

BITS PILANI – DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY
SECOND SEMESTER 2010 – 2011
BIOT C338 INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY
COMPREHENSIVE EXAMINATION (CLOSED BOOK)

Duration: 3 Hour

Date: 8.6.2011

Max. Marks: 40

Note: Answer all the questions

Answer to the point and draw suitable diagrams

1. What are solid-phase technologies in soil bioremediation? Explain any three methods with suitable diagram, microorganisms involved and its applications. [4.0]
2. What is process analysis in bioremediation technology? Explain in detail on the field application of process analysis to obtain kinetic and equilibrium data for process design on the following: [4.0]
 - a. Site characterization
 - b. Microbiological characterization
 - c. Environmental factors
 - d. Biodegradation rate
3. What are the different types of reactor options available for aerobic and anaerobic processes in bioremediation technology? Explain any two methods for aerobic and anaerobic processes with suitable diagrams, and its applications. [4.0]
4. Explain in detail on the mode of interaction of synthetic organic environmental pollutants with soil constituents with suitable diagram. [1.5]
5. Write a short note on the physical relationship of microorganisms to the structure of a soil aggregate containing an organic containment with a suitable diagram. [1.5]
6. What are the different pathways involved in the anaerobic transformation of toluene biodegradation. Explain the reaction pathways, end products and mention the dead-end metabolites. [3.0]
7. Petroleum contamination is considered one of the important environmental pollutants. Bioremediation of petroleum compounds are highly possible as many of its components are amenable for biodegradation. Explain on the following: [3.0]
 - a. TOL plasmid
 - b. *xylA*, *xylM*, *xylR*
 - c. Reporter genes
8. What are polycyclic aromatic hydrocarbons and mention the source for environmental contamination? Give examples for carcinogenic and non-carcinogenic polycyclic aromatic hydrocarbons. [2.0]
9. What are the different pathways involved in the microbial metabolism of polycyclic aromatic hydrocarbon biodegradation. Explain. [3.0]
10. Write short note on the following with respect to polycyclic aromatic hydrocarbon biodegradation: [3.0]
 - a. Bioavailability
 - b. Sorption and desorption kinetics
 - c. Surface active agents
11. What are the advantages and disadvantages of microbial consortia and pure cultures for the applications in nitroaromatics biodegradation. Briefly describe. [1.5]
12. What are polychlorinatedbiphenyls (PCBs)? Give examples, sources of contamination, and any two methods for biodegradation. [3.0]
13. What are the chemical and physical properties of chlorophenols? Explain. [1.5]

14. Draw a suitable diagram on microbe–metal interactions. Explain any two methods in detail for the microbial remediation of heavy metals. [2.0]
15. What do you understand and how can you help save the environment with respect to the following environmental issues and find solutions and give alternative methods: [3.0]
- a. Climate change with respect to environmental pollution
 - b. Sustainable food production with respect to environmental pollution
 - c. Replacing chemical fertilizers as possible routes for heavy metal contamination and agricultural runoffs
 - d. Global warming and Global cooling
 - e. Plastics on health, environment, sources of raw materials and alternatives
 - f. Identify at least any three products which you can avoid as part of environmental pollution

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BIOT C338 INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY
TEST-II (OPEN BOOK)

Duration: 50 min.

Date: 1.5.2011

Max. Marks: 20

Note: Answer all the questions

Answer to the point & draw suitable diagrams

1. Oil Spill in Gulf of Mexico and the methods followed to contain the spill were are mostly conventional like the one followed for the Exxon Vladez. Still trying to pin down exactly what happened in the Gulf last weekend. The Coast Guard has reported that a well south of Grand Isle that was being plugged and abandoned leaked for 4-6 hours for some reason with oil showing up on the beaches of Grand Isle, Elmer's Island and Fourchon. Cleanup is continuing although no new oil is washing ashore. [10.0]
 - a. With the information available develop a schematic method and analytical requirements for bioremediation of oil spill in water bodies. Justify.
 - b. List the methods so far followed and briefly explain each with advantages and disadvantages with reference to Exxon Valdez oil spill. Compare with Gulf of Mexico and reason whether the existing technologies can be sufficient or what innovations required for bioremediation of petroleum contamination.
 - c. How microbes can be used to remediate such pollution in water bodies, sub surface deposition of crude and soil/beach contaminated with oil
 - d. What is your observation to handle such incidents in future in of this magnitude in large area and massive scale?
 - e. What are the environmental and ecological consequences in terms of short term and long term and list out how human being are affected due to such pollution.

2. Polycyclic aromatic hydrocarbons (PAHs) are a group of approximately 10,000 compounds. Most PAHs in the environment are from incomplete burning of carbon-containing materials like oil, wood, garbage or coal. Many useful products such as mothballs, blacktop, and creosote wood preservatives contain PAHs. They are also found at low concentrations in some special-purpose skin creams and anti-dandruff shampoos that contain coal tars. [6.0]
 - a. List microbe which degrade PAHs.
 - b. Identify at least any one useful bacterial operon which can degrade PAHs and explain with a schematic diagram for the control of gene expression for the degradation of PAH pathways.
 - c. What are the possible areas in the bioremediation of PAHs more innovation can be made in order to increase efficiency of the process.

3. Nitroaromatic compounds are extensively used and often they are potential mutagen and carcinogen which have impact on environment and the ecosystem. List the bacteria which can degrade nitroaromatic compounds and identify bacterial genes and operons, and construct its functional units as a gene cassette. How it can be used for recombinant DNA technology for bioremediation technology? [4.0]

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SECOND SEMESTER 2010 – 2011
BIOT C338 INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY
TEST-I (CLOSED BOOK)

Duration: 50 min.

Date: 10.3.2010

Max. Marks: 25

Note: Answer all the questions

Answer to the point & draw suitable diagrams

1. Define the term bioremediation. Why it is important the laboratory studies for bioremediation and list at least any four reasons. [2.0]
2. Explain on solid-phase technologies with any two methods with suitable diagrams. [3.0]
3. Differentiate between bioventing and biosparging with suitable diagram on the methods and principle involved in each process. [3.0]
4. How toxic metal contaminated sites are treated and explain any one method? [2.0]
5. Explain the following and influence on bioremediation. [4.0]
 - a. Site characterization
 - b. Microbiological characterization
 - c. Environmental factors
 - d. Degradation rate
6. How groundwater remediation is carried out? Explain with at least two methods with suitable diagrams. [4.0]
7. How organic and inorganic phase influence the soil properties and bioremediation? Explain. [3.0]
8. Explain the following with respect to interaction of synthetic organics with soil constituents. [4.0]
 - a. Binding affinities
 - b. Impact on contaminant bioavailability
 - c. Transport phenomena
 - d. Abiotic catalysis

4. Name any two known bacteria and fungi which can degrade chlorinated phenols. [1.0]

5. What are the different factors which affect chlorinated phenol biodegradation? [1.0]

5. Write the sequence of any two routes/pathways of biochemical reactions of the degradation of toluene. [1.5]
6. What are dead-end metabolites? Give any two examples. [1.0]
7. Name any two enzymes involved in the degradation of Toluene and mention the bacteria which produce such enzymes as these have applications in the genetic manipulation for environmental bioremediation technology. [1.0]
8. What are metabolic inhibitors and how it is used in the studies on environmental biotechnology? Explain with an example for the Ethyl benzene biodegradation. [1.0]
9. List any four Toluene degrading bacteria? [1.0]