



B80 Effects of Donor Age and Water Exposure on the Quality of Oil Red O-Stained, Water-Exposed Latent Prints

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After attending this presentation, attendees will understand how the age of the fingerprint donor affects the quality of Oil Red O-stained latent prints that have been previously wet with water. Attendees will also understand how the quality of Oil Red O-stained latent prints that have been previously wet with water is affected by exposure to three common aqueous mixtures.

This presentation will impact the forensic science community by expanding the understanding of the applicability, scope, and limitations of Oil Red O lipid staining reagent for visualizing latent fingerprints on paper that has previously been wet with water. A better understanding of these variables — including donor age and exposure to different aqueous mixtures — will guide the user in application of this reagent in casework and validation studies.

Oil Red O is a soluble lipid stain that was reported in 2004 to be efficacious for partitioning into and staining sebaceous materials in latent fingerprints. It is considered particularly useful for visualizing latent fingerprints on porous surfaces that have been wet with water, such as wet currency or paper. While other water-soluble components such as salts and amino acids may be washed away by exposure to water, water-insoluble fatty components of the fingerprint residues are much more resistant to removal by water and often persist after exposure to water.

In seeking to better understand the utility, scope, and limitations of Oil Red O stain reagent in visualization of lipidic components of latent prints, the present study examines the effects of two variables on the quality of latent prints stained using Oil Red O: Variable 1 — exposure to moving water of three varieties (tap water, Mississippi River water, and water containing laundry detergent); and, Variable 2 — the age of the latent print donor (from 1 to more than 60 years old). These two variables are expected to affect the lipid composition of latent fingerprints in a number of ways.

Water is known to have a much smaller effect on sebaceous materials deposited on a surface than on inorganic constituents such as salts; however, different types of water might be expected to affect the lipid content more than pure water. For example, tap water contains ions, disinfectants, and disinfectant by-products that might interact physically or chemically with sebaceous materials to alter their makeup. River water contains sediment that might act as a physical abrasive, thereby mechanically removing sebaceous materials from a surface. Finally, laundry detergent is used as a surfactant to aid in removal of greasy stains and soils from fabrics in the presence of water. It would reasonably be expected to remove sebum from paper as well.

Donor age is well-established as a variable affecting the chemical composition of latent fingerprints. In fact, fingerprint donors have been classified and donor age predicted based on analysis of the chemical composition of the print residues. Children are known to have more, shorter chain, free fatty acid components in their fingerprints, leading to higher volatility and thus shorter persistence in abduction cases. Teenagers and young adults typically have oilier skin, characterized by longer chain lipids, fatty, waxy, and cholesteryl esters, which decrease in concentration into young adulthood and middle age. Finally, older adults are characterized by decreasing amounts of sebum and drier skin. Since Oil Red O partitions into lipid material, these changes should manifest in varying quality of stained fingerprints.

Fingerprint samples were collected on pieces of various papers, including typical office laser printer paper and cotton blend papers. Subjects deposited fingerprints in triplicate on various papers, which were then treated by exposure to moving water solutions using a mechanical agitator. The latent prints were then visualized using a prescribed staining procedure with Oil Red O dye solution. The stained prints were photographed and their quality was assessed using two methods: qualitative stain color intensity and visibility of a set of minutiae predetermined from examination of inked prints of the donor subjects. Effects of varying these parameters will be reported.

Oil Red O, Fingerprint Quality, Donor Age