Indentation Examination Enhancement

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This research was conducted to test whether adding moisture directly to cascade developer beads would improve Electrostatic Detection Apparatus (ESDA) results. The ESDA was used to detect latent indented impressions on 100 sheets of paper containing indentations. Fifty sheets were processed according to the ESDA manual instructions. Fifty sheets were processed with an additional step. The cascade developer beads were misted with a plant mist sprayer before being dispensed on the document. Results showed improved visualized indentations with the misting method of developing electrostatic images with ESDA.

Introduction

Indentation examination is an important technique for forensic document examiners (FDEs). An electrostatic detection device (EDD) develops latent indented material on questioned documents such as anonymous letters or medical records. Research was conducted to determine whether adding moisture directly to the cascade developer beads would improve EDD images.

Research conducted by Foster and Morantz (1979) on electrostatic imaging gave FDEs a new technique to visualize indented material on documents. Refinement and improvement of techniques used in various EDDs continues today. Morton (2004) and Licht and Murano (2004) considered the detrimental effects of woven gloves on electrostatic image results. The role of humidity on the development of electrostatic images was reported by Giles (1988), Noblett and James (1983), Riebeling and Kobus (1994), D'Andrea, et al. (1996), and Beal (2002). Consideration of the size and type of cascading beads used in EDD was described by Beal (2000). The effects of storage and friction associated with electrostatic images have been discussed by Licht and Murano (2004).

The EDD used in this study was the Electrostatic Detection Apparatus (ESDA) made by Foster + Freeman. The most recent refinement of ESDA technique involves a *mist + humidity* method using an ordinary plant mist sprayer to apply a fine water mist to the cascade developer beads before cascading them over the document in ESDA development.

Methods and Materials

In addition to the ESDA (Figure 1), the materials used in this study were:

1. ESDA humidifier made by Foster + Freeman, Evesham, U.K. (Figure 2).
2. ESDA imaging film made by Foster + Freeman.
3. ESDA fixing film made by Foster + Freeman.
4. Great White multi-use paper 20, 8½ in by 11 in, 84 brightness.
5. Skilcraft medium blue ballpoint pen.
6. Premier paper cutter, Photo Materials Co., Chicago, Illinois.
7. Taylor Humidiguide hygrometer and thermometer (Figure 3).
8. Supreno SE, nitrile exam gloves, Microflex, #SU-690-M (Figure 4).
9. ESDA cascade developer made by Foster + Freeman (Figure 5).
10. Brass mist sprayer (Figure 5).
11. Patterson 23 cm by 18 cm plastic film tray (Figure 5).

Methodology

As outlined in the 1980 instruction manual for the ESDA, the *humidity-only* indentation development method involved:

1. Recording temperature, relative humidity, and date for each of the 50 documents.
2. Handling documents with nitrile exam gloves.

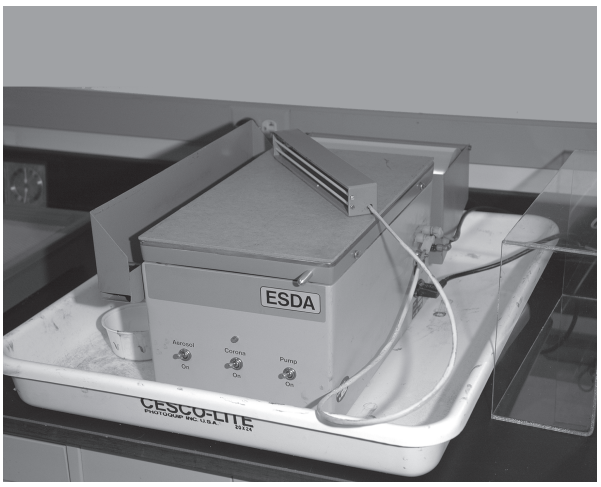

Figure 1. ESDA made by Foster + Freeman, Evesham, U.K.

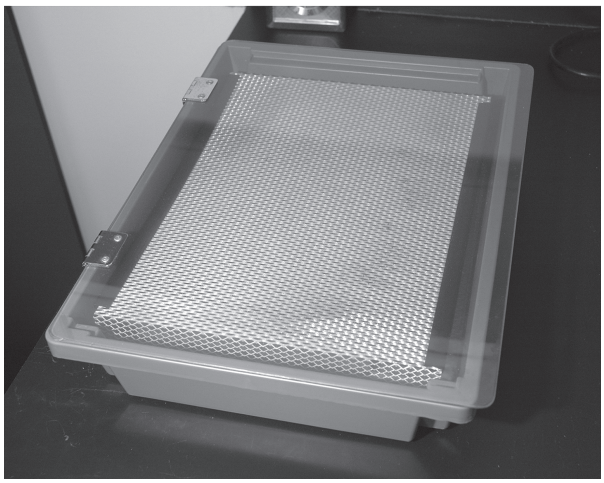

Figure 2. ESDA humidifier made by Foster + Freeman, Evesham, U.K.

