Development of Innovative Strategies to Protect the Aquatic Environment from Household Plastic Microfibers

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Every day millions of loads of laundry including synthetics are done in the United States alone. During washing, microplastic fibers are released from the fabric and discharged into the wastewater. Currently, wastewater treatment allows a significant amount of these microfibers to be discharged. This research aims to reduce microfiber release into the environment. Nine commonly used types of fabric were washed, and the wash-water was collected. This wash-water was analyzed for number of sub-micron plastic particles, average size of plastic particles, and charge (Zeta-potential) on the plastic particles. All fabrics produced significant numbers of micro-plastic fibers. The microplastic particles were found to be less than 0.7 microns in size using a Malvern Zeta-Sizer. The microplastic particles had a significant amount of negative charge associated with them. This is too small to settle in a reasonable time. The negative charge would keep the particles in suspension due to electro-static repulsion. To get the particles to settle, they need to have the charge neutralized and be allowed to grow into larger particles. A cationic polymer was needed to remove the microplastic particles. Poly DADMAC (poly-diallyl dimethyl ammonium chloride) was selected for this study. Differing doses of poly-DADMAC were added to wash-water obtained from washing four types of fabrics (fleece, jersey, rayon and microfiber sheet material) and allowed to gently mix (75 rpm) in a Phipps & Bird Stirrer for 30 minutes. The resulting solutions settled for one hour, and the numbers of remaining particles were determined by microscopic counting. Six replicates were performed. A dose of 40 mg/l of poly-DADMAC reduced the number of microplastic fibers by 95 to 98 percent.

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