



## NEW PERFORMANCE FOR HIGH VOLUME CANNABIS LABORATORIES

**Enabling high throughput in metal testing of various cannabis samples using Milestone's ETHOS UP with MAXI-24 HP**

### | INTRODUCTION

The medical cannabis industry is currently one of the fastest growing industries in the United States and is becoming more prevalent worldwide. As the industry matures, many challenges have been encountered. One of those challenges is how to ensure safe products that are free from potential contaminants dangerous for the human health.

Like all plants, cannabis absorbs metals from its environment, a result of normal plant metabolism. Cannabis plant is so effective at absorbing metals from its environment that it has been referred to as a hyperaccumulator of trace metals, including lead, cadmium, copper, chromium, arsenic, mercury and cobalt.

State governments and private laboratories are focusing on product safety testing with special emphasis on As, Cd, Hg and Pb, as they are extremely hazardous to human health, even at low levels.

Today's states regulation, require testing of several samples to ensure the customer safety between batch, as consequence, cannabis testing labs are exposed to a huge number of samples to be processed per day.

### MAXI-24 HP ROTOR FOR CANNABIS TESTING LABS

The cannabis industry deal with several samples that can range from end products such as salve, cookies, CBD oil, inhalation, vape cartridge to raw materials and production intermediates like cannabis



flowers and concentrates just to mention a few. These samples have different reactivity due to its natural composition and some of them, for example concentrates, shown high reactivity and they require a high performing microwave digestion system. In addition, cannabis testing labs deal with large number of samples, so it is pivotal to achieve high productivity.

The Milestone's ETHOS UP equipped with MAXI-24 HP rotor enables an efficient digestion of all the products of the cannabis industry, independently to their reactivity ensuring high productivity at the same time, making sample preparation fast, easy and efficient.

## | EXPERIMENTAL

In this industry report, a recovery study on cannabis and its end products has been performed to prove the efficacy of ETHOS UP with MAXI-24 HP in the sample preparation for metal analysis.

## INSTRUMENT

The ETHOS UP is the most advanced microwave sample preparation equipment, it meets the requirements of modern analytical labs.

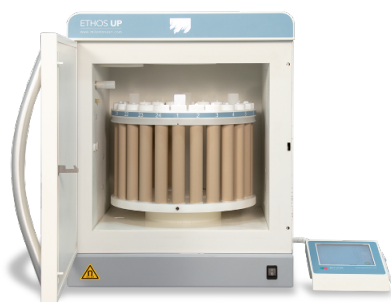


Figure 1 – Milestone's ETHOS UP

The ETHOS UP used in this study was equipped with MAXI-24 HP rotor controlled via Milestone's easyTEMP contactless temperature. The superior temperature measurement of easyTEMP allows the processing of different samples of similar reactivities, thus reducing labor time and increasing overall throughput.

## MAXI-24 HP ROTOR

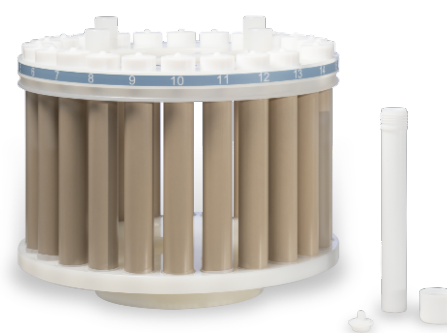


Figure 3 – MAXI-24 HP Rotor

The latest Milestone's development is the MAXI-24 HP, which combines performance and throughput within a single rotor-based platform. It completely innovates the rotor-base solutions providing high throughput without sacrificing the performance. Thanks to its 24 positions, it is the first high pressure and throughput rotor available in the market. The completely new design of its vessels allows to achieve conditions never seen for high throughput rotors. Thicker high purity PTFE-TFM vessels and caps, along with rugged PEEK shields are key ingredients to handle the conditions required to completely digest these samples.



## PROCEDURE

SAMPLE	SAMPLE AMOUNT	ACID MIXTURE
Cannabis plant material	0.5120 g	5 ml of HNO <sub>3</sub> + 1 mL of H <sub>2</sub> O <sub>2</sub>
CBD oil	0.4983 g	
Cannabis vape cartridge	0.5025 g	
Cannabis salve	0.4991 g	
Cannabis flavored cookies	0.5006 g	
Cannabis flavored gummy bear	0.4987 g	

Table 1 - Sample amount and acid mixture used for the microwave digestion

All samples were weighted into the MAXI-24 HP vessel, approximately 0.5 g (as reported in table 1), then they were fortified with 100 µL of a multi-elemental standard solution (As/Cd/Pb/Ag/Ba/Co/Cr/Cu/Mn/Ni/Se/V/Zn: 20 µg/mL; Hg: 10 µg/mL). The spiked final concentration resulted in 10 µg/L for Hg and 20 µg/L for all the others elements respectively. The acid mixture (trace metal grade) was added according to the data reported in table 1 and the proper microwave method suitable for all cannabis samples has been set according to table 1.

STEP	TIME	TEMP	POWER
1	00:10:00	160°C	1800 W
2	00:15:00	210°C	1800 W
3	00:10:00	210°C	1800 W

Table 2 - Microwave program used to digest samples

After microwave digestion, the samples were diluted to 50 mL with DI water and then, analyzed in ICP-MS.

