E54 The Mystery Behind the Composition of Black Fingerprint Powders

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Learning Overview: After attending this presentation, attendees will understand the characterization of black fingerprint powders using a variety of different analytical instrumental techniques in order to determine the particle size, homogeneity, elemental composition, and surface functionalized groups.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by classifying black fingerprint powders in order to assist in the selection of a fingerprint powder that is most appropriate for the desired use. The objective of this research was to characterize black fingerprint powders in order to assist latent print examiners in the selection process of a black powder for fingerprint development.

Fingerprint development has been used to visualize latent prints since the 19th century, and several modern companies produce a variety of different commercially available black fingerprint powders. While the method to develop fingerprints has been refined over the years, the composition of the fingerprint powders that are used in this print development has not been studied extensively.

Black fingerprint powders were analyzed using Dynamic Light Scattering (DLS), zeta potential, Inductively Coupled Plasma/Optical Emission Spectroscopy (ICP/OES), Attenuated Total Reflectance/Infrared (ATR/IR) spectroscopy, and Scanning Electron Microscopy (SEM) with Energy Dispersive X-ray Spectroscopy (EDS). DLS can be used to determine the size distribution of small particles in suspension or solution. Zeta potential can be used to evaluate the stability of particles in solution. ICP/OES is an analytical technique that is used in the detection of chemical elements. ATR/IR can be used to identify the functional groups present in a sample with little to no sample preparation. SEM is used to produce images of a sample by scanning the surface with a focused beam of electrons. EDS is used to determine the elemental composition of a sample.

DLS was used to obtain the particle sizes of the black fingerprint powders in an aqueous suspension and SEM was used to obtain the particle sizes of the black fingerprint powders in their native form. DLS and SEM in conjunction were used to assess the homogeneity of the fingerprint powders. ATR/IR assisted in determining the surface functional groups present in the variety of black fingerprint powders studied. ICP/OES was used to quantify the elements present and, in conjunction with EDS, was used to determine the elemental composition of the components present in black fingerprint powders.

Preliminary DLS data indicates that black fingerprint powders from several different manufacturers are not homogenous and that the dispersion of particle sizes in the samples varies between different manufacturers. It should be noted that the average particle size remains fairly consistent between manufacturers. While the particle size dispersion varies between manufacturers, the zeta potential, which is the surface charge of the particles, is consistently negative and ranges from -26.31mV to -37.31mV. This indicates that the surfaces of the particles are stable in an aqueous solution. The methods of characterization described above will be applied to colored fingerprint powders, in addition to white and bichromatic fingerprint powders, in the future.

Black fingerprint powders from different manufacturers can be characterized using DLS, zeta potential, ICP/OES, ATR/IR, and SEM with EDS. This characterization can be used to assess the performance of black fingerprint powders in the development of latent prints.

Fingerprint Powder, Characterization, Particle Size