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DEVELOPMENT OF BIOCATALYST FOR BIOBUTANOL PRODUCTION AND RECOVERY BY GAS STRIPPING

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Butanol, currently manufactured with petroleum feedstocks, is an important chemical with many applications including but not limited to the manufacture of butyl acetate, plasticizers, butylamines, amino resins, butyl acrylate, methacrylate, and glycol ethers. In addition, butanol finds its use in food and flavor industries for the extraction of food flavors. Currently, these uses represent the major markets for butanol (300 million gallons per year- Chemical Profile: n-Butanol, 2002, ChemExpo). Currently, butanol is not used as a biofuel because of cost. However, David Ramey, Environmental Energy Inc the Ohio State University drove an unmodified 1992 Buick 10,000 miles across the United States using only butanol as a fuel (www.butanol.com). Butanol has about 92% of the energy of gasoline. Under actual driving conditions, the fuel efficiency matched that of gasoline (http://peswiki.com/index.php/Directory:Butanol). This was corroborated by the results David Ramsey that were presented following his 10,000 mile trip where his 1992 Buick demonstrated a 9% increase in efficiency (miles/gallon) over conventional gasoline. Economical production of biobutanol has the potential to displace gasoline and aviation fuel (Schwarz et al., 2007) up to 100%. It is anticipated that the results obtained from the proposed research will advance acetone-butanol (AB) fermentation toward commercialization and could have a dramatic impact on addressing the nation's energy, fuel and industrial chemical needs.An important advantage of the solventogenic clostridia is their ability to ferment a wide range of carbon sources (starch, glucose, galactose, xylose, arabinose, mannose, etc) to AB. We have obtained a hyper-butanol producing microbial strain isolated from a closed South African butanol plant and preliminary experiments in our laboratory indicate under batch culture conditions, this wild-type strain consistently producees a total AB up to 24 g/L with a productivity of 0.5 g/L/h. Through chemical mutagenesis and adaptation, we anticipate increasing total AB titer to 34 to 36 g/L. We have made excellent progress in development of integrated AB fermentations and recovery systems employing gas stripping technologies. We anticipate use of improved gas stripping technologies with the developed mutants (which is compatible with the technology) to produce AB. The technology will drastically reduce or eliminate butanol toxicity of the butanol tolerant biocatalyst (C. beijerinckii mutant), enhance AB productivity, reduce process waste streams, and ultimately reduce distillation costs. With the ability of the mutant to tolerate and produce greater concentrations of butanol, the saturation of gas bubbles with AB during gas stripping processes will increase the AB stripping rate which will lead to efficiency of the integrated process.

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