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Application News

No. BAL-001

Balances / Moisture Analysis

Moisture Content of Cannabis and Hemp Flower as Measured with a Shimadzu MOC63u Moisture Analyzer

■ Introduction

Determining the moisture content of cannabis and hemp flower is required for improving the accuracy in analytical techniques. In fact, many regulations specifically state the results are reported as on a dry weight basis, and thus the need for a moisture balance. Analytical methods for cannabinoid components such as potency and terpenes profiles, as well as contaminants including pesticides and heavy metal require this information for accurate analysis.

Moisture analysis can also be indirectly useful in the determination of microbial contamination. Samples exposed in high relative humidity may be subjected to contamination as well as inaccurate analytical results. A moisture balance does not measure the relative humidity (or water activity) of the sample. Water Activity is a measure of the energy status of the water in a system. Water activity meters are also available from Shimadzu. A moisture balance measures total water. This paper is focused on moisture balance and thus the moisture content.

■ Instrument and Method

The MOC63u Moisture Analyzer determines the mass percentage of moisture contained in a sample via loss of weight by drying. The unit consists of a balance, combined with a drying chamber located above the balance, which is heated to a prescribed temperature by a programmed temperature profile. A halogen lamp is the heat source. The sample mass is continuously monitored for water evaporation. The data can be directly logged to a spreadsheet or printed.

The convergence level of the measurement is typically set to 0.05%, so that the measurement stops after this level of convergence has been achieved. Typically, a level of precision of 1% in moisture content can be achieved by this approach, without further pretreatment, and in an inexpensive way. It should be noted that cannabis does contain other volatile components (terpenes) that can evaporate by heating.

The balance features a 95 mm diameter pan and can weigh samples up to 60 g. Repeatability is excellent when the sample is spread thinly over the entire pan. In order to avoid decomposition of the sample, optimal heating conditions should be established for the specific matrix. Several modes are available for the heating profile, namely AUTO, TIME, RAPID, SLOW, and STEP. The AUTO mode allows for heating the sample at the normal rate and then maintains the temperature until the change in moisture content over 30 seconds reaches a set value between 0.01% and 0.1%. This is the mode of easiest operation. The TIME mode on the other hand allows for the profile to be applied for a given amount of time. This mode offers more opportunity for experimentation. The other three modes aim for special sample heating during the measurement, depending on the matrix involved.

The overall process consists of selecting the method of heating, connecting the balance to the data logger, taring the balance, loading the sample and starting the measurement by lowering the cover. The unit then logs the weight loss at regular intervals (selected before starting) until either the convergence value has been reached or the set time has elapsed (depending on the mode).

■ Measurements

Shown in Figure 1 is picture of the loaded pan before measurement. A set of 3 experiments were performed, each one repeated three times. The three experiments were set in TIME mode for 15 minutes, at three different temperatures. The weight used was approximately 2 grams. The header and the initial data from one run are shown in Table 1. Figure 2, 3, and 4 show the drying temperature profiles at 105, 110, and 120 degrees C, respectively, then up to termination. There should be discussion on total weight loss from graphs, also and precision data, or any other statistics which can be reported (with good values).

Figure 1: Picture of cannabis flower placed on the measurement pan of a MOC63u moisture analyzer

