TECHNICAL NOTE

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Chemical Reagents for the Development of Latent Fingerprints. III: Visualization of Latent Fingerprints by Fluorescent Reagents in Vapor Phase

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ABSTRACT: The use of certain fluorescing vapor-phase chemicals for the development of latent fingerprints is described. Some advantages of these chemicals over other methods that use fluorescers are discussed.

KEY WORDS: criminalistics, fingerprints, reagents, luminescence

There are indications that certain fluorescent reagents develop latent fingerprints on paper with a sensitivity higher than that of common colorimetric reagents. Mayer et al [*1*] have reported the study of fluorescamine and the use of *ortho*-phthalaldehyde in aerosol form for developing latent fingerprints. Menzel, Duff, and Dalrymple [*2-4*] reported the dusting of latent prints with coumarin 6 powder for laser illumination and the study of other fluorescers applied by dusting for ultraviolet (UV) illumination. Thornton [*5*] has modified the technique of dusting with coumarin 6 for laser visualization.

We have examined the possibility of developing latent fingerprints on paper by the application of certain fluorescers *in the vapor phase* in a manner similar to the common iodine fuming technique.

The potential advantages of reagent application by sublimation over application by dusting or spraying are the following:

1. The reagent is very evenly distributed.
2. There is no need for solvents that may destroy documents.
3. In the vapor phase the active "particles" are much smaller and thus a better resolution can be achieved.

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Eight fluorescing chemicals that sublime readily have been tested. All these compounds are crystalline solids at room temperature:

(1) anthracene,
(2) anthranilic acid,
(3) perylene,
(4) Rhodamine B,
(5) Rhodamine 6G,
(6) 7-diethylamino-4-methylcoumarin,
(7) triphenylcarbinol, and
(8) antimony trichloride.

Experimental Procedure

Latent fingerprints were collected on commonly used groundwood-free paper for an earlier study [*6–7*], and these fingerprints served for this project as well.

The exhibit under investigation was suspended over a crucible containing a few grams of the solid reagent (Compounds 1 to 7), about 5 cm from the crystals. The crucible was heated gently on a hot plate to 50 to 70°C and the exhibit was removed after 1 or 2 min. It was then examined under UV light (360 nm). All seven reagents produced clear impressions of the latent fingerprints under the UV light. The best results for fresh (up to one day old) fingerprints were obtained by anthranilic acid. For older prints (a few days) anthracene produced somewhat better results. Satisfactory results were obtained also with perylene, 7-diethylamino-4-methylcoumarin, and triphenylcarbinol. The results with Rhodamine B or Rhodamine 6G were less satisfactory.

An interesting point is that while the fumes of anthranilic acid adhere to the ridges, anthracene condenses around the ridges but not on them. The adsorption mechanism is now under investigation. Figure 1 shows prints from the same finger that were developed by anthranilic acid and anthracene and an inked print for comparison.

The inorganic reagent antimony trichloride was examined in a different manner. The exhibit was placed in a closed desiccator over a few grams of antimony trichloride crystals. It was maintained at room temperature for 24 h and then examined under UV light

FIG. 1—*Three different prints from the same finger:* (left) *print developed by anthranilic acid;* (center) *print developed by anthracene; and* (right) *inked print for comparison.*

(360 nm). The fluorescence of the fingerprints was impressively strong, with a good resolution of the minutiae.

An argon-laser illumination under conditions similar to those described by Dalrymple et al [2] also produced very good impressions of the same latent prints.

Latent prints kept in the desiccator for longer periods (over three days) turned gray and became visible in daylight, but longer exposure to the reagent (over one week) blurred the impressions and the fluorescence disappeared. Also, the paper became very brittle.

Upon exposure of the gray images to hydrogen-sulfide fumes, the images turned orange and the good resolution was retained. We ascribe this coloration to the formation of the orange compound antimony sulfide, which indicates that antimony trichloride fumes were initially adsorbed onto the ridges of the latent print.

The advantage of the fuming method over dusting was demonstrated by simply comparing the results obtained by both techniques. Anthranilic acid and anthracene were applied as described and by dusting (with a very fine powder) to one-week-old prints taken from the same donor. While identifiable images were obtained by the sublimation technique, dusting with both powders did not reveal even the presence of the latent prints.

The influence of such factors as the type of paper and the age of the latent prints on the quality and persistence of the prints developed by the sublimation method is being investigated.

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