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Evaluating the Environmental Risks of Metal Leaching from Bioplastics in Tropical Seawater at Different Temperatures

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Plastic production has experienced significant growth since the 1950s, with global output reaching approximately 400 million metric tons in 2022. This surge has led to substantial environmental challenges, as plastics persist in ecosystems for extended periods, contributing to pollution. In response to these issues, bioplastics have been proposed as a more sustainable alternative, aiming to decompose naturally and reduce environmental impact. However, both conventional plastics and bioplastics are composed of polymer materials and various additives introduced during manufacturing. These additives, which enhance specific properties of the plastics, can be potentially harmful to both environmental and human health. This study aims to detect and quantify metal-containing additives that are released from bioplastic products in marine tropical environments.

Leaching experiments were performed in seawater exposure media at 22 °C, 30˚C, 50 °C, and 80 °C to explore the effect of temperature on the leaching behaviour of bioplastics. Leachate samples were periodically collected to analyze the leaching kinetics. Inductively Coupled Plasma Mass Spectrometry (ICP-MS) was employed to detect 13 distinct metals in the leachate from various bioplastics. Of these samples, the largest variety and quantity of metals was found to have been released from a starch blend grocery bag and three oxo-biodegradable bags.