

國立成功大學
110學年度碩士班招生考試試題

編 號： 144

系 所： 環境工程學系

科 目： 微生物學

日 期： 0202

節 次： 第 2 節

備 註： 不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Ethylene dichloride or 1,2-dichloroethane ($C_2H_4Cl_2$) is a contaminant commonly found in the aquifer. To clean up the contamination, the microbiological treatment approach, namely bioremediation, can be used. The bioremediation technology is involved in a co-metabolic mechanism under aerobic conditions or a metabolic mechanism under anaerobic conditions.
 - (a) Please define the “co-metabolism” scientifically (5 pts)
 - (b) The anaerobic metabolism of 1,2-dichloroethane is usually referred to as a dehalorespiration. Please describe what the dehalorespiration is based on a microbial respiratory principle. (5 pts)
 - (c) Practically, fermentable substrates, such as glucose and vegetable oil, are introduced to the contaminated aquifers to stimulate the bioremediation in situ. Exemplifying with glucose, please describe how glucose is degraded anaerobically to benefit the dehalorespiration activity. (10 pts)
 - (d) In the case, as indicated in (c), the methane-producing archaea (methanogen) will compete with the bacteria of the dehalorespiration activity. Please explain the reason based on the microbiological perspective (5 pts)
 - (e) Following (c), which environmental and microbial factors you think will be critical to ensure the microbial dehalorespiration activities in the actual aquifer. Please explain the reasons as much as you can (10 pts)

2. A student is advised to obtain a benzene-degrading, Gram-negative pure culture that is phylogenetically classified in *Sphingomonadaceae* of Domain Bacteria and plays a vital role in degrading toluene in the oil-contaminated soil. The purpose is to use this benzene-degrading bacterium to clean up the soil contaminated with aromatic hydrocarbons.
 - (a) Please define “pure culture” from a microbiological perspective. (3 pts)
 - (b) In accordance with Koch’s postulates, how to establish a relationship between this bacterium and its toluene degradation in contaminated soil. (12 pts)
 - (c) Please design a selective medium recipe for isolating the targeted Gram-negative strain (10 pts).
 - (d) Please describe how you will conduct the isolation experiments. Draw the flowchart step by step if necessary. (10 pts)
 - (e) How do you do the Gram staining? What color should the target bacterium display under light microscopic observation in this case? (10 pts)
 - (f) What is the taxonomic rank of “*Sphingomonadaceae*” (2 pts)
 - (g) The student is lucky and obtains a new bacterial species. What evidence will you suggest the student to provide for a new species? (10 pts)
 - (h) The quantitative polymerase chain reaction (qPCR) is used for the quantitative analysis of the bacterial strains. Please describe the rationales of qPCR accordingly. (8pts)