentative conditions. Similar results were found for glycerol conversion. In parallel, sensitivity of known xylose-fermenting yeast strains to lignocellulosic hydrolysate inhibitors was systematically evaluated. Afterwards, three strains were genetically improved for fermentation of lignocellulosic hydrolysates by evolutionary engineering. Analysis of substrate consumption and product formation demonstrated that the newly isolated and the genetically improved strains can efficiently convert xylose and/or glycerol to a variety of chemicals, for example, xylitol and ethanol. Our results demonstrated the potential of bioprospection and evolutionary engineering to obtain new yeast strains for biotechnological applications.