

## Sequential utilization of sugars in mixed-sugar medium simulating microalgae hydrolysate for DagA and ethanol production

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Microalgal hydrolysate, a potentially low-cost alternative carbon source, could be used as a feedstock for valuable bioproducts production. At first, it was tried to produce DagA, a  $\beta$ -agarase by using a recombinant *Streptomyces lividans* in a mixed-sugar medium mimicking *Nannochloropsis oceanica* hydrolysate. Glucose, however, in the medium was found to have negative effects on the consumption of the other sugars and DagA biosynthesis causing a low substrate utilization efficiency and DagA productivity. To overcome such difficulties, a new strategy of sequential substrate utilization was developed. In the first step, glucose was consumed by *Saccharomyces cerevisiae* together with galactose and mannose producing ethanol, and then DagA was produced from the remaining sugars of xylose, rhamnose and ribose. Fucose was not consumed at all. By adopting the two-step process, the overall substrate utilization efficiency was about 3-fold increased with about 2-fold improvement of DagA production, let alone the additional benefit of ethanol production. The unconsumed fucose has a potential to be a high-value-added product with many applications once recovered.