

Evaluation of Diazonium Gold (III) Salts in Forensic Chemistry: Latent Fingerprint Development on Metal Surfaces

ABSTRACT

Diazonium salts in forensic chemistry will vastly aid in the design of novel hybrid developers for latent fingerprints on metal surfaces used as crime tools. We used the easily reducible aryldiazonium salt stabilized with tetrachloroaurate anion of the formula $[\text{NO}_2\text{-4-C}_6\text{H}_4\text{N}\equiv\text{N}]\text{AuCl}_4$. Localized elemental analysis, after 2 h of dipping in the diazonium salt, using XRF and EDS showed the deposition of gold on the fingerprints collected on copper, lead and aluminum. Poor development obtained from non-gold diazonium salt $[\text{NO}_2\text{-4-C}_6\text{H}_4\text{N}\equiv\text{N}]\text{BF}_4$, and temporal evolution of the deposition over 24 h showed images of poor contrast and scattered minor deposits. The reasoning for better developed fingerprint quality of gold-aryl film compared with the non-gold film can be due the packing effectiveness and the low reduction potential of the gold-based aryldiazonium salt. It can be noticed from the images that the grafted film was not filling the grooves but selectively adhered to the eccrine prints on copper and lead however showed indiscriminate deposition on aluminum surface. Obliteration of developed fingerprints was not observed on all surfaces. The degraded contrast on aluminum after the visible overflow of the trenches is a limitation of diazonium on highly reductive metal surfaces. The gold film aided to visualize the three levels of primary, secondary and tertiary fingermarks at unprecedented level of details. Reduced gold on fingerprints can be beneficial in archiving and future analysis.