

## Application of the Scanning Electron Microscope to Detergency Problems

While detergent evaluation is routinely performed on a quantitative basis in such a way that some tracer (soil) removal is measured, it is seldom that the character of the soil or the mechanical effect of its removal from the fabric can actually be viewed.

Such an evaluation of these types of surfaces was made in our laboratory using a scanning electron

microscope (SEM). The SEM used for these studies was a Cambridge Stereoscan Mark II. The fabric was a polyester-cotton (65:35) broadcloth (Fig. 1), and the soil was natural sebum collected on swatches rubbed across the face and neck to collect soil. The washes were made at 0.15% detergent concentration

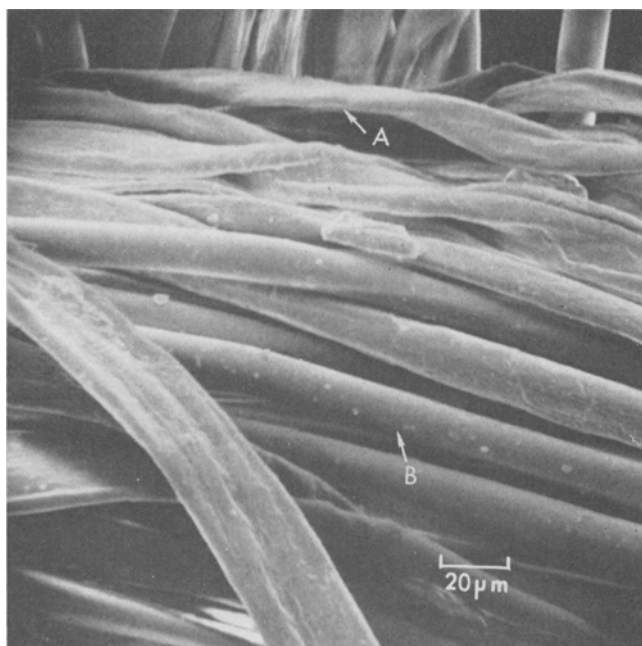


FIG. 1. Unsoiled fabric. Note differentiation between cotton (A) and polyester fibers (B). X450.

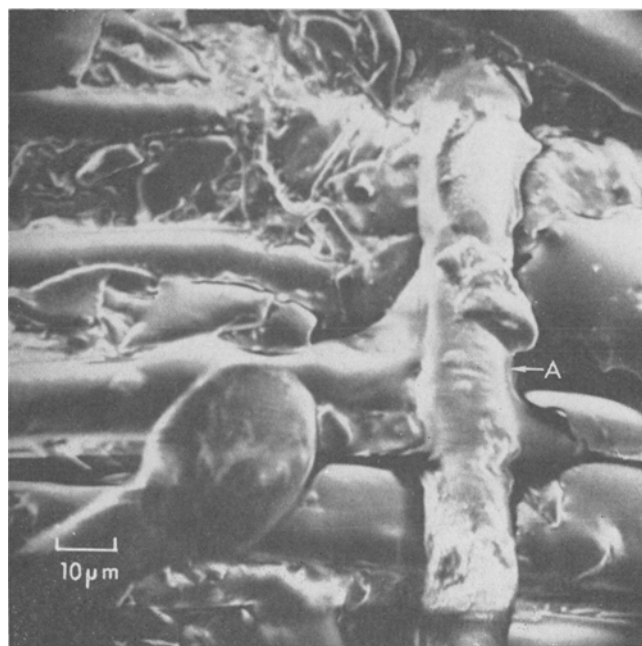


FIG. 2. Sebum-soiled fabric. X810. (A) Fiber coated with sebum.

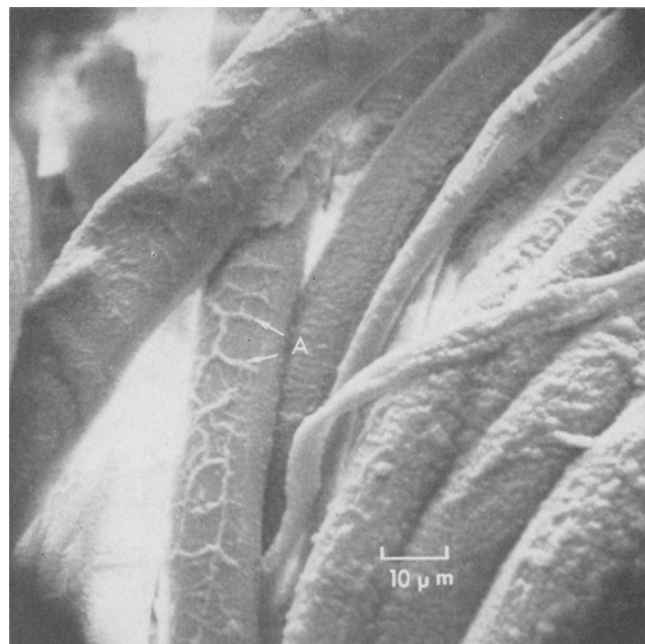


FIG. 3. Soiled swatch washed once. Note retracted and retained soil (A). X850.

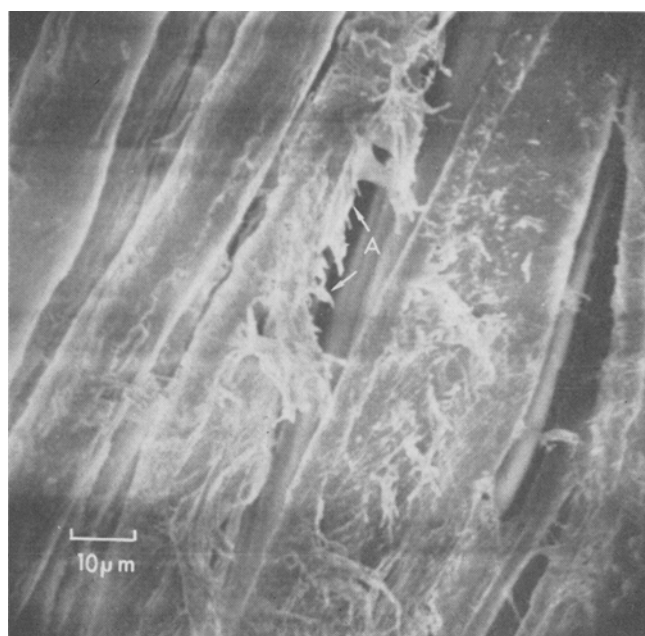


FIG. 4. Unsoiled swatches washed 20 times along with soiled swatches. Note lack of redeposition of sebum, and the fibrillation resulting from mechanical action during washes. Fibrillation (A) appears to occur largely with cotton fiber.

at 120 F for 10 min.

The photographs obtained with the SEM show the mode of soiling (Fig. 2), the relative soil removal after one wash (Fig. 3), and the redeposition and abrasion effect on the fibers after 20 washes, which caused fibrillation especially of the cotton fiber (Fig. 4). These examples suggest that the SEM could be used very successfully to show for example the

placement of particulate soil in the yarn of fabrics, degradation of fabric as a result of mechanical action, redeposition and distribution of soil and stains, and stain removal by enzymes.

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