Effects of Biodegradation on Diagnostic Ratios for Source Apportionment of Polycyclic Aromatic Hydrocarbons in Topsoil

ZHANG ZHIHUAN[1*], CHENG XIAOXUAN[1], WANG KE[1], CAI TING[1], LIU YU[1]

[1] China University of Petroleum, Beijng, China
    (*Correspondance: zhangzh3996@163.com)

Objectives and methods

The source of polycyclic aromatic hydrocarbons is mainly identified based on diagnostic ratios recently[1,2]. However, geochemical processes could bring some uncertainty for their source apportionment in soils. Among these processes, biodegradation may bear major responsibility for the changes of diagnostic ratios. But few researches has been available regarding the influence of biodegradation. In order to reveal the influence of biodegradation on the composition of PAHs and the effectiveness of diagnostic ratios for PAHs source apportionment, totally 77 groups of experiments were performed with *Pseudomonas, Achromobacter, Empedobacter brevis* and *microbacterium* as bacteria consortium and 16 PAHs and crude oil as substrate, separately.

Discussion of Results

First, the degradation rate of PAHs monomers increased with the duration time and varied with PAH monomers. The highest degradation rate of phenanthrene, anthracene and fluoranthene, pyrene, benzo[a]anthracene are 98.50%, 59.04%, 29.49%, 29.19%and 21.68%, respectively during 150 day degradation. Second, there is a significant difference in the degradation rate of PAHs with different number of rings in crude oil. The biodegradation rate of three-ring and four-ring PAHs(including phenanthrene, anthracene, fluoranthene, benzo[a]anthracene, pyrene, chrysene) increased and then decreased with the degradation time, while the biodegradation rate of five-ring and six-ring PAHs showed an increasing trend. This may be due to the degradation of the alkyl-PAHs or LMW PAHs produced by the degradation of HMW PAHs. Third, the biodegradation could impact on PAHs source apportionment parameters at some extent. As observed for the biodegradation of 16 PAHs, which induced an increase in the An/(An+Ph) ratios, while parameters including Fl/(Fl+Py), BaA(BaA+Chr) and LMW/HMW showed an decreasing trend with the increase of degradation time and IcdP/(IcdP+BgP) stay stable. As a result, some diagnostic ratios failed in a 150-day degradation period.

[1]Park et al. (2011) ARCH ENVIRON CON TOX 60(4),576-589. [2]Tobiszewski and Namieśnik (2012) ENVIRON POLLUT 162,110-119.