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Ecological Risk Assessment of Polycyclic aromatic Hydrocarbons (PAHs) in Wastewater Treatment Plants (WWTPs) Sludge from three Major Cities of Uttar Pradesh

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Abstract—*Persistent organic pollutants, such as Polycyclic aromatic hydrocarbons (PAHs), are characterized by their high toxicity and potential for mutagenic and carcinogenic effects. Distribution and ecological risk of 16 U.S. Environmental Protection Agency (USEPA) recognized polycyclic aromatic hydrocarbons (PAHs) were studied in sludge samples from wastewater treatment Plants (WWTPs) from major cities of Uttar Pradesh, India 10 batches of each Dry and Wet Sludge sample were taken from Lucknow, Kanpur, and Prayagraj during pre- and post-monsoon season. The EPA 8310 technique is used for PAH extraction and analysis. PAHs levels for the Pre-monsoon period in Lucknow, Kanpur, and Prayagraj varied from 5.9-1496.9 ng g^{-1}, 13.1-4339.9 ng g^{-1}, and 34.7-6628.4 ng g^{-1}respectively. PAHs levels for the post-monsoon period in Lucknow, Kanpur, and Prayagraj varied from 11.4-2196.9 ng g^{-1}, 7.8-1220.7 ng g^{-1}, and 15.8-4198.2ng g^{-1} respectively. The sludge sample's LOD, LOQ, and Recovery fall within the ranges of 1.18-23.92, and 3.95-79.67, respectively. The ecological risk of the maximum concentration of ΣPAHs and individual PAH were evaluated to understand the pollution status of the agriculture field. The RQ is defined as the ratio of a point estimate of exposure and a point estimate of effects. The negligible concentrations (NCs) and the maximum permissible concentrations (MPCs) of PAHs in the sludge sample were used for risk analysis. RQ is defined as RQ(NCs) and RQ(MPCs). RQ(NCs)<1, indicated no particularly serious ecological risk. RQ(NCs)>1, RQ(MPCs)<1 indicated that the current ecological risk caused by PAHs is moderate and potentially risky, while RQ(MPCs)>1 indicated that PAHs present in sludge have a high ecological risk. While RQ∑PAHs (MPCs)>1.0 indicated that the pollution of the individual PAHs was significantly more serious and that some control and remedial actions be done right away, RQ∑PAHs (NCs)>1.0 indicated that the individual PAHs might be of likely moderate significance. Anthracene, Benz[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Dibenz[a,h]anthracene, Indeno[1,2,3-cd]pyrene and Benzo[ghi]perylene RQ(NCs)>1.0 value found in the sludge samples from all three cities, which pose a moderate risk for ecology and environment. The levels of RQ(MPCs)>1 for Benz(a)pyrene (BaP) and Dibenz[a,h]anthracene in pre- and post-monsoon sludge samples from all three cities indicate very significant contamination. In Pre-monsoon samples from Lucknow and wet samples of post-monsoon from Lucknow, Kanpur, and Prayagraj, RQ∑PAHs (MPCs)>1.0 which indicates the pollution of the individual PAHs were significantly more serious and posed a negative impact on the environment and Biota.*

Keywords: *Polycyclic aromatic hydrocarbons (PAHs), Risk quotient (RQ), U.S. Environmental Protection Agency (USEPA), wastewater treatment plants (WWTPs), toxic equivalency factors (TEFs), Benz(a)pyrene (BaP).*