Automated Sample Preparation Using a Digital Syringe with Embedded SPE Capability

**Abstract**

Popular sample preparation techniques such as solid phase extraction (SPE) can be time consuming and expensive, whether implemented on automated platforms or performed manually. Furthermore, method development to improve the efficiency of the sample preparation process is often difficult and time prohibitive, with long evaporation steps throughout the process. A key objective for all laboratories is to implement efficient sample preparation where there is a need to improve productivity and minimize waste. While the introduction of automated and semi-automated platforms into the laboratory for sample preparation enables improved efficiencies, they generally come at a significant cost. We have combined the advantages of automation and SPE using a digital syringe with an embedded SPE cartridge which not only improves efficiencies, but virtually eliminates solvent use and waste. The miniaturized format is ideal for small valuable samples such as biological extractions fluids.

Here we demonstrate the advantages in combining the automation of a hand-held, digital syringe with miniaturized SPE sorbent embedded in the needle of the syringe. Method development is rapid and inexpensive, enhancing laboratory workflow, while increasing the accuracy and reproducibility of the SPE process.

**Background**

SPE is a valuable technique for sample preparation yet the SPE process can be time-consuming, labor-intensive, and expensive. The efficiency of the SPE process can be improved by automated instruments. However, these instruments can be expensive, requiring extensive training, and are not applicable for all laboratories. By coupling MEPS™ technology with a digitally controlled analytical syringe, (Figure 1), enables semi-automated sample preparation which can be programmed to carry out the whole extraction through to injection into the analysis system.

**Method, Results and Discussion**

**Caffeine in Saliva**

- **Sample:** Following caffeine consumption, saliva was collected into a clean glass vial.
- **Step Mode Amount (µL) Speed**
  - Aspirate 20 4
  - Mix (x8) 50 4
  - Dispense 20 4
  - Aspirate 20 4
  - Mix (x8) 50 4
  - Dispense 20 4
  - Aspirate 20 4
  - Dispense 5 4

**Opiate detection in Urine**

**MS Conditions**

- Positive ion mode
- Mass range 100-550 m/z.
- Dry temperature 180 ºC
- Nebuliser 25 psi
- Capillary voltage -4500 V
- End plate voltage -500 V
- Transfer line temperature 280 ºC
- He @ 1.2 mL/min in constant flow mode.

**Conclusion**

MEPS™ provides a fast and easy desalting step and the digital syringe format allows convenient sample introduction by direct infusion.

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