

Washing Effects of Sodium Fatty Acid on Various Fiber Materials Evaluated by ATR-FT/IR Method

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To investigate the detergency of oil-based soil components (olive oil) with sodium fatty acid for cotton as well as polyester, wool, and silk fabrics, oil-based soil components adhering to artificially soiled fabric surfaces made of various fiber materials were directly and independently quantified using attenuated total reflection (ATR)-FT/IR method, and the detergency of oil-based soil components with varying washing times was evaluated. In addition, the amount of oil-based soil on four kinds of fiber materials was compared by the ATR-FT/IR difference spectra between an original fabric and artificially soiled fabrics with (for 10 min) and without washing.

The oily soil absorption bands of the ATR-FT/IR difference spectra between an original wool fabric and artificially soiled fabrics washed for 0–10 min at 60 rpm are shown in **Fig. 1**. Two absorption bands of the oil-based components are observed around 2930 cm⁻¹ and 2850 cm⁻¹, and their peak intensities did not change after 1 min from the start of washing but significantly decreased after 10 min. This delay may be attributable to the barrier function of cuticles and the hydrophobic extracellular membrane (epicuticle) covering its top surface. In contrast, although the detergency of silk increased with an increase in washing time, oil-based soil components adhering to silk fabrics were not removed compared with those of wool fabrics even after 10 min of washing (**Fig. 2**). This is presumably because the oil-based components easily penetrate into silk fibrils and cannot be easily removed. Furthermore, the IR signal of the oil-based soil content adhered to the surface of unwashed wool fabrics was larger than that of silk fabrics. These results indicate that the detergency of both fabrics depends not only on their chemical properties but also on the surface structures of the fibers.

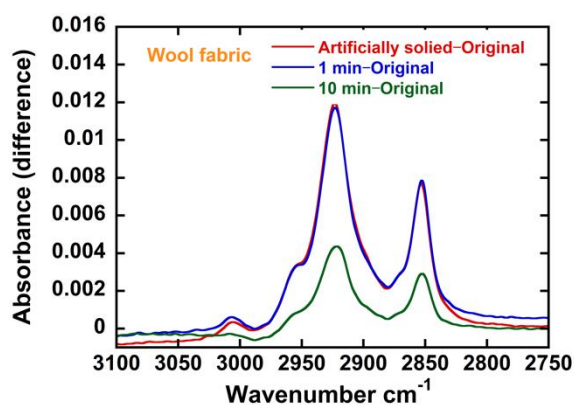


Fig. 1 Variations of the oily soil absorption bands in the ATR-FT/IR difference spectra between an original wool fabric and artificially soiled fabrics washed for 0–10 min at 60 rpm.

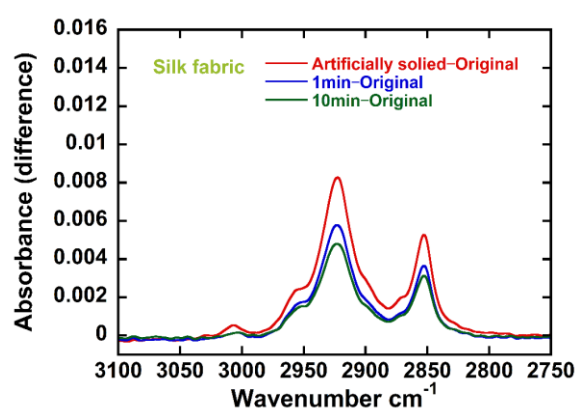


Fig. 2 Variations of the oily soil absorption bands in the ATR-FT/IR difference spectra between an original silk fabric and artificially soiled fabrics washed for 0–10 min at 60 rpm.

Keywords: ATR-FT/IR method, artificially soiled fabrics (cotton, polyester, wool, and silk), sodium fatty acid, washing effects, oil-based soil components, ATR-FT/IR difference spectra