

Application and Analysis of Chemical Testing on Regenerated Cellulose Fibers

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Fibers can play an important role in forensic cases and potentially help solve a crime. Due to fibers being small in size, easily transferred, and found in various places, fibers can be key pieces of associative evidence. One method that can be used in the analysis of fibers is chemical testing, a quick, easy, and relatively cheap presumptive method to qualitatively identify them.

The focus of this research was on regenerated cellulose fibers. Some classifications of chemically processed cellulose include viscose/rayon, modal, and acetate. Two types of chemical tests used on cellulose are zinc-chloro-iodide, based on color change, and cupriethylenediamine hydroxide, based on solubility. Prior results reported in the literature have shown that zinc-chloro-iodide will stain a blue-green color on viscose/rayon and violet on cotton, while other fibers stain a yellow-brown. Viscose/rayon is also reported as being soluble in cupriethylenediamine hydroxide.

The purpose of this research was to apply these chemical tests to fibers from a variety of modern samples. Viscose, rayon, modal, and acetate of different dyes, textures, and manufacturers were chosen to test if results were consistent with prior testing or if these differences would cause variable color changes and solubilities. The different classes were also compared to see if there were any differences among them.

Since the chemical tests are used for cellulose, 100% cotton samples were used as positive controls. 100% polyester was used as a negative control since it is a pure synthetic fiber containing no cellulose. Fibers from 35 different known samples were tested 10 times each for 3 trials using both chemical tests.

The behaviors of the positive and negative controls for zinc-chloro-iodide were very similar to that of previously reported results. Viscose and modal fibers tested similar to the positive controls, while there was some variation with the rayon samples. The acetate, however, had a distinct color difference.

The behaviors of the positive and negative control for cupriethylenediamine hydroxide were also similar to that of previously reported results. The 100% cotton fibers dissolved immediately and fast, while the 100% polyester was insoluble after 5 minutes. Viscose and modal were consistent with the positive controls. For this test, rayon also had a slight variation, while acetate had a distinct solubility difference.

This research suggests that class, dyes, textures, and manufacture influence the results of the chemical tests even though the fibers are all regenerated cellulose. Current testing of unknowns suggests that some can be distinguished, while others can be narrowed down. Further research will focus on testing more unknowns to determine accuracy of the chemical tests and if zinc-chloro-iodide and cupriethylenediamine hydroxide are reliable presumptive tests.