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Impacts of rubber factory wastewater on the stream macrobenthic assemblages

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In this study, we assessed how the rubber factory wastewater effluents change the water quality and sediment quality parameters in some factory-associated streams, namely the Aswathu Oya, Gurugoda Oya, and Rakwatthe Ela, in the wet zone of Sri Lanka, and how such changes influence the inhabiting macrobenthic assemblages. For this assessment, we established 06 sampling sites at the Aswathu Oya based on the judgmental sampling technique [*viz.* Site A (rubber factory wastewater effluent canal, Site B (point of effluent discharge in the stream, Site C (50 m upstream control site), Site D (50 m downstream site from site B, Site D (100 m downstream site from Site B, and Site E (150 m downstream site from site B], measured some water quality parameters [*viz.* Dissolved oxygen (DO), Chemical oxygen demand (COD), Biological oxygen demand (BOD_5), Conductivity, Total dissolved solids (TDS), Temperature (T), and pH] and sediment quality parameters [Organic matter content (OMC)] and, sampled the macrobenthic faunas in each site from December 2021 to January 2022 following standard field sampling techniques. We also retrieved the secondary research data from other streams that were also subjected to rubber factory wastewater effluents, namely Rakwatte Ela (2001) and Gurugoda Oya (2011), where both studies followed a similar sampling protocol. Data were analysed using univariate and multivariate statistical methods as appropriate. Although a certain degree of variation in data in the 03 temporal frames was noted, results revealed that all 03 streams share a common variation pattern in the water quality, sediment quality, and macrobenthic assemblages. For example, the COD, BOD_5, OMC, conductivity, and TDS levels were elevated, and the DO level was reduced significantly ($p<0.5$; ANOVA) in the highly polluted A and B sites in all 03 streams. The abundance of some macrobenthic species, particularly the tubificids and chironomids, was also significantly high ($p<0.5$; ANOVA) in these 02 sites. In contrast, the COD, BOD_5, OMC, conductivity, and TDS levels were low, but the DO level was significantly high in the furthest downstream site F and the upstream site C ($p<0.5$; ANOVA), but none of these parameters were significantly different between the two sites ($p>0.05$ ANOVA). The abundance of chironomids and tubificids was also significantly low in C and F sites compared to the highly polluted A and B sites ($p<0.5$; ANOVA). The species heterogeneity (H'), richness (SR), and evenness (J') of the macrobenthic assemblages elevated at the furthermost site F, where they became almost the same as those in upstream control site C. Therefore, the changes made by the rubber factory effluents to the water/sediment quality and the macrobenthic assemblages in the factory-associated streams are never permanent and disappear within a relatively short stretch of 150 m along the streams, most probably due to dilution of wastewater along the stream and the pollution-tolerant tubificids and chironomids are excellent bioindicator candidates to detect such changes.

Keywords: Chironomids, Macrobenthos, Point source pollution, Rubber factory effluents, Tubificids