EVALUATION OF THE M-VAC® AS A DNA COLLECTION METHOD

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The collection of DNA evidence is a crucial step in forensic investigations. Although methods for DNA collection such as swabbing, cutting, and taping are well-established in forensics, new and innovative methods are needed to maximize DNA recovery from challenging evidentiary items, e.g., those with porous and/or rough surfaces. The purpose of this study was to determine the efficacy of the M-Vac®, a novel wet-vacuum system, as a DNA collection method by collecting diluted blood on porous and non-porous surfaces. DNA yields obtained from the M-Vac® were compared to those from a standard operating protocol (SOP) which utilized a wet cotton swab.

Fifteen (15) substrates of varying porosity were tested: glass, wood countertop, pressure-treated wood, plywood, pine, drywall (unpainted and painted), brick, cinderblock, carpet padding, automotive carpet, automotive seating, trunk liner, and trunk mat. A volume of 1.44 mL of diluted 1:100 blood was spotted onto each substrate in ~100 cm^2 areas and, once dried, was collected using the M-Vac® or a wet cotton swab, in triplicate. Swabs were extracted according to a DNA casework SOP and M-Vac® samples were extracted according to the manufacturer's recommendations.

Quality assurance was performed on M-Vac® materials necessary for its use. The resultant nuclear and mitochondrial DNA quantitation data as well as short tandem repeat (STR) analysis did not indicate any true contamination. With regard to substrate testing, the M-Vac® yielded more DNA on 11 porous substrates compared to the SOP, five (5) of which were significantly greater. The M-Vac® yielded between 3 and 47 times more DNA than swabbing for these substrates. Furthermore, the M-Vac® and SOP yielded comparable total DNA on the remaining four (4) substrates, i.e. two (2) porous and two (2) non-porous surfaces. In no instance did swabbing significantly recover more DNA than the M-Vac®. Lastly, eight (8) selected porous substrates which were previously swabbed, were subsequently subjected to M-Vac® collection which recovered additional DNA that was, at minimum, equivalent to the initial swabbing, and maximally 46-fold more.

Given these results, the M-Vac® may provide an alternative collection method on difficult porous surfaces, especially when swabbing is unsuccessful. However, swabbing may be appropriate on non-porous surfaces for reasons of cost and simplicity. Future M-Vac® studies are expected to evaluate additional substrates and sample types, alternative DNA concentration filters, and STR analysis on the recovered DNA.