3. Making indented impressions on left and right sides of the 50 documents (Figure 6).
4. Cutting each of the 50 documents in half with a paper cutter.
5. Humidifying each document for 5 minutes.
6. Covering each document with ESDA imaging film.
7. Moving corona over the document 21 seconds in all directions.
8. Applying ESDA cascade developer approximately 3 times across each document.
9. Reapplying corona charge and cascading beads, if necessary.
10. Preserving ESDA image with fixing film.

The *mist + humidity* method for ESDA indentation development involved:

1. Following steps 1 through 5 above.
2. Pouring cascade developer into small plastic photo film tray.
3. Holding mist sprayer filled with distilled water approximately 12 inches above the film tray.
4. Spraying twice to let the mist fall onto the cascade developer beads.
5. Slightly agitating beads to evenly distribute moisture on the beads.

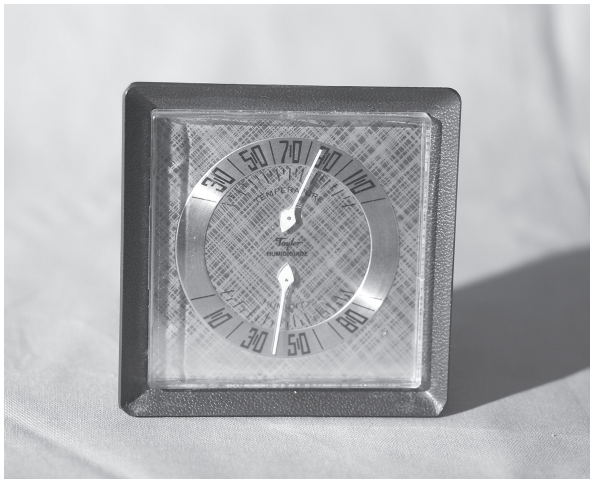

Figure 3. Hygrometer.

Figure 4. Nitrile examination gloves.

Figure 5. Cascade developer, plant mist sprayer, and plastic film tray used in the *mist + humidity* method.

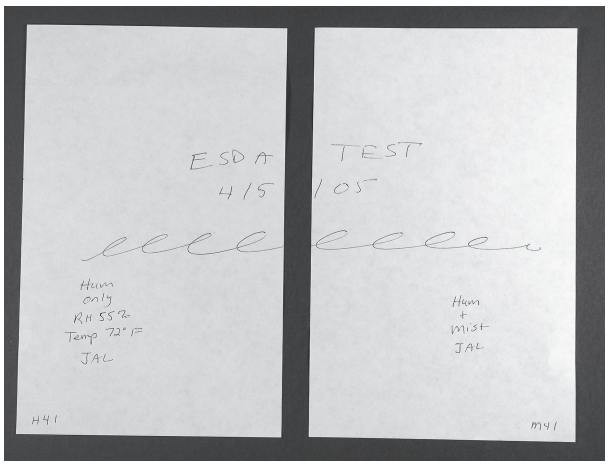

Figure 6. Pen writing on top sheets of paper used in this study.

6. Covering each document with ESDA imaging film.
7. Moving corona over the document 21 seconds in all directions.
8. Appling ESDA cascade developer approximately 3 times by pouring from plastic photo film tray across each document.
9. Reapplying corona charge and cascading with beads, if necessary.
10. Preserving ESDA image with fixing film.
11. Comparing *mist + humidity* images to *humidity-only* ESDA indentation development images.

Results

Fifty documents were tested with the *humidity-only* ESDA development method. Fifty additional documents incorporated an extra step in development. A fine mist was applied directly to the cascade developer beads with an ordinary plant mist sprayer. Thirty-six of the 50 documents processed using the *mist + humidity* method showed better image clarity than the *humidity-only* method (Figures 7a to 7c). Fourteen of the 50 *humidity-only* test results exhibited better image clarity than the corresponding *mist + humidity* results.

