



## **Concentrations of polycyclic aromatic hydrocarbons and chlorinated Paraffins in the agricultural soils in Shanghai and their environmental implications**

Jinglong Zhao, Xue-Feng Hu, Guo-Jun Lan, and Si-Wen Lu

School of Environmental and chemical Engineering, Shanghai University, Shanghai 200444, China

Polycyclic aromatic hydrocarbons (PAHs) and chlorinated paraffins (CPs) are well-known persistent organic pollutants (POPs) in the environment, which are toxic, bio-accumulative and suspected to be carcinogenic. Short-chain (SCCPs) and medium-chain CPs (MCCPs) are most commonly seen in soils and water and originate from typical industrial synthetics. In this work, the concentrations of 16 PAHs, prior controlled by the Environmental Protection Agency (EPA) of the US, 24 SCCPs and 24 MCCPs in the soils of six agricultural sampling fields in the suburbs of Shanghai were monitored. The results were as follows: The total concentrations of the 16 PAHs are in a range of 161.69-5141.08 ng g<sup>-1</sup>. The agricultural soils nearby industrial parks are often seriously polluted by PAHs, while those far away from the industrial areas in Qingpu District in the western suburb of Shanghai are in the lowest content of PAHs. The rate of fluoranthene (Flu) in the PAHs in the soils is the highest, 20.3% on average, followed by pyrene (Pyr) and chrysene (Chr), 16.3% and 12.8% on average respectively. The PAHs in the soils are dominated by high-ring homologues (above three rings), which makes up 87.5% on average. The rate of 4-ring homologues in the PAHs is the highest, 59.1% on average. This suggests that the PAHs in the agricultural soils in Shanghai were mainly derived from coal combustion. The concentrations of CPs in the soils are in a range of 6.99 - 499.27 ng/g. SCCPs, in a range of 3.18 - 101 ng/g, are dominantly composed of C<sub>12-13</sub> homologues, with the chlorination degree of 63.1% on average. Especially, in the soils of Baoshan and Qingpu Districts, Shanghai, the C<sub>13</sub> homologue makes up over 50% of the total SCCPs. MCCPs, in a range of 1.68 - 396 ng/g, are dominantly composed of C<sub>14-15</sub> homologues, with the chlorination degree of 52.3% on average. The concentrations of MCCPs are mostly higher than those of SCCPs in the soils. Compared with the soils of the other areas in the world, however, the concentrations of SCCPs and MCCPs in the agricultural soils in Shanghai are at the medium level. According to the ratios of homologues, CPs in the soils in Shanghai was mostly caused by the discharge of industrial solid wastes, sewage sludge application and/or wastewater irrigation. Generally, the degree of CPs contamination in the soils in Shanghai is lighter than that of PAHs. Moreover, the increase of PAHs in the soils is not correlated with the elevation of CPs simultaneously, suggesting that PAHs and CPs in the soils have different paths and sources of pollution. This work was supported by the Science and Technology Commission of Shanghai Municipality (Grant no. 17DZ1202300).