

## **MICROWAVE PRE-PROCESSING FOR ENHANCED RAPID DNA ANALYSIS OF FORENSIC SAMPLES**

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In recent years, there has been a push for rapid DNA analysis that can process biological samples from swab to profile in a few hours. This has proven effective for high quality samples and known references, but full DNA profiles have yet to be obtained from less than pristine forensic evidence samples. Since microwaves have long been known to disrupt cell membranes, their use prior to rapid DNA analysis provides a quick and inexpensive method to augment the recovery of DNA. This can be achieved with an off-the-shelf microwave at 300W with total of 40 seconds of energy imparted as determined by calibration with neon bulbs and evaluation of condensation in various areas within the microwave.

Microwaving samples prior to conventional DNA analysis resulted in a 340% increase in allele peak heights from 1% blood, 55% increased peak heights from 1% saliva, and 96% increased peak heights from 0.5% semen samples. In 1:9 saliva/semen mixtures the total number of detected alleles increased from 20 to 25 alleles with microwaving, with the minor donor allele peak heights increasing 106% to 130%. Rapid DNA processing of mock gun samples produced  $11 \pm 2$  alleles when microwaved in comparison to  $7 \pm 6$  alleles by conventional processing.

We focused further on the ability to develop DNA profiles from samples in the stochastic range since this presents one of the main challenges to introducing rapid DNA to routine forensic casework. We empirically determined this was best represented by 0.05% dilutions of saliva where there was > 82% enhancement in allele recovery with microwaving. The original sample collection method also profoundly impacts the downstream allele recovery with wet swab collection resulting in 5 alleles which increased to 12 alleles with dry swab collection. Interestingly, we found simply removing the original swab from the cartridge (where 7 alleles were developed), allowing it to dry between runs, and reprocessing it continued to produce additional alleles in the second re-run and produced composite profiles of 18.5 alleles on average. These results were reproduced by two separate forensic casework laboratories. Our findings show that the sensitivity shortcomings of rapid DNA instruments can be overcome by microwave pre-processing of forensic samples.