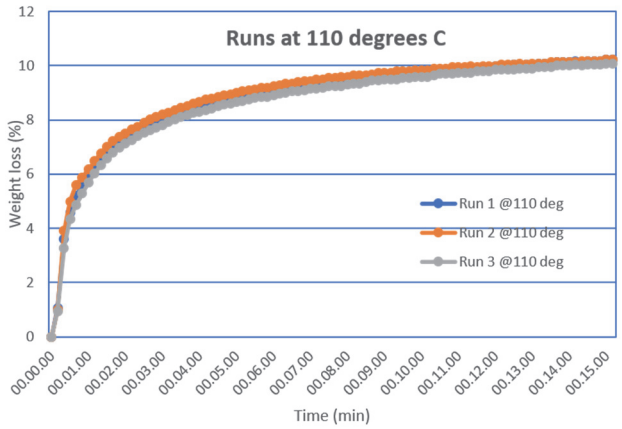

Figure 3: Drying temperature of 110 degrees C

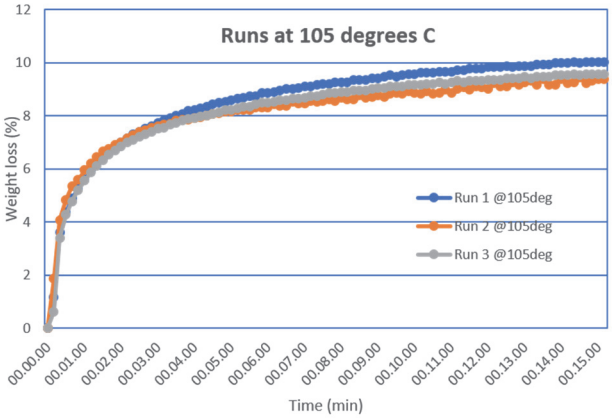

Figure 2: Dry temperature of 105 degrees C

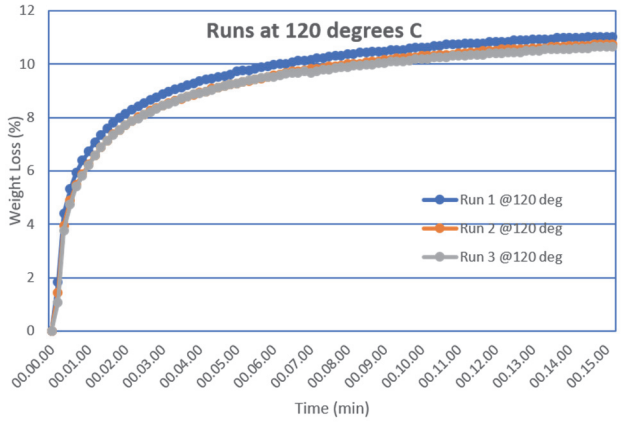

Figure 4: Drying temperature of 120 degrees C

Table 1: MOC63u data logged to Excel

SHIMADZU CORP.			**TIME**	**M/W<%>**			00.13.00	9.88
TYPE MOC63u			00.00.00	0			00.13.10	9.88
SN D209600021			00.00.10	1.18			00.13.20	9.93
ID 0000			00.00.20	3.6			00.13.30	9.93
CODE 0015			00.00.30	4.37			00.13.40	9.93
DATE 11-08-19			00.00.40	4.89			00.13.50	9.98
TIME 15.15			00.00.50	5.25			00.14.00	9.98
PNO. 2			00.01.00	5.61			00.14.10	9.98
UNIT M/W			00.01.10	5.92			00.14.20	10.03
MODE TIME			00.01.20	6.22			00.14.30	9.98
TEMP 105C			00.01.30	6.43			00.14.40	10.03
STOP 00.15			00.01.40	6.64			00.14.50	10.03
			00.01.50	6.84			00.15.00	10.03
Wet W<g>	1.944		00.02.00	7		-	00.15.00	10.03
			(Continued)					
			(Skipping to min 13)			**Dry W<g>**	1.749	

■ Discussion

The triplicate runs on the plots show good repeatability. A temperature of 110 degrees C seems appropriate for the determination of the moisture content in a typical cannabis flower matrix. The length of time can be set to 10 minutes; 15-minute long extended runs were utilized in this study in order to establish the stability of the convergence. If the balance is operated in AUTO mode with cutoff at 0.05% weight loss, this would result in runs shorter than 10 minutes for all temperatures, with progressively shorter runs as the temperature rises from 105 degrees to 120 degrees.

In terms of accuracy, a slight increase in weight loss is observed as the temperature is raised. This is expected, as mentioned before, due to weight loss from other volatile components (terpenes). The accuracy within a given temperature set of measurements can be roughly estimated to 0.5%, which includes the additional components due to volatile components other than water. The uniform distribution of the material on the pan does have some effect on the accuracy measurement as well.

■ Conclusion

The moisture balance can repeatably and accurately determine the moisture content of cannabis and hemp flower. A temperature of 120 degrees for 15 minutes is sufficient to determine the moisture content with accuracy better than 2% and excellent repeatability.

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