ABSTRACT

Hodgman, Charles Eric. M.S.A.B.E, Purdue University, August, 2009. A Metabolic Approach for Increasing Lipid Storage in Yarrowia Lipolytica Grown on Glycerol. Major Professor: Bernard Y. Tao.

It was recently demonstrated that the yeast Yarrowia lipolytica, is capable of growing on industrial glycerol, a byproduct of biodiesel production, and converting it into large amounts of intracellular lipid particles. Yeast lipids could serve as a potential source for additional biodiesel production. This research explored the effects of enhanced cytoplasmic glycerol 3-phosphate dehydrogenase activity on lipid accumulation during growth on glycerol. Cytoplasmic glycerol 3-phosphate dehydrogenase catalyzes the reaction between dihydroxyacetone phosphate and glycerol 3-phosphate. Glycerol 3phosphate serves as a precursor for triacylglyceride synthesis and was recently demonstrated to be a key metabolite in lipid accumulation. The continuous fermentation reactor was performed under nitrogen limiting conditions to induce lipid storage. A low dilution rate (0.04 hr⁻¹) was employed for optimal cell mass accumulation and nitrogen exhaustion. The system was agitated, aerated (1.8 L-air L-medium⁻¹ min⁻¹), isothermal (28 °C), with constant pH (6.00). At steady-state conditions the wild-type strain reached an average value of 2.70 g L^{-1} dry mass with 1.12 g L^{-1} lipid mass. The modified strain with enhanced glycerol 3-phsophate dehydrogenase activity reached an average value of

 2.75 g L^{-1} dry mass with 1.11 g L^{-1} lipid mass. These values are not statistical significantly different and suggest enhanced cytoplasmic glycerol 3-phosphate dehydrogenase activity does not have an affect lipid accumulation in this system.