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Behaviour of PAHs during sewage sludge fermentation in the presence of sulphate and nitrate

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ABSTRACT

In this study, the changes of polycyclic aromatic hydrocarbons (PAHs) in sewage sludge and supernatants during anaerobic digestion under nitrate- and sulphate-reducing conditions were investigated. $NaNO_3$ or Na_2SO_4 were added to the mixed sludge in order to obtain denitrification and sulphate reduction conditions, respectively. Abiotic loses of PAHs simultaneously were observed. Abiotic samples (with sodium azide) were also prepared. All sludge samples (biotic and abiotic) were incubated at 35°C in the dark. PAHs concentration was determined before incubation, after 13 d and after 20 d of incubation. Quantification of 16 PAHs (EPA) was carried out by GC-MS. PAHs were determined both in sewage sludge and in supernatants. During hydrolysis of organic compounds (first phase of fermentation) in the control samples (in sewage sludge and in supernatants) the increase of PAHs concentration occurred (especially naphthalene and 3-ring PAHs). The concentration of 16 PAHs in sewage sludge was reduced by 30% on average under nitrate-reducing conditions after 20 d and by 32% on average under sulphate-reducing conditions, respectively. The effectiveness of reducing of individual hydrocarbons was different. The concentration of carcinogenic PAHs in sewage sludge was reduced by 73% on average under nitrate-reducing conditions and by 79% on average under sulphate-reducing conditions, respectively.

Keywords: Sewage sludge; Supernatants; 16 PAHs; Redox condition; Fermentations