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Sorption of benzo(a)pyrene by Soils of Surface Horizons in the Coastal Zone

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ABSTRACT

Contamination of coastal soils with toxic and carcinogenic substances leads to disruption of the barrier functions of the entire aquatic ecosystem, which is a serious threat to the life and health of the population due to the increased risk of cancer. One of the most dangerous and widespread carcinogens in the environment is benzo(a)pyrene (BaP). To develop systems for predicting the state of coastal soils, information on the mechanisms of BaP accumulation in soils is required. In this regard, the aim of the work was to study the degree of pollutant sorption by coastal soils. To study the sorption characteristics of alluvial soils of the coastal zone in relation to BaP, soil samples taken from the surface horizons (0-5 cm) were saturated with the pollutant. The soils were characterized as medium loam and heavy loam. To saturate the pollutant samples, 0.2 g of soil samples were placed in dark 50 ml centrifuge tubes, 10 ml of BaP solutions in acetonitrile with a concentration of 100, 300, 600, 1200 or 2400 μg/ml were added, which corresponds to BaP concentrations of 0.39, 1.19, 2.38, 4.76 and 9.52 mmol/l. The resulting suspensions were shaken for 24 h on a reciprocating shaker, the mixture was centrifuged at 12000 rpm for 15 min in a centrifuge. The supernatant liquid was decanted, the sediment in the centrifuge tubes was dried in air in a fume hood, and the BaP content in the dried soil samples was determined by high-performance liquid chromatography (HPLC). For a general characteristic of sorption processes, the degree of pollutant sorption by soil was calculated as the proportion of pollutant absorbed by soil from the total concentration of BaP in the initial solution. It was found that BaP sorption in heavy loamy alluvial soil reaches 80.5%, in medium loamy soil – 75.2% with a pollutant content in the initial solution of 100 μg/ml. With an increase in the concentration of BaP in the initial solution during soil treatment, the degree of sorption decreases to 69.8% and 65.4% at 300 μg/ml, 61.2% and 40.5% at 600 μg/ml, 39.9% and 22.0% at 1200 μg/ml, 20.0% and 11.2% at 2400 μg/ml for heavy loamy and medium loamy alluvial soils, respectively. Thus, it was found that with an increase in the amount of fine particles, the sorption of BaP in alluvial soils increases from 75.2% to 80.5% at a pollutant content of 100 μg/ml in the initial solution. As the concentration of BaP in the solution increases during soil treatment, the degree of sorption decreases, which is more pronounced for medium loamy soil, where the proportion of sorbed BaP was 11.2%.

Keywords: PAHs, pollution, alluvial soils, coastal zone

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