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A Novel Method for Removal of Hazardous Microplastics from Water Using Magnets

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Millions of tons of plastic are produced worldwide yearly , that can facilitate all aspects of people's lives [1]. Release of microplastics (MPs) into the environment and their degradation causes serious environmental issues. Atmospheric factors like waves, abrasion, ultraviolet rays, and light oxidation in combination with bacteria can break down plastic parts into micro and nano particles[2].

MPs are usually defined as plastic particles with a size of 100 nm to 5 mm [3]. MPs are classified into two categories: primary and secondary plastics. Primary MPs are intentionally produced (MP particles) for specific applications. Secondary MPs are created during the fragmentation and degradation process of MPs, including synthetic textile fibers[4, 5]. There have been several reports regarding MPs that enter to the environment at all steps of a plastic product life cycle, from producers to waste management. It has also been published that these materials have the potential to enter the food chain and harm the health of humans and other living beings[6, 7].

In addition, MPs have been detected in the gastrointestinal tract of marine animals, and the human intestine. MPs stimulate local immune responses in peripheral tissues because they are regarded as foreign bodies by the host organism. Furthermore, MPs can carry other chemicals, such as environmental pollutants and plastic additives, that may be released and cause harm[8].

MPs toxicity is controlled by different pathways depending on their chemical structure and adhesive additives used during polymerization. Their durability and low degradability require removal methods[5].

In the last decade, MPs have been recognized as a new pollutant, and for this reason, investment on a global scale in this new research field has greatly increased. Therefore, strategies to solve the problem of MPs pollution should focus on source control, remediation, and cleanup. Currently, five strategies have been considered for managing and controlling these materials, including removing plastic microbeads from personal care product, using biodegradable materials, improvement of reuse, recycle and recovery of

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plastics, improvement of separation efficiency at wastewater treatment plant, development of clean-up and bioremediation technologies[9].

In line with one of these strategies, researchers at the Royal Melbourne Institute of Technology (RMIT) have developed an economical and sustainable solution that achieves better results than conventional methods in just one hour. These studies have emphasized the use of powder-based adsorbents that extract MPs up to 1,000 times smaller than those currently detected in wastewater treatment plants. Adsorbents have been successfully tested in the laboratory, and these materials can be developed as a new, effective, and cost-effective way to remove MPs from waterways. It has been reported that the nano-pillar structure can be recycled from waste and also has the ability to be reused several times, which will benefit the circular economy and the environment. The adsorbent is made using nanomaterials that can mix with water and in turn absorb MPs and dissolved pollutants. The surface properties of the adsorbent are prepared in such a way that it can effectively and simultaneously remove both MPs and soluble pollutants from water. Using these adsorbents, MPs can be removed that are a thousand times smaller than those currently detectable by wastewater treatment plants.

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