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Novel Radial Jet Reattachment For Analyte Extraction From Porous Surfaces

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Chemical surface detection technologies rely on the physical interaction of some phenomena with the analyte on the surface to be able to extract the chemical information from it. These techniques may involve light-matter interactions such as Raman or infrared, and others may involve a physical periodic sampling of the surface that is then analyzed by a secondary technique such as mass spectrometry. In all cases, these technologies probe only what is on the surface or very near to the surface that the material is on. In cases in which liquids are present on porous surfaces, the liquid is absorbed into the surface material making the extraction with physical sampling or interaction with light very difficult. Therefore, there has been a need to extract analyte from porous surfaces for analysis to understand what potential threats may be present.

In this work, a novel radial jet reattachment methodology is applied to extract analyte from smooth non-porous surfaces and from rough, porous surfaces. The analytes were extracted from the surfaces, captured on a sorbent tube, and analyzed with GC/MS, GC/FID, or GC/FPD. We show extraction efficiencies for various surface concentrations of analytes that range in vapor pressure from low (< 1 x 10 -1 torr) to high (> 1 x 10-1 torr). We show greater efficiency at extracting analyte from rough, porous surfaces than from smooth, non-porous surfaces. Further, we show that this technique can extract analyte from porous surfaces that range in vapor pressures over four orders of magnitude from porous surfaces with very short dwell times (0.5 s).

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