大氣中生物性微粒之特性及健康效應

Characteristics and Health Effects of Ambient Biological Particulates

中文摘要

大氣中的生物性成份（即生物氣膠）相當複雜，包括了真菌孢子、花粉、微生物，以及源自於生物的碎片、毒素、廢棄物等等，高濃度的暴露可能會造成過敏性呼吸道疾病的產生與惡化。本研究針對大台北地區大氣中生物性微粒進行為期一年的監測，以了解生物氣膠之特性，並評估可能的健康危害。

本研究在大台北地區新莊運動公園及台北市信義區分別進行為期一年的大氣中生物性成份監測，監測項目包括真菌孢子、真菌過敏原以及細菌內毒素，並評估可能的健康危害。針對環境採樣部分，真菌孢子於每月最後一週進行連續七天採樣，過敏原與內毒素則於每季進行兩週密集採樣。健康危害評估部份於信義區進行，利用鄰近教學醫院的門診及急診就醫資料，了解大氣中真菌孢子的可能健康危害。根據研究結果發現，大台北地區的總真菌孢子平均濃度為 1659 spores/m3，其中優勢真菌為 Basidiospores（擔孢子）、Ascospores（子囊孢子）、Cladosporium（分枝孢子菌）及 Aspergillus/Penicillium（麴黴屬/青黴菌屬），平均濃度皆高於 100 spores/m3，出現頻率大於 95%。在真菌過敏原部份，Alt a 1 在粗微粒及細微粒中的平均濃度分別為 0.0008 ng/m3 及 0.0003 ng/m3、Asp f 1 為 0.0007 ng/m3 及 0.0013 ng/m3、Cla h 1 則為 0.2219 ng/m3 及 0.0963 ng/m3。內毒素在粗、細微粒中的平均濃度分別為 0.17 EU/m3 及 0.10 EU/m3。利用統計模式分析生物性微粒與環境因子的相關性，結果指出真菌及內毒素濃度與氣象因子（如溫度、相對濕度、風速、大氣壓力）及大氣汙染物（如 PM10、SO2 等）間有顯著的相關性。根據多變項回歸模式分析結果發現，過敏性疾病就診人次與多種真菌孢子（如 Alternaria、Aspergillus/Penicillium、Botrytis、Drechslera/Helminthosporium 等）、氣象因子（如溫度、風速、相對濕度等），以及大氣汙染物（如 PM10、O3、THC 等）有顯著相關，而環境因子對過敏性疾病除了立即的影響外，亦有延遲效應。本研究提供大台北地區大氣中生物性微粒的長期監測資料、評估與其他大氣環境因子間的相關性，並瞭解對過敏性疾病患者的可能危害。未來應更進一步瞭解真菌孢子引起呼吸道疾病發病的機制，以及確認其因果關係，並同時評估其他生物性微粒（如內毒素）的可能健康危害。

英文摘要

The composition of ambient biological particulates (bioaerosols) is complex, including fungal spores, pollens, microorganisms, and fragments, toxins and particulate wastes originating from various organisms. Exposure to high levels of bioaerosols may result in development or exacerbation of allergic respiratory diseases. We conducted a one-year monitoring study to assess the characteristics and health

impacts of ambient biological particulates.
We conducted one-year environmental sampling in both Shin-Jhuang and Taipei city to monitor ambient fungal spores, fungal allergens and endotoxin. Fungal spores were collected in the last week of every month during the study period. Fungal allergens and endotoxin were monitored 2 weeks every season. Assessment of health impact was conducted in Taipei city only. We collected outpatient and emergency visit data of a nearby teaching hospital to evaluate the potential health effects of ambient fungal spores. According to the study results, the average concentration of total fungal spores was 1659 spores/m3, and the predominant fungal taxa included Basidiospores, Ascospores, Cladosporium, and Aspergillus/Penicillium, with average concentrations higher than 100 spores/m3 and present in more than 95 % of the samples. The average fungal allergen concentrations in coarse (2.5-10 ?慆) and fine particles (<2.5?慆) were 0.0008 ng/m3 and 0.0003 ng/m3 for Alt a 1, 0.0007 ng/m3 and 0.0013 ng/m3 for Asp f 1, and 0.2219 ng/m3and 0.0963 ng/m3 for Cla h 1. The mean levels of endotoxin in coarse and fine particles were 0.17 EU/m3 and 0.10 EU/m3, respectively. According to the results of regression analyses, we found the concentrations of measured bioaerosols were associated with meteorological parameters (e.g., temperature, relative humidify, wind speed and barometric pressure) and air pollutants (e.g., PM10 and SO2). According to multivariate analyses, hospital visits due to allergic diseases were related to several fungal spores (e.g., Alternaria, Aspergillus/Penicillium, Botrytis and Drechslera/Helminthosporium) and environmental parameters (e.g., temperature, wind speed, relative humidity, PM10 and ozone). Environmental factors also showed delayed effects on allergic diseases. This study provided the characteristics of ambient particulates in Taipei, Taiwan, and evaluated the relationships between ambient particulates, environmental parameters, and health impacts. Futures studies should scrutinize the mechanism that fungal spores trigger the onsets of respiratory diseases, as well as investigate the health impacts of other biological particulates (e.g., endotoxin).