H. Dokter submission - Attachment #4

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Dispersion Mechanism of a Pesticide Chemical in Woven Fabric Structures

REFERENCE: Kim, C. J. and Kim, J.-O., **"Dispersion Mechanism of a Pesticide Chemical in Woven Fabric Structures,"** *Performance of Protective Clothing: Second Symposium, ASTM STP 989,* S. Z. Mansdorf, R. Sager, and A. P. Nielsen, Eds., American Society for Testing and Materials, Philadelphia, 1988, pp. 680–691.

ABSTRACT: The dispersion mechanism of a DDT solution in a variety of woven fabric structures is described. The dispersion is illustrated by scanning electron microscope (SEM) micrographs and related to fiber morphology, fabric geometry, weight, and finish. The kinetics of dispersion is related to the size and shape of the dispersion area and to the concentration of radioactive-labeled DDT. Findings show that final location of DDT within textile substrates is related to fiber content and morphology, fabric geometry, and finish. Fiber irregularities serve as deposit sinks for the chemical soil. The finish influences soil dispersion by making the fiber surface smoother. Fabric weight and geometry determine the size and shape of the dispersion area. The maximum concentration of DDT deposit is found to be at the outermost boundary of the dispersion area, not at the center.

KEY WORDS: capillary radius, chemical soil, cotton, cotton/polyester blend, DDT, deposit sink, dispersion areas, dispersion mechanism, fabric and yarn geometry, fiber morphology, finish, pesticide, polyester, protective clothing, radioactive-labeled, scanning electron micrographs

Concern for safety with respect to exposure to pesticide has increased in recent years. Human exposure and absorption of pesticide can be minimized through the appropriate use of clothing as a body covering. When the contaminated clothing comes in contact with the skin, the chemical transfers from the fabric to the skin [*1,2*]. If the contaminant chemical is not removed from the clothing, the skin may absorb the chemical from the clothing fabric [*3*]. Appropriate care methods for washable, contaminated clothing, therefore, would reduce the health risk from pesticide exposure [*4*].

To select effective methods of removing chemical soils from contaminated fabrics, it is necessary to understand the soiling process and the distribution of the soil in a fabric structure. The literature has shown that soiling and soil-release processes are controlled by many of the same parameters [*5*]. The purpose of this research is to describe the soil-dispersion mechanism of an industrial/pesticide chemical in fabrics having different geometries and characteristics, in terms of the final location of the soil, the size and shape of the dispersion area, and the soil concentration in specific locations of the dispersion area.

The main soiling mechanism for liquid soil is reported as capillary penetration [*6*]. According to Raheel and Gitz [*7*], the rate of penetration and transport of a pesticide-soil solution from a garment to the underlayers depends on fabric geometry. For all-cotton fabrics, the ease of wettability is higher in fabrics with larger interfiber and interyarn cap-

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