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Biobutanol production by strain improvement

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Biobutanol currently acts as one of the promising alternatives to conventional fuels as it offers various benefits. Hence, research related to cost-effective substrates, genetically engineered microbes keeps on continuing to improve its large-scale production. Butanol is used in industries and laboratories for various purposes as it is less corrosive in comparison to ethanol. This is used as a solvent and as an extract agent in the manufacture of pharmaceuticals. But its use as fuel has attracted researcher’s attention in recent years. The production of butanol is known for many years; it can be synthesised chemically or biologically but butanol obtained from biological ways with the renewable resources by the microorganisms through fermentation is beneficial both to the environment and mankind. The biological process uses renewable resources that are economical, such as wheat straw, corn core, switchgrass, algal culture, etc., and gives high product selectivity, high security and fewer by-products. Through ABE fermentation, butanol is produced industrially by involving Gram-positive, endospore-forming Clostridium strains. The strain modification is performed with genetic engineering technology to make the organism high butanol-tolerant to improve butanol yield. The strain undergoes either pathway- or regulation-based construction, which helps in blocking or overexpressing the desired genes. This metabolic engineering helps in developing strains that are efficient for desired products obtaining from renewable sources. Recent research reveals that there are a few other bacteria that are more tolerant to butanol than Clostridium, although they lack butanol producing ability. The example includes lactic acid bacteria (after long-term adaption), which makes them a promising host for butanol production. Scientists have constructed the whole butanol-producing pathway by implementing the synthetic biology strategy in Escherichia coli, Bacillus subitilis, Saccharomyces cerevisiae and Pseudomonas putida. This strategy is attempted in many microbes along with a co-culture approach to improve the yield of biobutanol.

Keywords: Butanol, Gene modification, ABE fermentation, Strain improvement, Strain construction, Clostridium sp., Saccharomyces cerevisiae

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