アジアンダスト共存下における水相中ナフタレンの転化反応

Conversion of naphthalene in the aqueous phase under the action of Asian Dust particles

○張 露露[1]、楊 露[1]、周 全渝[1]、張 セン[1]、ケイ 万里[1]、魏 永杰[2]、 建栄[3]、中坪 良平[4]、島 正之[5]、鳥羽 陽[6]、早川 和一[7]、唐 寧[6,7]

○Lulu Zhang[1], Lu Yang[1], Quanyu Zhou[1], Xuan Zhang[1], Wanli Xing[1], Yongjie Wei[2], Jianrong Bi[3], Ryohei Nakatsubo[4], Masayuki Shima[5], Akira Toriba[6], Kazuichi Hayakawa[7], Ning Tang[6,7]

1. 金沢大院医薬保、2. 中国環境科学研究院、3. 蘭州大学、4. 兵庫県環境研究センター、5. 兵庫医科大医、6. 金沢大薬、7. 金沢大環日セ

1. Graduate School of Medical Sciences, Kanazawa Univ., 2. Chinese Research Academy of Environment Sciences, 3. College of Atmospheric Sciences, Lanzhou Univ., 4. Hyogo Prefectural Institute of Environmental Sciences, 5. Department of Public Health, Hyogo College of Medicine, 6. Institute of Medical, Pharmaceutical and Health Sciences, Kanazawa Univ., 7. Institute of Nature and Environmental Technology, Kanazawa Univ.

Objective

Asian Dust can be carried by East Asian winter monsoon and is prevailing in the spring. During this period, China is prone to air pollution due to various combustion emissions. Polycyclic aromatic hydrocarbons (PAHs) are a class of organic compounds with carcinogenic and mutagenic potential that mainly originate from combustion processes. During transportation, Asian Dust can mix with PAHs in the local air after deposition, which potentially catalyzes the conversion of PAHs to more toxic derivatives and aggravates health effects in the downwind areas. To simulate the atmospheric process, this study investigated the effect of various Asian Dust particles on the conversion of naphthalene in the aqueous phase under different conditions.

Methods

Asian Dust particles were collected in different Chinese deserts, including the Gobi Desert (AD 1), Taklamakan Desert (AD 2), Horqin Sand Land (AD 3), and Loess Plateau (AD 4). Naphthalene was chosen as the model PAH. Sulfuric acid, nitric acid, and hydrochloric acid were used as acidic modifiers. The experiments were carried out under a combination of different conditions including darkness, ultraviolet (UV) irradiation, neutral and acidic conditions. The blank control groups (not containing Asian Dust particles) were carried out simultaneously. Naphthalene and possible products were determined by high-performance liquid chromatography coupled with a UV detector.

Results

Under dark and neutral conditions, there was no obvious interaction between AD 1 to AD 3 and naphthalene in aqueous solution, while AD 4 showed weak adsorption to naphthalene in aqueous solution since no product was observed in the process. This difference may be due to the smaller size and larger specific surface area of AD 4 particle than the other three kinds of particles. In addition, the fitting curve of the adsorption amount of naphthalene by AD 4 particles with the change of particle mass conforms to Langmuir adsorption isotherm. Under UV irradiation and neutral condition, naphthalene in aqueous solution was degraded and several products were detected. The presence of Asian Dust particles slowed down the reduction rate of naphthalene but had no effect on the type of products. On this basis, the acid was introduced into the system, and it was found that acid had little effect on the degradation of naphthalene and the production of products.

Conclusion

The interaction between Asian Dust particles and naphthalene is unobvious, and Asian Dust can potentially alleviate the degradation of naphthalene and the production of products.