Shandon Xylene Substitute in Document Examinations

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A variety of practical applications were found for Shandon Xylene Substitute in the examination of questioned documents. This product is marketed as a non-carcinogenic substitute for xylenes, but does not have quite the same properties. The most useful properties of this xylene substitute are that it is non-destructive to inks, paper and plastics, is less volatile than xylene, and is only a weak solvent of correction fluids. Its principal uses here have been to make paper translucent, thereby allowing obliterated writings to be read through the back side of the page. This translucent state also allows infrared examinations through the paper. Applications were made to cases involving obliterations made with correction fluids, overwritings, ink, and multiple layers of these materials. Shandon Xylene Substitute does not affect indented writings and ESDA examinations. It evaporates without leaving any odor, discoloration, or distortion.

Introduction

The necessity of finding a solution to a problem led to this document laboratory following up on an observation that a xylene substitute was useful for making paper translucent. As the problem evolved, a study evolved, and led to the finding that a product called Shandon Xylene Substitute has a variety of practical applications in the examination of questioned documents. This product is marketed as a non-carcinogenic substitute for xylene. It does not have quite the same properties as xylene and the differences make it more useful than xylene in questions involving obliterations to documents. This chemical allows for non-destructive examinations to reveal facts about writings hidden with correction fluid, ink, stickers, and labels.

Methods and Materials

The solvents used in this study were Shandon Xylene Substitute, xylene, mineral spirits, and 1-1-1 trichloroethane (correction fluid thinner). The papers used were similar to those found in casework and included: address sheets for a planner, card stock, carbon forms, 25% cotton paper, general use copy paper, a variety of notepad papers, manila folders, 0.5 mm pressboard, and 1 mm pressboard. The writing instruments included many random samples of ballpoints, roller balls, felt tips, plastic points, and a fountain pen. The correction fluids were of the brands Wite-Out™, PaperMate™, Liquid Paper™and Planet Pleaser™. Printed material consisted of examples from laser printing, inkjet printing, offset lithography and flexography.

All procedures were simulations of casework where handwritten text was covered with other materials. Most of these were on notepad papers and copy machine paper. However, printed products were tested to insure that document types routinely seen in casework were not adversely affected, and that random types of office paper, photocopy paper and printed products were examined.

Infrared examinations were conducted using two focused light sources having 500w projector lamps, blue-green glass excitation filters (i.e., Corning 9780), a controlled light document examination box, Leitz infrared longpass filters (a series from 700 nm through 950 nm), a Sanyo model VDC3785 video camera and a black-and-white monitor. Results that were photographed were made using a 35 mm camera focused on the monitor screen. An office photocopier was used to photocopy some of the simpler results onto transparencies.

The most common question in this type of casework is, "What was written under this correc-

tion fluid?" Therefore, most simulations were made with one, two, or three layers of correction fluid with ink writing between layers. Solvent added to paper was done with a dropper, one drop at a time, until the area in question became translucent. The results could then be observed visually, and then if necessary, enhanced with various lighting and viewing techniques. The xylene substitute evaporates slowly enough to allow the examiner to use whatever techniques are needed to complete the examination.

Results

Review of the Simple Sample

The simplest sample is when one layer of correction fluid, or a label, obscures writing. The translucent state of the paper due to the added solvent allows a view of the hidden writing through the back of the page. The result can be photographed, scanned to create a digital image, or photocopied onto transparency sheets to quickly get a right reading result. This result can be obtained on paper as thick as manila folders. For thicker material like pressboard, the image requires transmitted illumination from a focused source to get enough light and contrast to view the writing. Thin pressboard, less than 0.5 mm thick, may yield a readable result with strong transmitted light, but this material is better examined with classic infrared techniques. The addition of a solvent to the 0.5 mm pressboard did allow more IR throughput. The 1.0 mm pressboard was, expectedly, too thick.

Review of the Complicated Sample

A more complicated sample involves multiple layers of correction fluid and writing. If a luminescing ink is between layers of correction fluid, it is very difficult to detect the luminescence even though in similar samples infrared illumination penetrated the sample. It was observed that thick layers of correction fluid reflected most of the blue-green excitation light. Thin layers of correction fluids did not reflect as much light, and the luminescence was visible. Infrared illumination does penetrate the correction fluid in some samples, and makes infrared absorbing inks visible, but no attempt was made to determine the depth to which the infrared reaches. Therefore, it appears that the effectiveness of classic infrared examination techniques through the correction fluid has to be determined on a case-to-case basis.

