STUDIES ON MICROBIAL DEGRADATION OF A DETERGENT IN A WATER-FLOW SYSTEM

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Abstract

Sodium alkylether sulfate (AES) is a pollutant that is generally found in detergents. To determine its degradation mechanism, an AES solution (10%, v/v) was treated at 28°C using charcoal immobilized microorganisms at the Niida River, in Hachinohe, Japan. Observation revealed that AES treated with immobilized charcoal was decomposed into smaller molecular substances, along with a succession of rod, spiral, and spherical-shaped microorganisms that appeared during the incubation. Resultant substances from the degradation of AES were separated by thin layer chromatography (TLC), and were then analyzed by a Fourier-transform infrared radiation (FTIR)-spectrometer. We detected alkyl, ether, sulfo, and carbonyl groups in the molecules of degraded AES.

Molecular simulations were applied to verify and to estimate the physicochemical properties of these speculated molecules. From these simulations, the potential energy surface, the atom partial charge and bond order which relate to optimum geometry, reactivity, and stability, respectively were calculated. In this report, a successful procedure to analyze degraded products of AES is thus proposed.

Key words: sodium alkylether sulfate; biodegradation; molecular simulation; molecular orbital theory; degradation process

Nomenclature

AES=sodium alkylether sulfate
TLC=thin layer chromatography
FTIR=Fourier transformation infrared radiation
HPLC=high performance liquid chromatography

Introduction

Biological activated carbon is widely employed in wastewater treatment (Kim *et al.*, 1997, Lykins *et al.*, 1988). It is known that charcoal immobilized microorganisms is substituted biological activated carbon. Several species of microorganisms are believed to be involved in the degradation process of various pollutants. AES is a pollutant generally found in detergent that is relatively resistant to biodegradation. Composed of alkyl, ether, and sulfo groups, the degradation of AES is somewhat obscure.

In a wastewater treatment plant, the carbon atom of an AES compound is oxidized to produce several intermediates and CO_2 under aerobic conditions. BOD and COD are typical

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