MANIPULATION OF BACTERIA TO OPTIMIZE SYNTHESIS OF BIOPRODUCTS FROM GLYCEROL

Pettinari, M.J.

Facultad de Ciencias Exactas y Naturales, Departamento de Quimica Biologica
Universidad de Buenos Aires Ciudad Universitaria 1428, Nunez, Argentina
jul@qb.fcen.uba.ar

We know that many microorganisms can use glycerol as a carbon source to synthesize a variety of products, but it is a substrate that will normally not be fermented, so there are a number of industrial products that we are used to get from microbes that are not easily obtained when using glycerol as a substrate, such as ethanol. As a consequence, the challenge posed these days to microbiologists regarding glycerol is to obtain microorganisms that can produce different bioproducts using it as a substrate. There are many biotechnologically important products that can be obtained from glycerol using *E. coli*. Among these we will discuss the synthesis of polyhydroxybutyrate (PHB), a biodegradable thermoplastic, and ethanol. Hydroxybutyrate, the monomer of PHB, is formed from the condensation of 2 molecules of acetyl-CoA that is then reduced, consuming NADH or NADPH, so the substrates for PHB synthesis are acetyl-CoA and reducing power. There are several ways in which metabolism can be manipulated to increase PHB production, mainly by directing C and electrons towards the synthesis of PHB monomers. One of the strategies used to achieve this is the use of redox control mutants. These mutants produce and excess of reducing power, and in order to balance their redox state they adjust their metabolism to use more reducing equivalents. As a result, they synthesize more reduced products such as PHB and ethanol, and less amounts of other products like acetate. These studies show a way in which carbon and redox balance mechanisms can be manipulated in order to enhance the use of the substrate for the production of highly reduced products, even when using a reduced substrate such as glycerol, that will be normally used in an oxidative catabolism, which does not lead to the production of fermentation products.