# 中文摘要

本論文以一完全混合氣流系統之均質表面擴散理論推導一數學模式以描述通風畜舍中粉塵態臭氣(Dust-Borne Odor)之動態行為。主要研究方法為將臭氣、氣懸粉塵(Air-Borne Dust)、粉塵態臭氣之產生及移除機制併入擴散模式中，並考慮不同畜舍之顆粒大小及停留時間。推導出之動態方程式可預測出通風率、粉塵顆粒濃度、氣懸顆粒分佈、溫度及通風範圍大小等參數對不同粒徑粉塵態臭氣濃度之影響，其中以通風率及氣懸顆粒濃度影響較大。當通風率由 280 $m^3$ $h^{-1}$ 增加為 845 $m^3$ $h^{-1}$ 時，粉塵態臭氣濃度到達穩定時間約縮短成三分之一(由原 75 小時縮短為 25 小時)，而其最大濃度則減少為 33%(由原 12.98 mg $m^{-3}$ 減少為 4.255 mg $m^{-3}$)；當通風率增加至 1440 $m^3$ $h^{-1}$ 時，粉塵態臭氣濃度達穩定時間縮短為 15 小時，而其最大濃度減少為 20%，2.542 mg $m^{-3}$；粉塵顆粒濃度則和粉塵態臭氣濃度成正比。另外，同一系列預測中氣懸粉塵濃度約介於 10 mg $m^{-3}$ 至 100 mg $m^{-3}$ 間，此結果和 Carpenter（1989）研究發現之斷奶幼豬舍氣懸顆粒濃度為 79 mg $m^{-3}$ 相符，因此雖無法以實驗直接測得不同粒徑之粉塵態臭氣濃度，但採用和前人研究比較氣懸粉塵濃度之方式可知本論文之預測模式有一定之可信度。

**關鍵詞**：臭氣；氣懸粉塵；粉塵態臭氣；吸附；沈澱

## Abstract

A mathematical model was developed to describe the dust-borne odor concentrations in ventilated animal housings based on the concept of homogeneous surface diffusion of a complete mixing airflow system. The aim of the research is to incorporate the generation and removal mechanisms of odor, airborne dust, and dust-borne odor. The age and size distribution of airborne dust in different ventilated animal housings was also studied. The developed dynamic equations are sufficient to predict the effects of parameters, such as ventilation rate, dust particle concentration, ambient aerosol profile, temperature and enclosure dimension to varied size dust-borne odor. Among these parameters, ventilation rate and dust particle concentrations have the higher influences. The stable time of dust-borne odor concentration can be shortened to 1/3 (from 75 to 25 hours) and the maximum concentration be decreased to 33% (from 12.98 to 4.255 mg $m^{-3}$) while the ventilation rate increased from 280 to 845 m3 $h^{-1}$ ; the stable time of dust-borne odor concentration can be shortened to 15 hours and the maximum concentration decreased to 20% (2.542 mg $m^{-3}$) while ventilation rate increased to 1440 $m^3$ $h^{-1}$. Dust particle concentration is directly proportional to dust-borne odor concentration. In additional, the predictive results showed that the concentration of airborne dust was ranging from 10 to 100 mg $m^{-3}$. This is in agreement with the results of Carpenter (1989), which showed that airborne dust concentration was 79 mg $m^{-3}$ in swine buildings. It shows that the model is suitable to predict the dust-borne odor concentration although it is difficult to examine the dust-borne odor in varied size.



***Keywords***：Odor ; Airborne Dust ; Dust-Borne Odor ; Adsorption ; Deposition