Review of Translucent Paper

Making the paper translucent renders two other visualizations possible. First, more light is transmitted through the questioned area, and may allow visualization of the obscured writing. Second, any writing on the paper itself, i.e., the first writing, can still be examined by IR techniques through the back of the translucent paper, and two inks can be differentiated this way. Several casework samples involved names and addresses being scratched out before correction fluid was added, and then more writing and correction fluid was added over that. The first writing and its obliterating ink had very different responses to blue-green excitation, and therefore the entry written first was readable.

Review of Correction Fluids

An interesting observation was made that thin layers of some correction fluids induced previously non-luminescing inks to luminesce. Furthermore, if a thick layer of correction fluid was added, enough to obscure the luminescence from the face of the document, the luminescence could be observed through the back of the document. Another solvent used showed that the 1-1-1 trichloroethane had the same effect on those inks, but the solvent caused those inks to chromatograph, especially the component that luminesced. This leads to two implications for casework. First, the luminescence observed in an unknown ink covered with correction fluid may not be seen in the untreated ink. Second, if one ink has been used to obscure another ink, and both inks react the same to infrared examinations, it may be feasible to induce luminescence in only one of the two inks. How this might be tested in real casework is yet unknown.

Discussion

Several organic solvents could be used to make paper translucent. The main concern is to be nondestructive to the ink, paper, obscuring material, laboratory devices, and personnel. The Shandon Xylene Substitute does not affect any inks tested so far, including the new gel inks and Pentel's "Hybrid." It may soften correctable ribbon-typed text, as does xylene, but abrasion is required to

damage the typed characters. Xylene did not affect the gel inks, but did affect many aqueous inks, most from felt tip pens. Xylene also evaporates too quickly to be useful on even the tenacious inks. Xylene dissolves correction fluids readily enough to be a destructive solvent on the document. Mineral spirits was not found to affect any inks tested, but evaporated too quickly to be useful. Both mineral spirits and xylene substitute are weak solvents of some correction fluids and did not dissolve some of those found in casework samples. Neither of these dissolved the correction fluid fast enough to damage the evidence in the course of reading the obscured writing. Also, 1-1-1 trichlorethane, the correction fluid solvent, is a rapid solvent of the dried correction fluid and was damaging to some inks, therefore it was not useful for any careful examination of documents in casework.

Perhaps one of the most important properties of the xylene substitute is that when it evaporates, there is no residual odor, wrinkling of the paper, or visible residue left on the paper.

ESDA Examinations

ESDA examinations are unaffected by the addition of any of the tested solvents once the solvents have completely evaporated from the paper. Impressions are unaffected. One way of visualizing writing obscured by correction fluid is to run an ESDA examination of the back side of the page. Sometimes, even sidelighting of the face of the correction fluid allows a visualization of impression. A word of caution, though, is that impressions from overwriting may appear as part of other writing and also that some impressions don't appear in the correction fluid when others do. Some potential problems may exist here, as they may in the decipherment of any obliterated writing.

About Xylene Substitute

Since the xylene substitute was a weak solvent of some correcting fluids, it was sometimes possible to remove a layer of correction fluid without affecting the underlying ink and/or correction fluid. The submitter of the document should first consent to the altering of the document by removal of a blank layer of correction fluid, and even then it is still wise to proceed with much caution. If there are multiple layers, it is necessary to insure that removal of the top layer can be done separately from the layer below. The best technique found was to moisten a cotton swab with the xylene substitute and roll it across the correction fluid, repeating the process until the layer is very thin or removed. It was noted that some brittle underlying layers of correction fluid with their respective layers of writing cracked away from the paper when the top layer was removed. Other layers may soften when the top layer softens. The best scenario for the removal of a layer is when the layers are very different, yet this may not be readily apparent.

Conclusions

1. A product sold as Shandon Xylene Substitute can make papers translucent.

2. This product does not evaporate as quickly as xylene or mineral spirits.

3. This product does not damage the questioned inks, paper, impressions, or printed matter.

4. Infrared examinations can be conducted through the translucent paper.

5. Casework questions have been answered that would not have been possible without some solvent to make the paper translucent.