Discussion

This study revealed that in the 50 side-by-side comparisons of the 2 types of ESDA processing, 36 *mist + humidity* documents showed better clarity of ESDA lift images than the *humidity-only* method. The *mist + humidity* method, however, deposited more toner on each lift. These images are much darker than the ESDA lifts processed with the *humidity-only* method. The excess toner deposited can interfere with the clarity of restored indented impressions

Variations in temperature and humidity can change the quality of ESDA lifts. Tests were conducted in a single laboratory in Wisconsin, USA, beginning March 30, 2005, and ending April 5, 2005. During the time of the tests, relative humidity in the laboratory measured in a range from 49% to 55%. The laboratory temperature was recorded at 70 °F to 74 °F.

A separate container of ESDA cascade developer was used for the *mist + humidity* method. The *humidity-only* cascade developer was used solely for documents developed with that method.

Conclusion

This limited study showed that adding water mist directly to ESDA cascade developer beads enhanced ESDA clarity in 36 out of 50 documents processed with the 2 methods. FDEs may wish to create a separate setup for the *mist + humidity* method in their laboratories. This technique may be added to the array of refinements used by FDEs to enhance ESDA results.

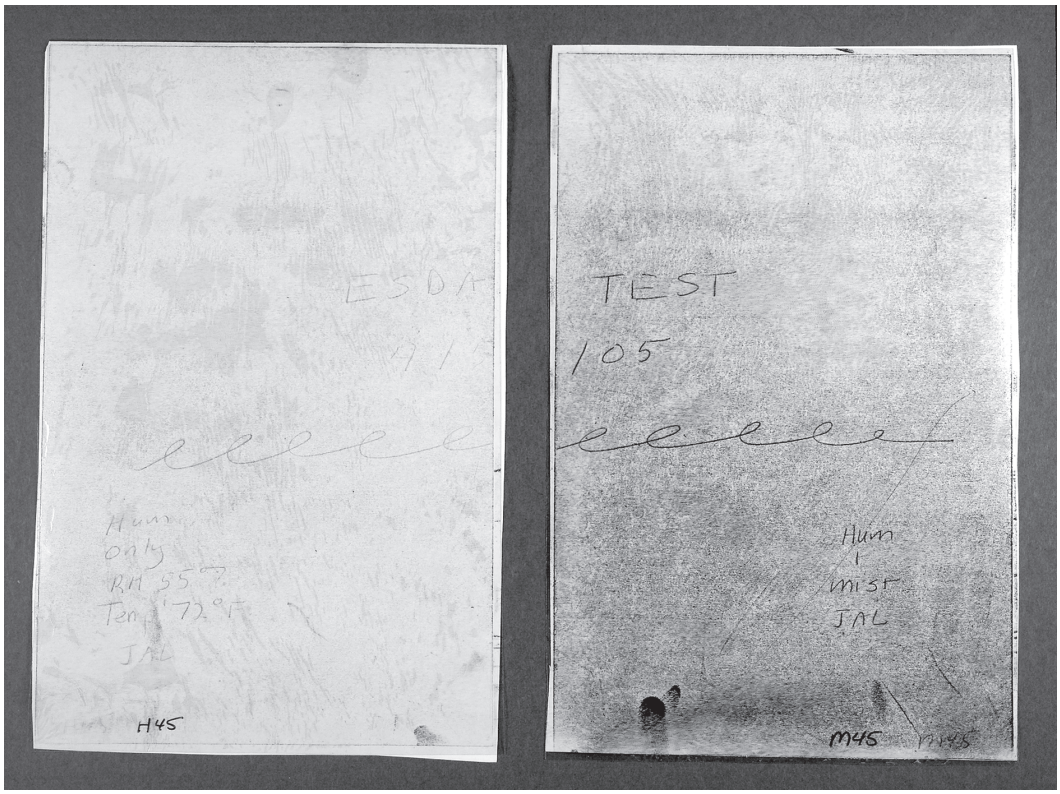

Figure 7a.

