ABSTRACT

Polymers commonly found in clothing, such as nylon and polyester, contribute to a significant percentage of all micron-scale (< 1 mm) oceanic plastic pollution in the form of microfibers. These microfibers fall off clothes during the high RPM and vigorous shaking of a typical washing machine unit, and exit in the wastewater expelled from the unit during the washing cycle. Too small to be filtered out by municipal septic systems, these microfibers enter natural bodies of water and act like micro- sponges for organic compounds while also being eaten/inhaled by marine life. This research sought to investigate the effects of parameters such as polymer type, clothing age, and cycle type on the amount of microfibers that leave washing machines in an average cycle. Five articles of fabric of different synthetic compositions were analyzed for this project. The average masses of microfiber released from a rag, sweater, ski pants, jacket, and blanket were found to be 0.0043 ± 0.0029, 0.012 ± 0.0063, 0.020 ± 0.0072, 0.031 ± 0.0092, 0.055 ± 0.011 grams per liter of washing machine wastewater. The microfiber length ranged from 200 to 4400 microns, with an average of 412 ± 326 microns. The microfiber diameter ranged from 15 to 30 microns, with an average of 22 ± 7 microns. In addition to quantifying the mass of microfiber pollution, simultaneous research was performed on developing an inexpensive membrane separator that can reduce the amount of microfiber pollution. A sand and stainless steel mesh membrane was found to be sufficient at removing 98% of all microfibers in washing machine wastewater.