武汉市干湿沉降中可溶性有机碳和酸碱度的相关性分析

摘　要

干湿沉降是全球物质循环和能量输送的关键环节。可溶性有机碳（DOC）在大气中的含量分布及其时空变化，对探讨大气气溶胶在其他环境介质中转化所起的作用具有非常重要的意义。

本文于 2018 年选取武汉市洪山区地大空气监测站为采样点，对武汉市湿、干湿沉降进行了为期 12 个月的采样分析，并测定其 pH 值和 DOC 含量。同时收集同期气象要素和大气污染物的数据，进行其与武汉市空气质量指标的相关分析，探究其时间变化规律，一方面，填补了武汉市干湿沉降持续观测的空白，积累武汉市区 2018 年干湿沉降中可溶性有机碳含量的基础数据。另一方面，有利于帮助了解武汉市区可溶性有机碳与污染物之间的关系。

本文的主要研究结论：（1）武汉市洪山区 2018 年湿沉降 DOC 含量全年平均值为 128.90，变化范围在 73.33~283.83μM 之间。2018 年干湿沉降 DOC 含量全年平均值为 480.26μM，变化范围在 114.36~1535.94μM 之间。与国内外其他城市比较，武汉湿沉降中的 DOC 含量低于其他内陆地区，与其它沿海地区相近，显著高于大部分海洋湿沉降。（2）干湿沉降的月平均 pH 值 6.73，范围在 6.21～7.23 之间，武汉市一年中每月的平均 pH 值具有明显规律，对各月 pH 值进行排序，大小关系依次为 4 月>9 月>8 月>7 月>6 月>2 月>1 月>5 月>3 月>10 月>12 月>11 月。其中 pH 值在 4 月最高，为 7.18，11 月最低为 6.21。湿沉降的月平均 pH 值则为 6.26，范围在 5.13～7.23 之间，武汉市一年中每月的平均 pH 值具有明显规律，对各月 pH 值进行排序，大小关系依次为 4 月>9 月>10 月>6 月>5 月>2 月>7 月>8 月>1 月>11 月>12 月>3 月。其中 pH 值在 4 月最高，为 7.23，3 月最低为 5.13，季节分布上都属于春冬较低，夏秋较高。湿、干湿沉降的 pH 值在 0.05 水平上显著相关，且干湿沉降 pH 值明显高于湿沉降。湿、干湿沉降的 pH 值均与 O_3 月平均浓度的相关性成正相关，且在 0.05 水平显著相关。（3）O_3 浓度与 $PM_{2.5}$、CO 浓度呈负相关，且在 0.01 水平显著相关。含硫、含氮酸性气体浓度在 0.01 水平上显著相关，且相关系数达到 0.724。SO_2 浓度与 $PM_{2.5}$ 浓度在 0.05 水平显著相关。
关键词：干湿沉降；气溶胶；DOC；pH 值

Abstract

Dry and wet deposition is the key link of global material circulation and energy transmission. The content distribution and temporal and spatial variations of soluble organic carbon (DOC) in the atmosphere are of great significance for the discussion of the role of atmospheric aerosols in the transformation of other environmental media.

In this paper, Wuhan Hongshan district Chinese University of Geosciences air monitoring station was selected as the sampling point in 2018. The wet, dry and wet deposition in Wuhan was sampled and analyzed for 12 months, and its pH value and DOC content were determined. At the same time, meteorological elements and air pollutants data of the same period were collected, and their correlation with air quality indexes of

Wuhan was analyzed to explore their temporal variation rules. On the one hand, it filled the gap of continuous observation of dry-wet deposition in Wuhan and accumulated basic data of soluble organic carbon content in dry-wet deposition of Wuhan in 2018. On the other hand, it is helpful to understand the relationship between soluble organic carbon and pollutants in Wuhan.

The main research conclusions of this paper are as follows :(1) the annual mean value of DOC content in the Hongshan district of Wuhan in 2018 is 128.90, with a variation range of 73.33~283.83 μM. In 2018, the annual average of dry and wet deposition DOC content is 480.26 μM, and the variation range is 114.36~1535.94 μM. Compared with other cities at home and abroad, the DOC content in wet settlement in Wuhan is lower than that in other inland areas, similar to that in other coastal areas, and significantly higher than that in most Marine wet settlement. (2) the monthly average pH value of dry and wet deposition is 6.73, ranging from 6.21 to 7.23. The monthly average pH value in Wuhan has an obvious rule. The pH value of each month is sorted, and the size relationship is in sequence: April > September > August > July > June > February > January > May > March > October > December > November. The pH value was the highest in April, 7.18, and the lowest in November, 6.21. The monthly average pH value of wet settlement is 6.26, ranging from 5.13 to 7.23. The monthly average pH value in Wuhan city has an obvious rule in a year. The pH value of each month is sorted, and the size relationship is in sequence: April > September > October > June > May > February > July > January > November > December > March. The pH value was the highest in April (7.23) and the lowest in March (5.13). The seasonal distribution was lower in spring and winter and higher in summer and autumn. The pH values of wet and dry settlement were significantly correlated at the level of 0.05, and the pH values of dry and wet settlement were significantly higher than that of wet settlement. The pH values of wet, dry and wet deposition were positively correlated with the O_3 mean concentration, and were significantly correlated at the level of 0.05. (3) O_3 concentration was negatively correlated with $PM_{2.5}$ and CO concentration, and was significantly correlated at the level of 0.01. The concentration of sour gas containing sulfur and nitrogen was significantly correlated at the level of 0.01, and the correlation coefficient reached 0.724. There was a significant correlation between SO_2 concentration and $PM_{2.5}$ concentration at the level of 0.05.

Keywords: wet and dry deposition; Aerosol; DOC; pH

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