

Abstract

Contamination of sediment by persistent organic pollutants (POPs) and plastic pellets together with the other forms of plastic debris was evaluated bimonthly during May 2011 to March 2012 in four beaches named Aksa, Versova, Juhu and Dadar along Mumbai coast. Plastic debris recovered by floatation in concentrated NaCl was categorised into three classes based on size, colour and weight and quantified in terms of the number and weight of items. Three groups of POPs such as polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and polycyclic aromatic hydrocarbons (PAHs) were analysed by gas chromatography. The mean abundance of plastics was 7.49 ± 1.02 g (0.17-56.27 g) by weight and 68.83 ± 16.74 items (12-960 items) by number per square metre and microplastics accounted for 42% numerically. Significantly higher accumulation by the number of items was found in Juhu beach and by weight in Dadar beach. The mean concentrations of seven PCBs, 16 OCPs and 16 PAHs in plastic pellets were 54.92 ± 6.27 , 197.27 ± 30.21 and 9202.30 ± 114.89 ng g⁻¹ while these were 0.63 ± 0.10 ng g⁻¹, 1.15 ± 0.13 ng g⁻¹ and 106.39 ± 12.98 ng g⁻¹ in sediment, respectively. The PCBs in pellets and sediments was dominated by the lower chlorinated compounds. HCHs predominated over DDTs in pellets and sediment. Significant temporal variations of PCBs and OCPs were closely related to the weather pattern. PAH in plastic pellets and sediment proved the predominance of petrogenic sources over pyrogenic sources with significant temporal variation in relation to oil pollution. Significant correlations were found for PCB and PAH in pellets and sediment. The closely identical temporal and spatial trends were observed for POPs in plastic pellet and sediment. The contamination by organic pollutants was comparatively high in Versova and Dadar beaches. The study shows that plastic pellets can be used as a tool to monitor the POPs in coastal waters on regional scale to study the temporal variation. Data gathered through this study on the PCBs, OCPs and PAHs can be used as reference values for future POP monitoring programmes.