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ICGEB scientists engineer fungal genome to enhance biofuel synthesis

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The new engineered fungal source Penicillium funiculosum could be a strong alternative in the industrial enzyme repertoire for biofuel production.

Scientists at New Delhi-based International Centre for Genetic Engineering and Biotechnology (ICGEB) have peered into a fungal genome to tweak its regulation for production of enzymes that break down cellulose into simple sugars. These 'cellulolytic' (cellulose breaking) enzymes obtained from a microbial source are in high demand in the biofuel production industry and are currently obtained from one industrial workhorse fungus.

The new engineered fungal source *Penicillium funiculosum* could be a strong alternative in the industrial enzyme repertoire for biofuel production.

Dr. Syed Shams Yazdani and his group from ICGEB's microbial engineering department have found that *P. funiculosum* effectively produces the 5 times more active enzyme GH7 cellobiohydrolases (CBH1) – vital for the breakdown of cellulose – as compared to its fungal cousin Trichoderma reesei, which is mostly used in the industrial enzyme cocktails. In his further research he has altered the fungal genome to double the enzyme production in this industrial workhorse fungus by disrupting a catabolite repressor called Mig1.

The scientists have published their work in the journal Biotechnology for Biofuels [A. Randhawa. et al.] *Disruption of zinc finger DNA binding domain in catabolite repressor Mig1 increases growth rate, hyphal branching, and cellulase expression in hypercellulolytic fungus Penicillium funiculosum NCIM1228. Biotechnology for Biofuels (2018) DOI: 10.1186/s13068-018-1011-5*

The biological conversion of cellulosic biomass to produce environment friendly fuels and chemicals is in demand and the conversion of lignocellulosic biomass to fermentable sugars is the most complex step. Enzymatic hydrolysis offers the potential for higher yield, higher selectivity, lower energy costs and milder operating conditions than chemical processes, the mechanism of enzymatic hydrolysis and the relationship between the substrate structure and function of components is not well known and limited success has been realized in maximizing sugar yields at very low cost. "Our novel innovation will provide detailed information for gene regulation and gene disruption method to get better growth, enhanced carbon source utilization and higher cellulase activity than parent strain" says Dr Syed Shams Yazdani, lead research scientist, also coordinator of the government-funded DBT-ICGEB Centre for Advanced Bioenergy Research (DICABeR).

DBT-ICGEB Centre for Advanced Bioenergy Research (DICABeR) is an integrated centre for performing cutting-edge basic research and its translation. It is a platform for the synthetic biologists to work in diverse bioenergy areas such as microbial engineering, biochemical engineering, algal engineering and systems biology.