Department of Biochemical Engineering & Biotechnology

BBL810 (Enzyme and Microbial Technology)

Major Test

Nov.21, 2017

Venue: LH-510

Maximum Marks-40

Note: Attempt all questions. Answer one question at one place.

Q.1 (a). What is the difference between a highly active enzyme and a highly specific enzyme? (2)

(b). What is chymosin and what role does it play in process of cheese manufacture? (1+3=4)

(c). Why is it economical to use immobilized glucose isomerase for isomerization of glucose into glucose-fructose mixture in place of soluble enzyme? Describe the process in brief. (2+2=4)

Q.2. *Saccharomyces cerevisiae*, a powerful ethanologen, can ferment xylulose to ethanol but not its isomer, xylose. Two enzymes, xylose reductase (XR) and xylitol dehydrogenase (XDH), are required to impart this capability to the yeast. XR can carry out xylose to xyliol conversion in which NADPH or NADH can serve as cofactor. For XDH-catalyzed reaction, only NAD+ can serve as its cofactor.

To construct a recombinant *S. cerevisae* strain, which can ferment both glucose and xylose efficiently to ethanol, the properties of XR were studied in various microbes. The XR enzymes from three different yeasts had the following properties:

(i) XR from yeast 1: Km for NADPH = 2 mM, and for NADH = 10 mM

(ii) XR from yeast 2: Km for NADPH = 30 mM and for NADH = 1 mM

(iii) XR from yeast 3: Km for NADPH = 40 mM and for NADH = 0.1 mM.

Which one of the three XR genes would you prefer to use for construction of recombinant *S. cerevisae* strain and why? Assume that all the three XR have the same Km for xylose, and that the intracellular concentrations of NADPH and NADH are 1 mM and 0.25 mM, respectively, in *S. cerevisiae.*

(6)

Q.3. Write the names and functions of cellulose-hydrolyzing enzymes, required to hydrolyze cellulose completely into glucose. How do glucose and cellobiose influence the hydrolysis process? What type of process modification can enhance the hydrolysis of cellulose to glucose? (3+2+2=7)

Q.4. What is glutathione? Describe the main features of the process which was used for its commercial production? (5)

Q.5. Write one point concerning the strength and one concerning the weakness of the paper you studied in your Term Paper (not more than half a page). (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).(In reductive branch of the pathway, glycerol is converted to 1,3-PD).

(a). If glycerol catabolism produces one mole each of acetic acid and 2,3-butanediol in the oxidative branch, what will be the yield of 1,3-PD in moles per mole of glycerol? (4)

(b). If glycerol catabolism produces one mole each of acetic acid and butanol in the oxidative branch, what will be the yield of 1,3-PD in moles per mole of glycerol? (4)

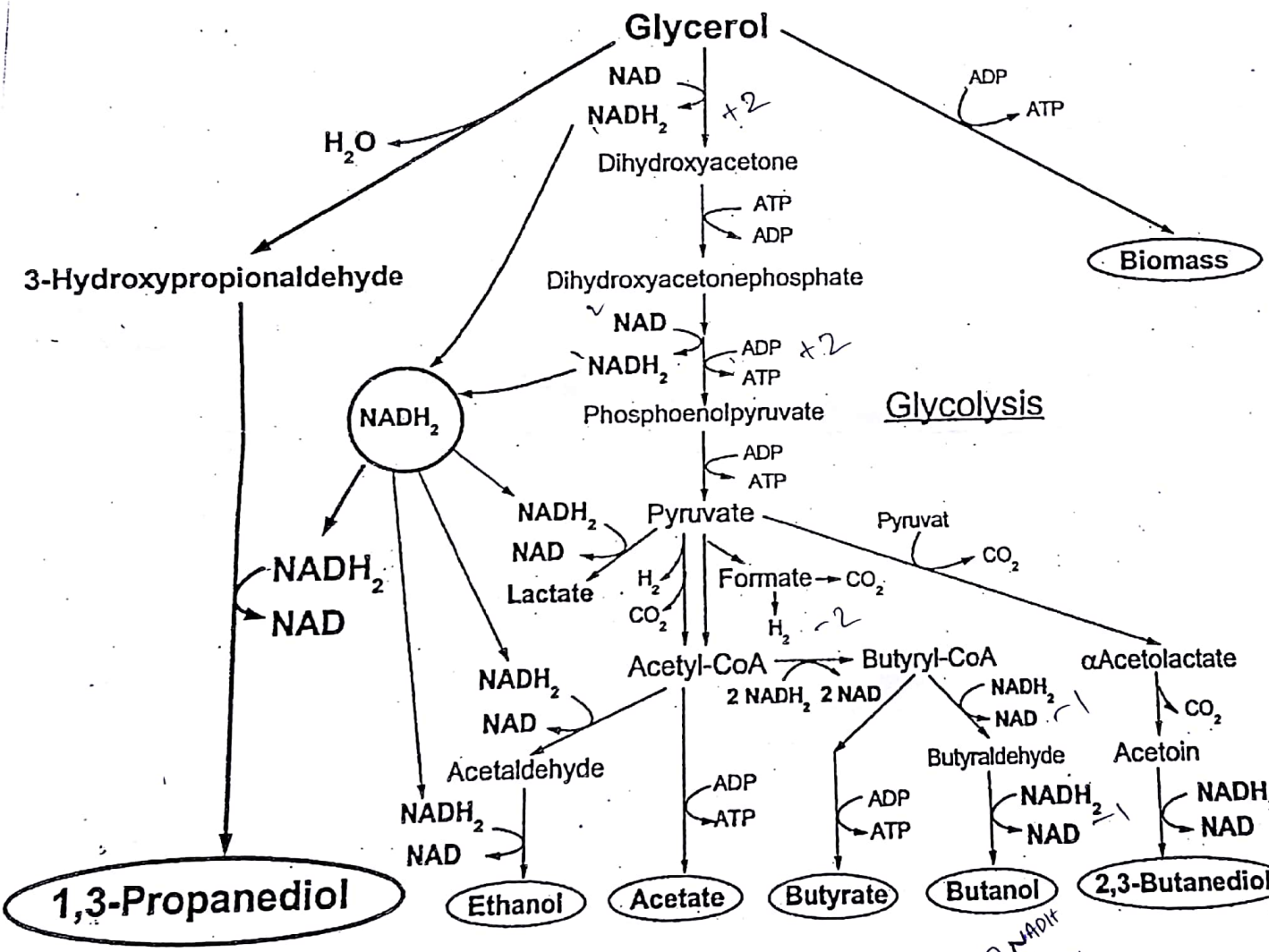

Fig. 1. Metabolic pathways of glycerol metabolism