

HemaDrop: A Novel Elemental Composition Technology for Microliter-Size Blood Droplets via Solid State Techniques

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Blood Diagnostics are one of the most common testing methodologies used to test for a plethora of diseases. 7 milliliters (mL) is considered the standard volume required per test. Drawing 7 mLs of blood can induce hospital-acquired anemia in ill patients. Reducing the volume drawn while increasing analysis speed and accuracy can improve healthcare practices. HemaDrop, a novel hyper hydrophilic surface coating, solidifies microliter (μL) sized blood droplets within minutes, forming Homogeneous Thin Solid Films (HTSFs) without phase separation or segregation. HTSFs can be analyzed within minutes using Rutherford Backscattering Spectrometry (RBS), which provides quantitative elemental compositional depth profile, and X-ray Fluorescence (XRF), which provides a relative elemental composition of the sample, both within minutes with minimal damage to samples. Blood HTSFs were tested for accuracy in measuring electrolytes (Na, K, Mg, Ca, Cl) and hematocrit (Fe) from single μL droplets. By comparing the RBS data and an iterative peak-fitting simulation software for RBS, SIMNRA, the error was determined to be less than 1% on average for the elements tested. Furthermore, relative error analysis between multiple HTSFs establishes reproducibility within 10%, the medically-accepted standard. Electrolytes & hematocrit levels are often the first tests conducted in ER, ICU, and hospitals, as general status depends critically on hydration (electrolytes concentration), and oxygenation (Fe hematocrit levels). These are repeated daily and sometimes every few hours, and are essential to maximizing efficiency. HemaDrop can help address these needs by providing rapid, low-cost, and accurate blood analysis in the solid state.

Awards Won:

Fourth Award of \$500