Parallel procedure was performed on unspiked samples in order to calculate the recovery rate in relation to the spiked levels.

## QUANTIFICATION

ICP-MS Instrumental Parameters. RF power (W): 1600; Sampling depth (min) 10; Carrier gas (L/min): 0.8; Sweeps/Reading: 20; Readings/Replicate: 1; Number of replicates: 3; Integration time (ms): 1000; Dwell time per AMU (ms): 50; Mode: KED; Scan mode: Peak hopping; Cell Gas A: 0.6; RP a: 0; RP q: 0.25.

## RESULTS AND DISCUSSION

The performance of the Milestone's ETHOS UP equipped with MAXI-24 HP rotor was evaluated through a recovery study on samples of interest for the cannabis industry, from plant material to edibles and concentrates. The spike levels and the acceptance criteria were chosen according to the action levels reported by the California state regulation and considering the criteria of the USP and ICH guidelines. All sample were properly digested and the final solutions were clear and colorless upon dilution. The analytical results are shown in Table 3 with good recoveries of all elements and RSDs below 3%. This demonstrates the robustness and reproducibility of microwave digestion using the ETHOS UP equipped with MAXI-24 HP technology.

Figure 3 shown the temperature profile of the digestion as well as the multiple temperature visualization and recording for all the samples digest in the run.

## INDUSTRY REPORT MAXI-24 HP | CANNABIS

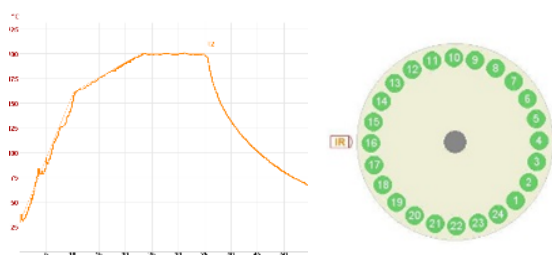


Figure 3 – MAXI-24 HP Microwave Run Report and Multiple temperature traceability

This study has been performed on approximately 0.5 g of sample, as requested by several state regulations, and working much more below the limit levels required by the regulation (generally 0.2 ppm for Cd, Pb and As and below 0.1 ppm for Hg). The recovery was always in the range 80-120% as required by regulation.

		As	Cd	Hg	Pb	Ag	Ba	Co	Cr	Cu	Mn	Ni	Se	V	Zn
Cannabis plant material	Recovery (n=3) (%)	90.3	93.4	93.8	96.7	91.3	90.5	89.7	92.8	-*	-*	95.2	90.7	104.1	-*
	RSD (%)	1.8	0.9	2.1	1.4	2.3	1.6	0.6	0.4	-*	-*	0.6	2.2	0.3	-*
CBD oil	Recovery (n=3) (%)	91.8	88.9	101.2	94.2	86.9	89.8	99.5	102.3	94.3	90.9	84.6	93.9	105.4	92.8
	RSD (%)	2.8	2.7	1.6	2.9	2.3	2.7	1.4	2.5	2.2	2.6	2.0	2.7	1.5	2.9
Cannabis vape cartridge	Recovery (n=3) (%)	92.7	90.8	94.4	106.5	96.3	88.4	106.1	94.2	101.9	94.8	97.6	101.3	90.4	95.3
	RSD (%)	1.5	2.1	1.1	1.4	1.8	1.3	1.7	1.1	1.3	1.7	1.9	2.2	1.2	1.7
Cannabis salve	Recovery (n=3) (%)	94.2	94.8	103.5	90.2	87.3	89.2	88.8	94.5	93.2	99.1	94.3	90.7	94.9	89.9
	RSD (%)	2.5	1.4	1.3	2.1	2.3	1.6	1.8	2.0	1.4	1.0	1.8	1.5	1.7	1.4
Cannabis flavored cookies	Recovery (n=3) (%)	91.6	94.3	93.8	97.5	91.4	96.4	92.6	91.6	96.7	94.3	90.1	94.6	94.1	-*
	RSD (%)	2.8	1.0	1.3	1.4	1.1	1.3	2.1	2.3	0.7	1.7	1.4	2.4	1.1	-*
Cannabis flavored gummy bear	Recovery (n=3) (%)	98.1	97.1	97.7	96.9	97.8	92.9	94.8	94.1	90.8	96.2	90.6	91.4	94.9	92.6
	RSD (%)	2.1	0.6	0.9	1.9	2.4	0.6	0.8	0.7	0.5	1.2	1.5	2.4	0.3	1.6

Table 3- Data of the recovery study. \* The ratio between spiked/unspiked concentration was too low.

### CONCLUSION

The data shown in this technical note demonstrates full recovery of the most common elements occurring in cannabis plants and related products. Highly reactive samples such as gummy bears, cookies and CBD oil have been completely digested even in large sample amounts, ensuring reliable analysis. In addition, microwave digestion using Milestone's ETHOS UP with MAXI-24 HP rotor provides the highest level of reproducibility, even for volatile elements such as As and Hg. Milestone's ETHOS UP

equipped with MAXI-24 HP rotor has been validated in this study for cannabis industry. The configuration matches the application and productivity requirements of cannabis testing labs, being a viable option for metals analysis in cannabis material.

### ABOUT MILESTONE

At Milestone we help chemists by providing the most innovative technology for metals analysis, direct mercury analysis and the application of microwave technology to extraction, ashing and synthesis.



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