Retardation of degradation performance of an activated sludge for a xenobiotic under periodic xenobiotic loadings

陳易新、張玉明

E-mail: 9500945@mail.dyu.edu.tw

ABSTRACT

This study was to investigate the performance of a continuous activated sludge for a persistent xenobiotic when the sludge was subjected to periodic loadings of the xenobiotic. The activated sludge was fed with the xenobiotic 2,4-D and sucrose until steady states, and 2,4-D was removed for periods of time (called down-time DT), before square shocks of 2,4-D were re-applied. Operation conditions for the activated sludge were: fixed hydraulic residence time of 8 hours, varied mean cell residence times (θ c) of 8 and 14 day, and varied lengths of DT. The results showed that: (1) For DT up to approximately 1/2 θ c, the activated sludge was able to recover after the shocks; (2) the activated sludge failed at DT of 8 days and 10 days, for θ c of 8 days and 14 days, respectively; (3) the retardation of the sludge ability to re-degrade 2,4-D can be mathematically modeled as exponential decay. In addition to the loss by sludge wastage, a de-acclimation rate of 0.288 mg-SS/l-d was found, while a transfer gain rate was shadowed by the loss.

Keywords : Activated Sludge ; xenobiotic ; 2,4-D

Table of Contents

REFERENCES

參考文獻 1. A. Vallecillo, P. A. Garcia-Ehncina, M. Pena, (1999). Anaerobic biodegradability and toxicity of chlorophenols. Wat. Sci. Tech., Vol.40, 161~168. 2. Aiking H., and G. Sojka, (1979). Response of Rhodopseudomonas capsulate to illumination and growth rate in light-limited continuous culture. Journal of bacteriology. Vol.139, pp.530~536. 3. Allan E.K., (1993). Distribution and activity of microorganisms in lake effect of physical processes. pp.47~68. in Ford Y. E. eds. Aquatic Microbiology. Blackwell Scientific Publication, Inc., Boston. 4. Aly, O.M., and S.D. Faust, (1964). Studies on the fate of 2,4-D and ester derivatives in natural surface waters. Agric. Food Chem. 12(6):541~546. 5. Audus, L.J, (1960). Herbicide behaviour in the soil. Chapter 5 in Physiology biochemistry of herbicides. L. J. Audus. Academic Press, New York, N. Y.555. 6. CCME (1995), 2,4-D. In: Canadian water quality guidelines. Ottawa, Ontario, Canadian Council of Ministers of the Environment. 7. Foster P.L. and J.M. Trimarchi, (1994). Adaptive reversion of a frameshift mutation in Escherichia coli by small base deletion in homopolymeric runs. Science, Vol. 265, pp.407~409. 8. Foster, R.K. and R.B. Mckercher, (1973). Laboratory incubation studies of chlorophenoxyacetic acids in chernozemic soils. Soil Biol. Biochem. 5, 333~337. 9. Gaudy,A.F., and Gaudy, E.T., (1980). Microbiology for Environmental Scientists and Engineers. Mc.Graw-Hill Now York. 10. Halter, M, (1980). 2,4-D in the aquatic environment. Section II in Literature Reviews of Four Selected Herbicides: 2,4-D, dichlobenil, diquat & endotall. Shearer R., and M. Halter, eds. 11. Hemmett, R.B. and S.D. Faust, (1969). Biodegradation Kinetics of 2,4-dichlorophenoxyacetic acid by aquatic microorganisms. Residue. Rev.29:191~207. 12. Hu, H.Y., Nozawa, M., Fujie, K. Makabe, T. and Urano K. (1998) Analysis of microbial acclimation to refractory chemicals in wastewater using respiratory quinine profiles. Wat.Sci.Tech. Vol.37, pp.407~411. 13. Johnson. W.G., T.L. Lavy, and E.E. Gbur, (1995b). Sorption mobility, and degradation of triclopyr and 2,4-D and four soils. Weed Sci. 43:678~684. 14. Johnson.W.G., T.L, Lavy, and E.E. Gbur, (1995a). Persistence of Triclopyr and 2,4-D in Flooded and Non-Flooded Soil. Journal of Environmental Quality, 24(3) pp493~497. 15. K. W. Wang, B. C. Baltzis, G. A. Lewandowski, (1996). Kinetics of phenol

