Department of Biochemical Engineering & Biotechnology

BBL431 (Bioprocess Technology)

Major Test

May10, 2016
15.30- 17.30 hrs
Venue: LH-108
Maximum Marks-40

Note: Write answer of all parts of a question at one place.

Q.1. (a). Define volumetric productivity? Consider ethanol production process which uses the yeast *Saccharomyces cerevisiae*. Write two types of process interventions that can increase the volumetric productivity of the process? (2+4=6)

(b). Consider ethanol production process from sucrose by the yeast *Saccharomyces cerevisiae*. If 11 g/L of ethanol is produced from consumption of 25 g/L of sucrose, what is the value of yield in terms of % of theoretical value? (3)

Q.2. Consider production of lactic acid by a homo-fermentative *Lactobacillus delbruckii,* which produces lactic acid from glucose. Write the overall balanced equation for this fermentative pathway and calculate the theoretical yield of lactic acid in grams per gram of glucose. (2+2=4)

Q.3. Consider the biosynthetic route in which aspartate is converted to lysine, methionine and threonine in the branched pathway.

(i). In *Escherichia coli*, the first enzyme of the pathway that is aspartate kinase is cumulatively inhibited by all the three end products. Lysine alone (at 40 mM) inhibits it by 20%, methionine alone (at 30 mM) by 40% and threonine alone (at 30 mM) by 30%. What will be the residual activity of the enzyme when all the three end- products are present simultaneously at these concentrations? (3)

(ii). In *Corynebacterium glutamicum*, however, this enzyme is inhibited by concerted feed-back mechanism. The three end- products at concentrations mentioned in 3 (i) above, when present simultaneously, inhibit the enzyme completely. What will be the residual activity of the enzyme when lysine alone (at 40 mM) is present? (3)

Q.4. Consider the metabolic pathway for synthesis of lysine by *Escherichia coli* and *Corynebacterium glutamicum* from aspartic acid.

(a). Why is *C. glutamicum* preferred for industrial production of lysine over *E. coli* ? (4)

(b). What is the biochemical basis of the effect of oxygen on overproduction of glutamic acid? (4)

Q.5. (a). Write any six important properties of alkaline proteases which are required for using it along with a detergent for washing under bleaching environment. (3)

(b). How was subtilisin made resistant to bleaching agents? Describe the methodology in brief. (4)

Q.6. Consider the oxidative and reductive branches of the metabolic pathway shown in Fig.1 for production of 1,3-propanediol (1,3-PD). If glycerol catabolism produces one mole each of acetic acid and butyric acid in the oxidative branch, what will be the yield of 1,3-PD in moles per mole of glycerol? (4)

Q.7. Write the salient features of the paper (that is, why was the work done and what were the conclusions of that work) you studied in your Term Paper (not more than one page). (2)

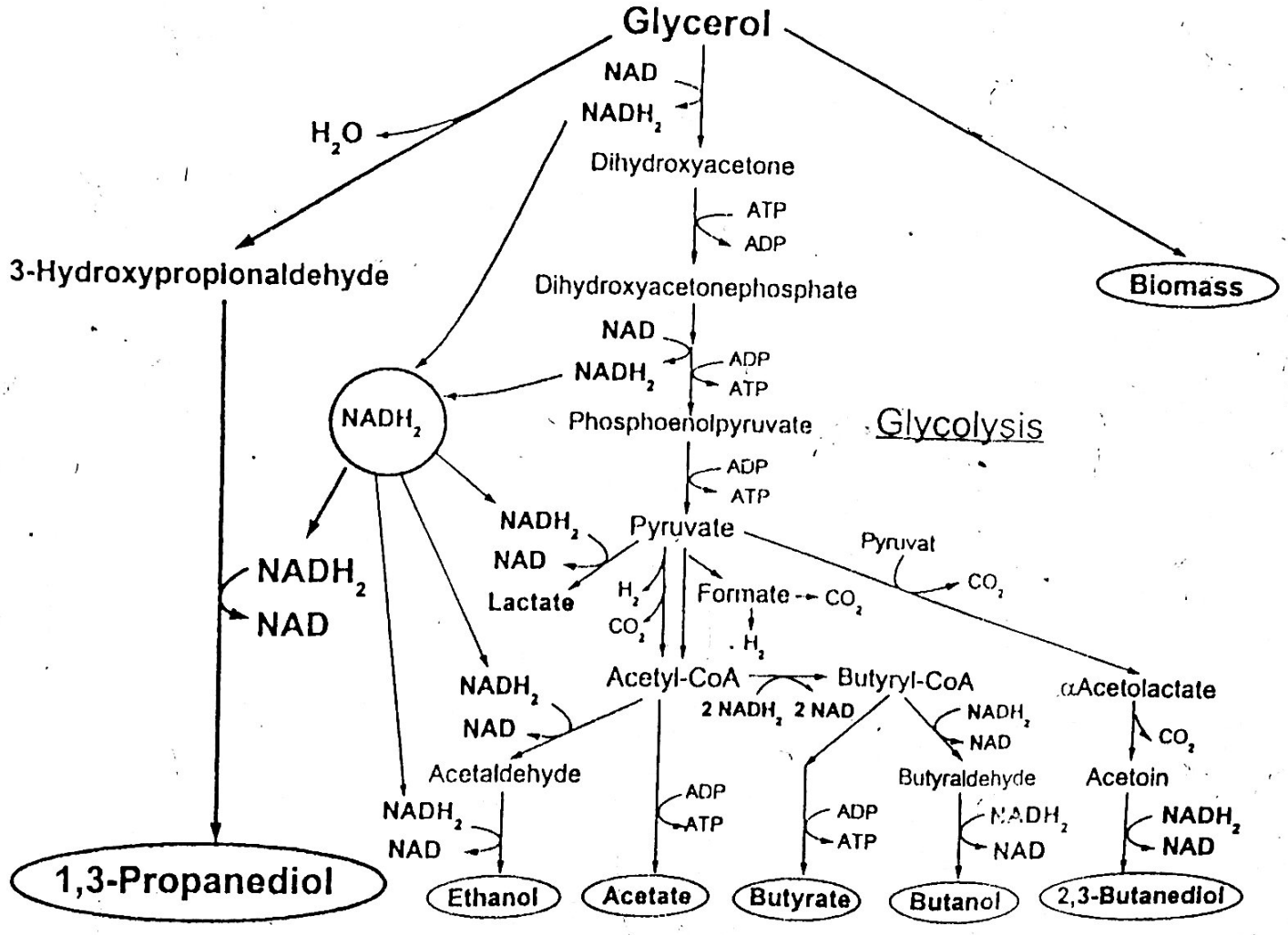

Fig. 1. Metabolic pathways of glycerol metabolism