

Department of Biochemical Engg & Biotech, IIT Delhi
BBL740 (II Semester, 2018-2019), Plant Cell Technology, MAJOR EXAM

Please attempt all questions Date- 28th April 2019, 3.30 -5.30 P.M. Max. Marks: 40
L H 408

1. Schematically describe the cause & effect of hydrodynamic stress during plant cell cultivation. Briefly describe how the manifestation of this is assessed qualitatively & quantitatively to establish the extent of the shear & damage of cells in the bioreactor. (5)
2. What are the (four) major advantages of immobilization of plant cells? Explain why whole cell immobilization is essential as opposed to enzyme immobilization some times? Describe the Microencapsulation & Adsorption techniques for the immobilization for the plant cells with advantages & disadvantage of each one of them. By a schematic diagram describe a reactor configuration for the production of secondary metabolite which is capable of separation of product and gases during cultivation. What strategies can be used for leaching of the intracellular plant metabolite? (1+1+2+2+1)
3. Describe possible interaction between cells and eddies which can lead to shearing &/or damage to the cells during the plant cell cultivation accordingly to hypothesis of Kolmogorov's theory. What hydrodynamic stress indicators were proposed by above theory to quantify the shear effects of plant cells in a bioreactor? (4)
4. What are the three major problems in extracting azadirachtin from the *A. indica* seeds? Describe the operation of a Mist hairy root reactor for azadirachtin production. What were the specific bottlenecks in the operation of the Mist hairy root bio-reactor? Briefly describe the mode of action of azadirachtin for insects/pests. (1+2+1)
5. (a) Different strains of *Agrobacterium rhizogenes* have different transformation ability (True / False)
(b) Name the precursor & elicitor which increased the azadirachtin production during hairy root propagation.
(c) What compound is produced when any hairy roots are under stressed conditions? How is it quantified?
(d) What was the effect of increase of CO₂ & O₂ supply (purged separately) on hairy root growth of *A. indica*. (1+1+1+1)
6. Why (a) continuous cultivation and (b) in-situ cell retention is particularly important for production of plant metabolites? Describe the distinct features of cell recycle/ retention reactor. Why is it particularly important for plant cell cultivation? (1+1+2+1)
7. What are the two advantages of statistical optimization of media as opposed to conventional OVAT (one variable at a time) procedure? What is the purpose of Plackett Burman (PB) protocol in the design of medium recipe? Describe the role of dummy variable (nutrient) in PB trial experiments. (2 +1+1)
8. What indirect methods can be used to measure the biomass concentration in Plant cell cultures? (2)
9. What is the distinct role of permeabilizing agents in the hairy root cultivation technology Briefly describe the desirable characteristics for selection of permeabilizing agent? List out permeabilizing agents which have been successfully used for cell culture of *A. indica* cell cultures. (4)
10. What do you understand by oxygen vectors? How it can help increasing the DO in the bioreactor? (1)