Reduction of Microplastic release in Textile Laundering by PVA Nanofibres

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Abstract: The reduction of microplastics, small polymeric particles less than 5 mm in size, is essential to safeguard ecosystems, protect human health, support sustainable economic activities and contribute to global efforts towards a more environmentally responsible and sustainable future [1].

Textile wastewater may contain microplastics due to various sources within textile manufacturing processes and due to their use. However, microplastics may also be generated due to the use and care of clothing. Different processes such as washing at home, abrasion during use, deterioration of the textile over time or the generation of lint in the drying machine, pose a problem due to the generation of microplastics [2-4].

As a solution to these problems, electrospinning equipment has been used to generate nanofibrous filter surfaces. Polyvinyl alcohol (PVA) nanofibres were synthesized and subjected to some thermal modifications to insolubilize them and a series of tests to assess their structural integrity and filtration efficiency.

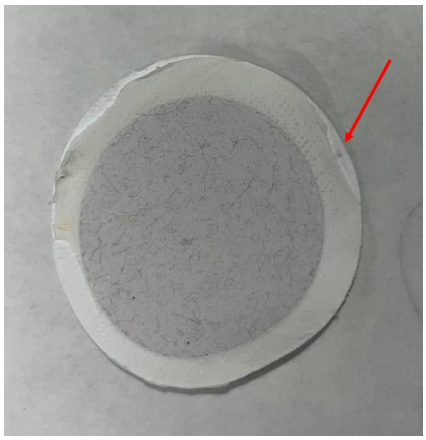

Figure 1 Filter coated with nanofibers after wastewater from laundry filtration.

Glass nanofiber filters were coated with PVA nanofibers, thermally reticulated. After laundry, the wastewaters were filtered. Figure 1 shows the nanofibers on the glass fibers. The red arrow shows a zone where the nanofibers have been peeled off. The dark circle shows the filtration zone with microplastics. The filtration results demonstrated that the nanofibrous filter was useful to capture these microplastics, and also showed that the longer the electrospinning time, the higher the filtering capacity. SEM images and results showed the presence of microfibres retained in the nanofibrous filters as well as a high amount of soap particles used in the washing processes.

The results also show a higher presence of microplastics from those textiles with recycled yarn compared to those with virgin yarn. This may be due to the mechanical treatment applied to the yarns to recycle the fibres, which may have shortened the fibre length.

Research indicates that the incorporation of PVA nanofibres into laundry wastewater treatment systems could significantly reduce microplastic pollution. This study underlines that PVA nanofibres are a promising remedy for a critical environmental problem, with great potential to improve the sustainability of textile maintenance procedures.

Keywords: *polyvinyl alcohol, crosslinking, filter, electrospinning.*

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