Occurrence of microplastics in a coastal aquifer in Northwest Mexico

Daniela Alvarado-Zambrano*[1], Jose Roberto Rivera-Hernández[1], and Carlos Rene Green-Ruiz†[2]

[1]Universidad Politécnica de Sinaloa – Carretera Municipal Libre Mazatlán Higueras Km 3, 82199. Mazatlan., Mexico

[2]Instituto de Ciencias del Mar y Limnología. Universidad Nacional Autónoma de México. – Cap. Joel Montes Camarena s/n, Cerro del Vigía, 82047. Mazatlan., Mexico

Abstract

Due to their ubiquity, slow degradation rates, toxicity, and interaction with chemical contaminants, microplastics (MPs) are considered emergent pollutants. These materials have been studied on biota and other environmental compartments, such as soils, and fresh and seawater. Despite the importance of groundwater as a resource for millions of people worldwide as drinking water and personal hygiene, domestic, agricultural, mining, and industrial purposes, there are very few studies concerning MPs in this compartment around the world. Six capped boreholes were analyzed in terms of abundance, concentration, and chemical characterization of MPs, at three different depths, from a coastal aquifer (Laguna Agua Grande aquifer) in Northwest Mexico. This aquifer is highly permeable and affected by anthropogenic activities like agriculture and septic tank outflows. A total of 221 particles of MPs were found in the eighteen samples. In terms of concentration, the interval ranged from 4 to 29 particles/L, with an average of 12.3 particles/L. Four synthetic polymers were identified: isotactic polypropylene (iPP), hydroxyethylcellulose (HEC), carboxylated polyvinyl chloride (PVC), and low-density polyethylene (LDPE); being iPP the most abundant (64.3%) in all the boreholes. Agriculture activities and septic outflows are considered the potential regional sources of these contaminants into the aquifer. Three possible transport pathways to the aquifer are suggested: (1) marine and (2) marsh intrusion, and (3) infiltration through the soil. In Mexico, there is no regulation regarding the discharge of plastic waste from anthropogenic activities into the environment, nor the management of groundwater contaminated with plastics for different purposes. More research about the occurrence, concentration, and distribution of the different kinds of MPs in groundwater is needed to better understand the behavior and health risks to organisms, including humans.

Keywords: Coastal aquifer, microplastics, groundwater

*Speaker

†Corresponding author: cgreen@ola.icmyl.unam.mx