

中文摘要

豬糞尿再厭氧條件下會產生揮發性有機質(VOCs)，本研究採用兩種不同的污染質傳輸模式，探討對甲酚(p-cresol)，甲苯(toluene)，二甲苯(xylene)，己烷(hexane)四種 VOCs 的擴散傳輸行為。第一種傳輸模式(Little 修正式)假設 VOCs 由豬糞尿中間層產生，穿過一層豬糞尿層及一空氣邊界層；第二種傳輸模式(Jury 修正式)假設糞漿未經攪動，VOCs 由豬糞尿污染層產生，穿過一層澄清層及一空氣邊界層，模擬 VOCs 擴散傳輸過程，將 VOCs 的濃度變化表示成一擴散方程式，經由理論推導，並根據 Freundlich 等溫吸附假設，計算畜舍內對甲酚，甲苯，二甲苯，己烷四種 VOCs 的濃度，並求出人在畜舍內三十年暴露時間下所吸入的 VOCs 總劑量，並與安全標準劑量相比較，訂立畜舍惡臭的清除準則。在考慮衰減以及 Freundlich 等溫吸附 ($q=1 \mu\text{g g}^{-1}$, $n=1$ ，豬糞尿厚度 2 公分)假設下，Little 修正式模擬結果：對甲酚，甲苯，二甲苯三種 VOCs 的清除準則依序為 49.6 g g^{-1} 、 1.49 mg g^{-1} 及 3.62 mg g^{-1} 。Jury 修正式模擬結果對甲酚，甲苯，二甲苯三種 VOCs 的清除準則依序為 8.31 mg g^{-1} 、 5.24 mg g^{-1} 及 6.70 mg g^{-1} 。

關鍵詞：豬糞尿；揮發性有機質；Freundlich 等溫吸附；清除準則

Abstract

Volatile organic compound (VOCs) will be released as the result of mass transfer from stored pig slurry under anaerobic decomposition. This research proposes two different kinds of contaminant transport models to discuss the diffusion behavior of four selected VOCs of p-cresol, toluene, xylene, and hexane. In modified Little's model, we make a hypothesis that VOCs released in the middle layer of pig slurry transport through pig slurry layer and an air boundary layer. In modified Jury's model, we hypothesize that pig slurry is undisturbed. The VOCs are released in contamination layer and transported through a clean layer as well as an air boundary layer. The variation of VOCs concentrations could be presented as a diffusion equation to simulate the diffusion transport processes. According to Freundlich isotherm and theoretical hypothesis, the air concentrations of four selected VOCs and total exposure dose could be calculated. Swine manure cleanup criteria based on non-exceedence of the total hazardous dose corresponding to an acceptable risk from indoor inhalation of four VOCs were calculated in a typical pig unit. When considering the degradation phenomenon and Freundlich isotherm ($q=1 \mu\text{g g}^{-1}$, $n=1$, $L = 0.01 \text{ m}$), the cleanup criteria of p-cresol, toluene, and xylene in modified Little's model are 49.6 g g^{-1} , 1.49 mg g^{-1} and 3.62 mg g^{-1} , respectively; while 8.31 mg g^{-1} , 5.24 mg g^{-1} and 6.70 mg g^{-1} respectively in modified Jury's model.

Keywords : Pig slurry; Volatile organic compounds (VOCs); Freundlich isotherm; Cleanup criteria