E80 Statistical Evaluation of Latent Prints Developed by Oil Red O Solutions

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Learning Overview: This presentation will compare the relative quality of latent prints developed by the two most commonly promoted Oil Red O (ORO) solutions on numerous substrates and in sequence with other developmental techniques.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by enabling latent print examiners to utilize the ORO solution that would deliver the best results when processing for latent prints on porous substrates.

While Physical Developer (PD) can develop latent prints on dry and previously wetted porous substrates, PD processing utilizes multiple components that are costly, can be destructive to paper, have a short shelf life, and are not suitable for all scenarios. Conversely, 1-[2,5-Dimethyl-4-(2,5-dimethylphenylazo)phenylazo]-2-naphthol, more commonly known as Oil Red O (ORO), is simpler, less expensive, non-destructive to paper, and has a much longer shelf life than pre-made PD solutions.

ORO has previously been suspended in either propylene glycol or with 0.23 M NaOH in 77% methanol by volume, hereafter referred to as ORO1 and ORO2, respectively.[1,2] The relative ability of these two solutions to develop latent prints has previously been evaluated to a limited extent. Also, ORO has been recommended to precede PD when used sequentially in series with other latent print processing techniques.[2-3] In a 2013 study, Frick, Fritz, Lewis, and Bronswijk contrarily noted that there was slightly better contrast when ORO was placed after PD, but still recommended PD follow ORO because of PD's "destructive potential."[1]

This research evaluated the two different ORO solutions on exemplars of both thermally sensitive and insensitive paper to determine which solution developed higher quality prints on each substrate for more than 20 donors. Prints developed by ORO solutions were benchmarked against those developed by PD and against those developed in sequence with 1, 2-indanedione and ninhydrin. Finally, the robustness of ORO solutions was tested using aged natural prints. Print quality was measured using the Universal Latent Workstation's (ULW) Latent Quality (LQ) Metrics overall clarity score as well as scoring by five trained latent print examiners using unenhanced grayscale images.

Overall, latent prints were sufficiently developed by both ORO solutions on most thermal and non-thermal paper exemplars. On one non-thermal paper, ORO2 provided equal or greater contrast and detail than on the thermal paper (p=0.01 and <0.001 as analyzed by both LQ Metric clarity and examiner scores, respectively). Contrastingly, ORO1 had equal or significantly (p <0.05 for half of the donors) better results on a thermal paper compared to the non-thermal paper. ORO2 typically produced higher quality prints than ORO1 for all substrates with only a few exceptions for some thermal papers. The relative quality of prints produced by both ORO solutions were typically of equal or higher quality than PD, except for a few donors for which the inverse was observed. Additionally, ORO was tested sequentially following 1,2 indanedione and ninhydrin, but proceeding PD. Neither 1, 2-indanedione and ninhydrin inhibited ORO, but the resulting ORO prints were not of as high a quality as prints produced by only ORO. In summary, both ORO solutions developed latent prints of suitable quality for comparison, but ORO2 generally produced prints of higher contrast/clarity.

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Reference(s):

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