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EXAMINATION OF PAINT CHIPS AND SCRAPINGS WITH THE SPECTROPHOTOMETER

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The police laboratory is faced with a great variety of problems, most of which resolve themselves into identification and comparison of various materials which will connect the suspect with a particular crime or crime scene.

Paint and similar coatings are frequently obtained as evidence in cases where physical force has been used. Breaking and entering, safe burglaries, hit-and-run accidents, and even homicides may involve paint as evidence. The quantity of material varies considerably, but is usually quite small. With no standard quantity to work with, methods of analysis and comparison will also vary, and any method which will give additional information may be useful. Probably no single examination will give a positive identification of one specimen with another, but several examinations showing similarities will make the identification more nearly positive.

With these thoughts in mind, the use of the reflectance attachment of the Beckman Model B Spectrophotometer was considered for comparison of colors in paint scrapings and chips obtained during criminal investigations. Since the illuminated spot in this instrument is comparatively small (1/8 x 3/16 inches) adequate specimens will sometimes be available, and reflectance readings can be obtained. Results of these tests could be used to supplement visual, microscopic, chemical, and spectrographic examinations to show similarity or dissimilarity of color as well as composition, type of surface, impurities, and so on.

Several items should be considered before reaching any conclusion from reflectance values read from specimens of this type. Since the size and shape of the evidence specimens will vary considerably a strictly quantitative interpretation of the reading will not give direct results. However, the wave lengths of maximum and minimum reflectance should be similar from like specimens. It is doubtful if these values could be compared with known standards to identify the brand or manufacturer

of the paint because of the unknown degrees of weathering to which the evidence specimens have been exposed. A comparison of the evidence paint with specimens from the suspected source will give more conclusive results since, if they are identical, both specimens should have been subjected to the same conditions of weather, light, temperature, and so on. The color and character of the surface upon which the paint in question has been used will also have a considerable effect on the reflectance reading obtained. Many coatings, particularly the lacquer type often used on automobiles, are quite translucent and much of the light passes twice through the coating before reaching the photo tube, thus the color of the undercoat or surface beneath the paint may be recorded along with that of the paint itself. Metallized paints or those containing metal particles suspended throughout will give quite different reading than plain coatings. The presence of metal particles and undercoatings should be discernible from microscopic examination, and dissimilar coatings can be eliminated even without the use of the Spectrophotometer.

Procedures used in these types of examinations vary with the types of specimens available. Where large chips of paints were to be had or where a portion of the surface could be cut out these were placed directly in the specimen holder of the Spectrophotometer and readings taken. In some instances several chips were used to cover the illuminated area. For the smaller particles or scrapings a recessed plexiglass holder was used to concentrate the specimens in the area where the illuminated spot would fall. The recess of the plastic block was cut slightly larger than the dimensions of the illuminated spot to allow for slight shifting of the spot with changes in wave length. Careful selection of the particles was necessary to insure that the proper specimens were being compared and to separate extraneous material. Quantities of paint scrapings in the order of three milligrams were successfully used in these holders. Some difficulty was encountered from static charges on the particles of paint, particularly with plexiglass holders. A staticmaster photo brush was used to eliminate these charges by placing the plexiglass block in front of the area where the radiations were emitted while the specimens were placed in the recess. Any type of irradiation static eliminator should be satisfactory for eliminating these charges.

The Model B Beckman reflectance attachment is an integrating sphere and measures only the diffuse reflectance so that the change in the surface of the paint from a glossy to a powder or a collection of fragments does not change the reflectance reading unduly, and satisfactory read-

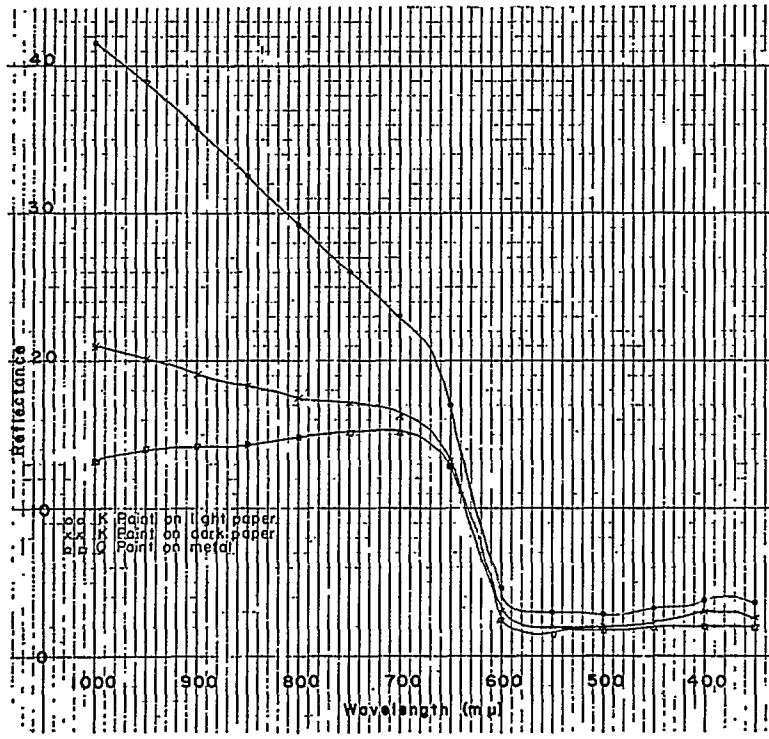

Figure 1.

ings apparently could be obtained from the types of specimens which would be obtained in many criminal cases. Both the red and blue photo tubes were used to cover the wave length range from 1000 to 350 μ. The red tube records the range from 1000 to 600 μ and the blue tube from 600 to 350 μ. A magnesium carbonate standard was used, and the slit was adjusted to give one hundred per cent reflectance reading from this material. The tube mountings for the Beckman Model B Spectrophotometer come equipped with 500 megohm load resistors. By replacing these resistors with 2000 megohm resistors the effective band width is reduced by a factor of two. (Beckman Bulletin number 235.)