biodegradation in the presence of glucose. Biotechnology and Bioengineering, Vol.51, Issue 1, pp87~94. 16. Kintz, P., Tracqui, A., and Mangin, P., (1992). Accidental death caused by the absorption of 2,4-dichlorophenol through the skin. Archives of Toxicology, 66: 298~299. 17. Kunc F, Rybarova J., (1983). Effect of glucose on the amount of bacteria mineralizing 2,4-dichlorophenoxyacetic acid in soil. Folia Microbiol (Praha). 28(1):54~56. 18. McCarthy, D.L., Navarrtet, S., Willett, W.S., Babbitt, P.C., and Copley, S.D, (1996). Exploration of the relationship between tetrachlorohydroquinone dehalogenase and the glutathione S-transferase superfamily, Biochemistry, 35(46): 14634~14642. 19. Oh, K.H, and O.H. Tuovinen, (1991). Bacterial degradation of phenoxy h erbicide mixtures 2,4-D and MCPP. Bull. Euviron. Contum. Toxicol.47:222~229. 20. Prescott L.M., J.P. Harley and D.A. Klein, (1999). Microbiology,4th ed. McGraw-Hill. 21. Que Hee, S.S., and R.G. Sutherland, (1981). The phenoxyalkanic Herbicides, Volume 1 : Chemistry, Analysis, and Environmental Pollution Press. Inc., Boca Raton, Florida 319 pgs. 22. Rheinheimer G, (1992). The influence of environmental factors on the development of microorganisms. pp.111~147. in Rheinheimer G. eds. Aquatic Microbiology 4th ed. Baffins Lane, England. 23. Sandmann erima Loos, and lp Van Dyk, (1988). The microbial degradation of 2,4-Dichlorophenoxyacetic acid in soil. Reviews Environ. Contam. Toxicol. 101:1~53. 24. Shaw, L.J., and R.G. Burns, (1998). Biodegradation of 2,4-D in a noncontaminated grassland soil profile J. Environ. Qual 27.pp.1464~1471. 25. Tyler, J.M. and Finn, R.K., (1974). Growth rates of a pseudomonas on 2,4-dichlorophenoxyacetic acid and 2,4-dichlorophenol. Applied Microbiology, 28(1): 181~184. 26. Vallecillo, A., Garcia-Encina, and Pena, M., (1999). Anaerobic biodegradability and toxicity of chlorophenols. Water Science and Technology, 40(8): 161~168. 27. Wang, Y., C. Jaw, and Y. Chen, (1994). Accumulation of 2,4-D and glyphosate in fish and water hyacinth. Water Air Soil Pollut. 74: 397~403. 28. WHO (1984), 2,4-Dichlorophenoxyacetic acid (2,4-D). Geneva, World Health Organization (Environmental Health Criteria 29). 29. Winteringham, F.P.W., (1985). Environment and Chemicals in Agriculture. Elswevien Applied Sc. Pub., London. 30. Yerachiel Argaman, (1995). A Stady-State Model For The Single Activated Sludge System—I. Model Description. Wat. Res. Vol. 29, No, 1, pp.137~145. 31. 「水污染防治法規」，行政院環境保護署環境保護人員訓練所編印，(2003). 32. 王三郎，「應用微生物學」，高立圖書有限公司，(1994). 33. 王俊欽、李季眉，「固定化微生物對2,4-二氯酚及2,4,6-三氯酚之分解」，第二十屆廢水處理技術研討會論文集，第1-9~1-15頁，(1995). 34. 王俊欽、李季眉、盧至人，「酚對於固定化微生物分解2,4,6-三氯酚之影響」，國立中興大學工程學報，第八卷，第1～8頁，(1997). 35. 李茂山、盧至人，「受2,4-二氯酚污染土壤之生物復育」，第二十三屆廢棄物處理技術研討會論文集，第299~304頁，(1998). 36. 林志勇，「微生物分解能力之化學計量」，私立大葉大學環境工程學系研究所碩士論文，(2002). 37. 「活性污泥法新技術」，經濟部工業污染防治技術手冊，(1994). 38. 張紘偉，「氯酚分解的質體核酸(plasmid DNA)量化分析」，私立大葉大學環境工程學系研究所碩士論文，(2003). 39. 陳國樹、袁紹英、張碧芬，「厭養混合菌分解氯酚化合物之研究」，第十八屆廢水處理技術研討會論文集，第487~499頁，(1993). 40. 曾四恭、盧中榮，「不同碳源對氯酚脫氯之影響」，第二十屆廢水處理技術研討會論文集，第3-39~3-44頁，(1995). 41. 黃秋嫆，「固定化氯酚分解菌處理廢水中含氯酚類有毒物質之研究」，國立中興大學環境工程學系研究所碩士論文(1993)，. 42. 廖宏慈，「氯酚?類衍生物誘發DNA氧化損害作用之研究」，國立中興大學環境工程學系研究所碩士論文，(2001). 43. 蔡旭清，「活性污泥分解2,4-D中間產物之動態」，私立大葉大學環境工程學系研究所碩士論文，(2003). 44. 黃文璽，「活性污泥在持久有機物間歇負荷下分解能力之興衰」私立大葉大學環境工程學系研究所碩士論文，(2005). 45. 歐陽嶠暉，「下水道工程學」，長松文化公司，(2000).