


series	cap color	membrane	pore size	part #
eXtremelFV®		PVDF	0.2µm	85531

## Automated Hydrolysis and Sample Preparation for the Analysis of 12 Opiates in Urine using the Thomson eXtremelFV®s by LC-MS/MS

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### Introduction

This improved sample preparation method allows for the quantitative measurement of Opioids in urine. Opioids are highly addictive and affects nearly 5 million people in the U.S. Opioids include naturally occurring Opiates, semi-synthetic opioids derived from morphine and synthetic opioids are analgesic alkaloids found naturally in Papaver somniferum, poppy plant. The use of hydrolysis in the analysis of natural and synthetic opiates in urine has become standard practice in forensic toxicology. Many laboratories currently use solid phase extraction or solid liquid extraction techniques in the sample preparation of urine for the analysis for opiates. This improved automated sample preparation method evaluates the robustness for the quantitative measurement of opiates in urine without the need for SPE/SLE thereby reducing pipetting errors. The sample preparation of incurred urine, controls, standards and internal standard additions as well as the hydrolysis step are performed by a liquid handler. The Thomson eXtremelFV®s provide a simple and efficient extraction technique that has demonstrated adequate analyte recovery, reduced matrix interferences and the reduction of solvent and consumable waste.

### Analytes

**Table 1.** Drugs analyzed in this Opiate Panel

6-Monoacetylmorphine	Hydrocodone
Norhydrocodone	β-Naltrexone
Hydromorphone	Noroxycodone
Codeine	Morphine
Oxycodone	Dihydrocodeine / Hydrocodol
Naltrexone	Oxymorphone

### Equipment / Reagents

- Hamilton Automated Liquid Handler
- ABI 4500 Mass Spectrometer
- Shimadzu Prominence HPLC
  - Flow Rate: 0.5 mL/min
  - Run Time: 8.5 minutes
  - Injection Volume: 15µL
  - Mobile Phases:
    - A: 0.1% Formic Acid in HPLC Water
    - B: 0.1% Formic Acid in Methanol
- Column: Restek Ultra Biphenyl Columns (5µm 50 x 2.1 mm)
- Thomson eXtremelFV® 0.2µm PVDF (P/N 85531)

- Thomson 48 position Vial Filter Press (P/N 35010)
- β-Glucuronidase - IMCSzyme™, genetically engineered beta-glucuronidase, p/n #04-E1F-010

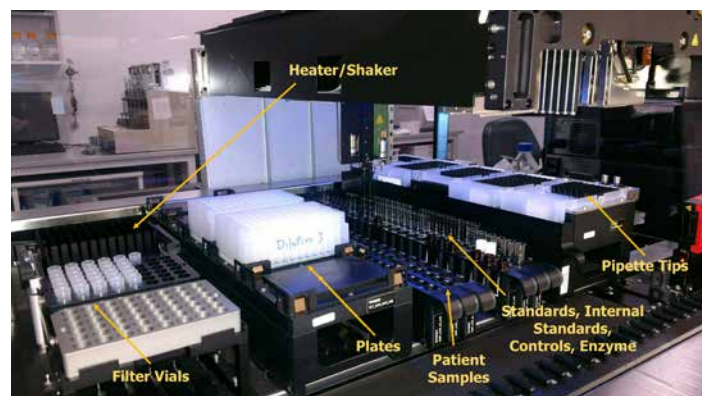
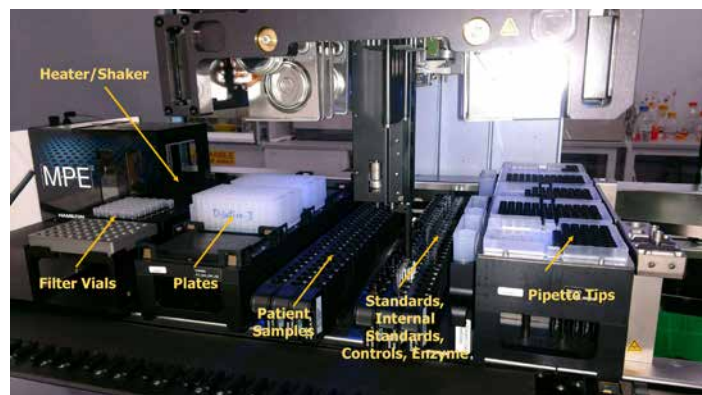
### Method:

The method created for the Hamilton Liquid Handler will replace manual steps currently performed by lab personnel. The method includes the pipetting of blanks, patient samples (dilution if necessary), controls, standards, internal standard and enzyme from 12x75mm glass tubes into a 96-Well plate for the hydrolysis step. The final step in the robotic method is the transfer of the hydrolyzed urine samples to a 48 position plate containing the outer shell vial of the eXtremelFV®s. The plungers are then added to the outer shell vials of the eXtremelFV® and the plate is transferred to the Multi-Press. The samples are analyzed by LC-MS/MS.