Several types of cases are recorded here where use was made of the reflectance readings on paint specimens.

A stolen car was recovered after it had been repainted. Specimens of paint were obtained from this car and from the outside of a paint container which was believed to have contained the paint used to repaint the car. Only paint from the outside of the container was available since the can had been refilled with another material. On visual observation the paints appeared similar in color (maroon). Spectrographic examinations showed similarity

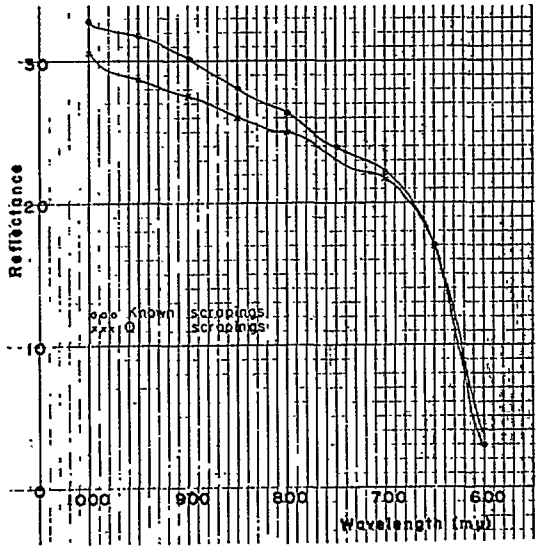

Figure 2.

also. Reflectance measurements were made with portions of the fender bearing the questioned paint and with portions of the label containing the known paint. There appeared to be a considerable divergence in the reflectance of these two specimens, particularly toward the infrared end of the spectrum (see Figure 1). The paint on the car fender was painted over an original black paint while the portion of label used in this instance was white or at least very light in color. By selecting another portion of the label which had black printing underneath the paint, another set of curves were run and in this case the reflectance more nearly matched that of the questioned specimen (Figure 1). An additional set of readings were made with scrapings from the questioned and known paint, which did not include any undercoat. The reflectance curves from these two paints agreed quite well, indicating that the paints themselves were quite similar in color (Figure 2).

In another case paint chips were obtained from the trunk of a car believed to have been used to haul away a safe which was later recovered after having been broken open. A comparison of the paint chips from the trunk of the car and paint scrapings from the door of the safe showed a very great similarity, and the reflectance curves were parallel throughout the range of the instrument (Figure 3). These reflectance values were similar even though there was some difference in the visual appearance of the paints, particularly with respect to the glossiness. This could readily be explained, however, by the fact that the safe from which the known paint was taken had been submerged in a creek for some time before it was recovered.

A third case involved the comparison of fingernail polish to assist in identifying coins taken from a coin operated machine which had been broken into. The proprietor in this instance had marked a number of the nickels used in the machine with a red fingernail polish. Reflectance readings were taken on coin specimens from the establishment and coins recovered from a suspect. The colors matched quite well with the reflectance attachment and also when

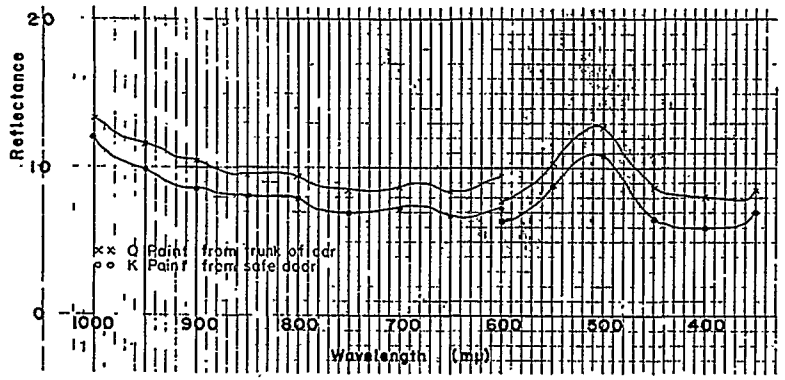

Figure 3.

some of the nail polish was dissolved in amyl acetate and transmittance readings were made.

A number of reflectance readings have been made on paint specimens from cars of various makes and colors; however, the number examined to date is not large enough to conclude that similar reflectance curves would indicate a positive identification. They do indicate a considerable difference from car to car and thus any similarities encountered would add one more link to the chain of similarities which might be found by microscopic, chemical, and spectrographic means.

Reflectance readings may be made from specimens of paints and coatings which are obtained in criminal investigations even though the quantity is fairly small. The required quantity is, of course, somewhat greater than that needed for spectrographic work. No standard procedure can be used for every case due to the variations in size and conditions of the evidence material. Quantitative results will probably be of little value as such, but qualitative results could be quite valuable. In interpreting results consideration must be made of such factors as undercoats, metal particles suspended in the material, and any matters which would contaminate the specimens as far as colored material is concerned. Each case must be studied separately and on its own merit. A considerable amount of control work will probably have to be done in connection with each individual case, and a number of blank and known determinations run. This, of course, is nothing new to Police Science, as controls and blank tests are required in most of our examinations.

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