Proceedings of the 8th World Congress on New Technologies (NewTech'22)
Prague, Czech Republic– August 03-05, 2022
Paper No. ICEPR 133
DOI: 10.11159/icepr22.133

Assessing Transport of Microplastics in the Ergene River

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Extended Abstract

Microplastic pollution has become a global concern, particularly in the last decade due to their rapid increase in the environment. Rivers are the major transport pathways of microplastics to reach the marine environment. Understanding how microplastics are distributed horizontally and vertically in rivers is a requirement to assessing the risks associated with microplastic abundance. This study aims to investigate the effect of flow characteristics on the transport of microplastics and identify transport of these particles mechanistically between a tributary and main stream of the Ergene River, Turkey using mass-balance and hydrodynamic equations. For this purpose, Corlu tributary of the Ergene River was chosen as the study area.

River samples were collected from the six stations of the Ergene River including Corlu tributary and upstream and downstream of the outfall of this tributary in September 2020. Fifteen litres of water sample were collected from the water surface of each sampling station using stainless-steel buckets and transferred to glass bottles. Additionally, the parameters including flow rate (m s^{-1}) and stream depth (m) of the river were measured using Acoustic Doppler Current Profiler instrument. After removing organic matter, the collected water samples were filtered onto a plankton mesh with 45 µm pore size. Microplastic particles were visually identified under stereo-microscope (Olympus SZX 16, 30x) and transferred to a clean cellulose filter paper, previously checked for airborne contamination. Microplastic particles were photographed and counted by the help of ImageJ software.

Turbulent flow in rivers leads the lower mass of water to move towards the upper mass and exchanges momentum of river flow completely. River velocity fluctuations as a result of turbulence and the depth-dependent velocity profile were estimated for each sampling station using hydrodynamic parameters measured in the field. The model was validated comparing mean values of predicted velocity profile with the measured river velocity in the field. Finally, transport of microplastics was identified mechanistically using a mass-balance approach between sampling stations for a predetermined control volume. The time-dependent variation of microplastics between sampling stations was estimated, considering the river flow characteristics. Since river velocity varies with turbulent flow, the probable amounts of microplastics at these locations were calculated by Monte-Carlo simulation using GoldSim software [1] as the modelling environment.

Microplastic levels in Station 3 were found extremely high, probably due to intensively active textile industries within this area. Additionally, the temporal change of microplastics with turbulent flow was estimated mostly at Station 3.

Acknowledgement

This research is supported by Boğaziçi University Research Fund Grant Number 14507.

References

[1] GoldSim Technology Group, *GoldSim User's Guide*. WA, 2021.