The opiates analyzed in this method include Codeine, Oxycodone, Dihydrocodeine/Hydrocodol, Hydrocodone, Hydromorphone, 6-Monoacetylmorphine, Morphine, Noroxycodone, β-Naltrexone, Naltrexone, Norhydrocodone, Oxycodone, and Oxymorphone. Stock solutions for each analyte and internal standards are made in methanol. These stock solutions are diluted in negative urine by the liquid handler to generate working solutions for a 6-point calibration curve, generate controls and add internal standards to specimens. Limit of Detection (LOD) and Limit of Quantification (LOQ) were compared to the existing validated method for opiate analysis by LC-MS/MS. The 6-point standard curve for 6-Monoacetylmorphine includes the LOQ, Level 1 concentration of 5ng/mL with upper limit, Level 6 concentration of 1000ng/mL. For all the other analytes the LOQ, Level 1 concentration of 50ng/mL with upper limit, Level 6 concentration of 20000ng/mL.

### Liquid Handler / Sample Prep

- To ensure proper tracking, the liquid handler reads barcode on the sample.
- 12 x 75mm glass culture tubes are used for: Urine Standards, LC Checks, Controls, Internal Standard and Enzyme.
- Eight channel pipette head is utilized for adding standards, internal standards and enzyme to each of the 12x75mm culture tubes to create blanks, Standard Curve, patient samples and controls.
- All samples are transferred to a 96-Well plate and the plate is transferred to the heater/shaker unit.
  - Vortexed for 2 minutes.
  - Hydrolyzes for 30 minutes at 55° +/- 2°C.
- Upon completion the plate is removed from the heater/shaker and returned to the deck for a 10 minute cool down.
- During cool down, 2% Methanol is added to each eXtremelFV® outer shell.
- All hydrolyzed samples are transferred to the eXtremelFV® outer shell.
- The rack containing the eXtremelFV® outer shells is removed from the deck of the robot and the plungers are added ¼ of the way down.
  - The rack containing the eXtremelFV®s is vortexed for 5 minutes.
- The plungers are completely depressed using the Thomson Multi-Press.
- Samples are ready for analysis by LC-MS/MS.

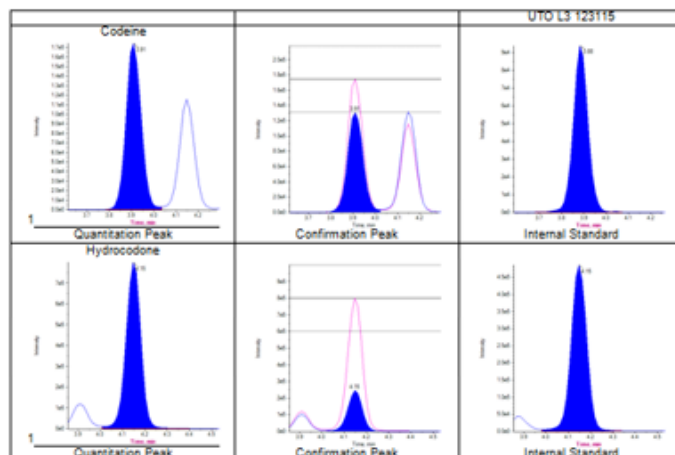


## Results

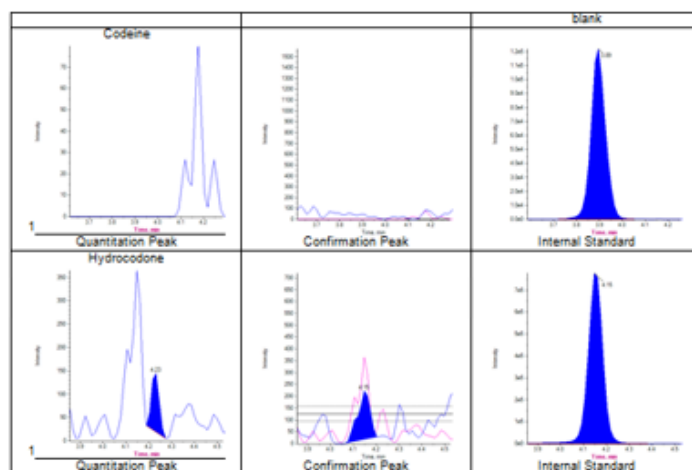
Final concentrations for the various analytes are as follows:

	Final Concentration: Opiates (ng/mL)	Final Concentration: 6-MAM (ng/mL)
Level 1	50	5
Level 2	200	20
Level 3	1000	50
Level 4	5000	250
Level 5	10000	500
Level 6	20000	1000

## Positive Results



## Negative Results



## Conclusion

This validated automated method reduces the risk of contamination and alleviates the risk of human pipetting errors during specimen transfer steps. Samples are diluted, receive Internal Standards, hydrolyzed and dispensed into the vial going onto the LC-MS/MS. All sample/specimen containers are barcoded and tracked throughout the process significantly reducing the need for repeat sampling. 🔄

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