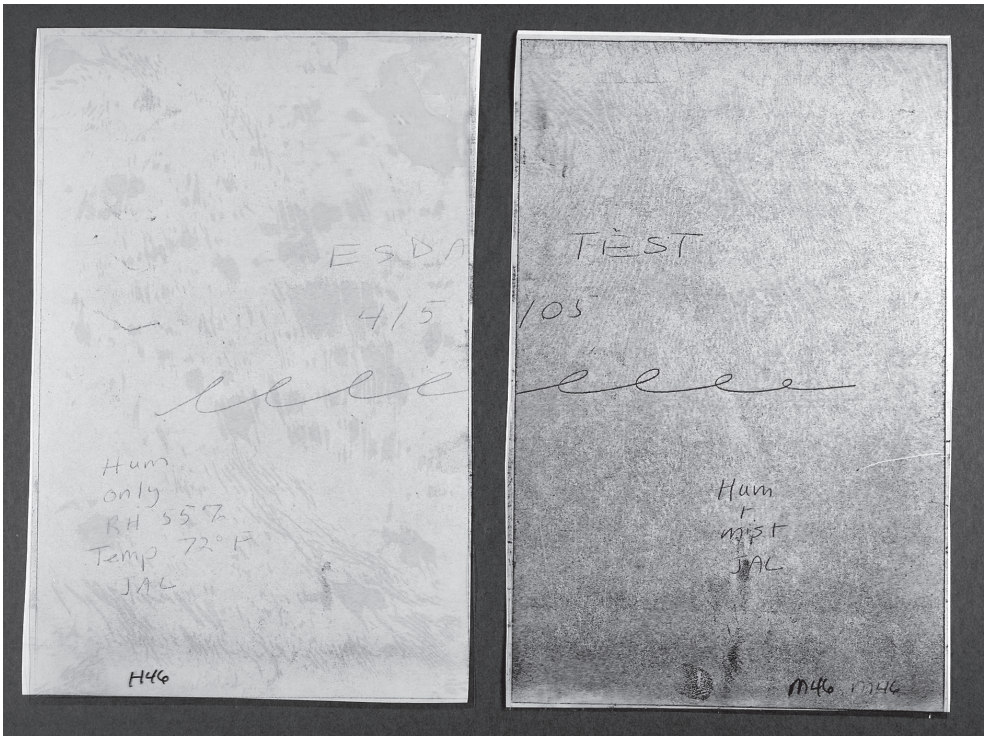

Figure 7b.

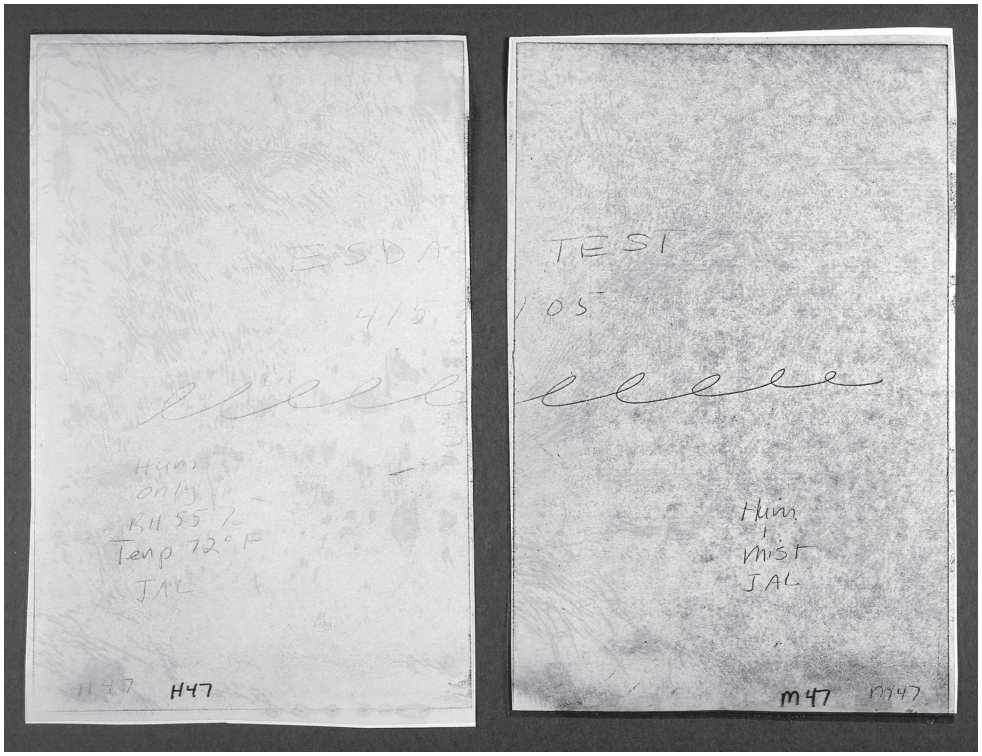

Figure 7c.

Figures 7a, 7b, 7c. Three side-by-side comparisons of ESDA lifts using the *humidity-only* method on the left and *humidity + mist* method on the right.

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