

Comparison of different methods for determination of Cannabis inflorescences humidity

Iskra Davkova*, Nadica Trajkovska, Ivana Cvetkovikj Karanfilova, Ana Trajkovska, Gjoshe Stefkov, Svetlana Kulevanova, Marija Karapandzova

Ss Cyril and Methodius University in Skopje, Faculty of Pharmacy, Institute of Pharmacognosy, Mother Theresa 47, 1000 Skopje, Republic of North Macedonia

Introduction

Cannabis is one of the most popular plants nowadays and its use in medicine has an increasing rate. This is why the quality of Cannabis is of a great importance. As a plant, it is more susceptible to diseases caused by different microorganisms, as well as to attack of environmental contaminants. An excess of water could encourage microbial growth and affect the consumer's health, due to the increased use of Cannabis for medicinal purposes. Moisture not only effects shelf-life and taste sensation but also the percentage of THC in Cannabis products, as it is a substantial part of the total weight (Miao et al, 2014). Regarding this, two direct moisture content measurement techniques were compared to determine the possible differences in the estimated values of the moisture content in *Cannabis sativa* cultivars.

Materials and methods

Plant materials

Plant material was consisted of dried flowers originating from three different *Cannabis sativa* cultivars: Kerosene Krash, Gluberry OG and Passion.

Determination of water by oven drying method (Loss on drying, LOD)

Determination of water by the oven drying method was done according to the method 2.2.32 given in DAB 2018.

This method is simple and straightforward, and involves three step. An aliquot of analyzed sample was weighed in glass container, then dried in a vacuum oven (pressure 41.5-2.5 kPa at temperature of 40°C for 24h) and weighed afterwards again. Before the sample was re-weighed, it was cooled in desiccator.

Determination of water by distillation (DWD)

Determination of water by distillation on Cannabis inflorescences was done according to the method 2.2.13 given in the European Pharmacopeia 10.0.

200ml toluene R and about 2mL of water R were introduced into the dry flask. The flask was heated on electric heater for 2 hours to distill the liquid and cooled down for 30 minutes. The determined volume of aqueous distillate was read (first distillation). After that, an aliquot of Cannabis sample was weighted and transferred to the flask. The flask was heated gently for 15minutes. When boiling point was reached, the rate of distillation was adjusted to 2 drops per second until the most of the water distilled over. Then, the rate was increased to about 4 drops per second. As the water was completely distilled, the condenser tube was rinsed with toluene R. The distillation continued for 5 more minutes. After cooling and separating the water/toluene layer, the volume of water was determined (second distillation). The content of water was calculated in percentage using the equation $100(n_1-n)/w$, where w is the weight in g of the material being examined, n is the number of ml od water obtained in the first distillation and n_1 is the total number of ml of water obtained in both distillations.

Results and discussion

The results from loss on drying of Cannabis inflorescences humidity obtained by vacuum oven drying method ranged between the samples from 6.87% in Kerosene Krash, 6.91% in Glueberry to 6.96% in Passion. The method for determination of water with toluene distillation revealed much higher values and ranged from 9.97% in Kerosene Krash, 8.64% in Glueberry to 13.53% in Passion.

Oven drying is a simple and convenient technique that requires at least 24 hours (Miao et al, 2014). On the other hand, water distillation is much quicker but more complicated method. The values obtained by LOD are representing the loss of mass of the sample consisted from the masses from all the components that can evaporate in a vacuum oven (pressure 41.5-2.5 kPa at temperature of 40°C for 24h), that generally comprises water, but also easily volatile compounds like terpenes. LOD generally encompasses extracellular water and volatile compounds which usually comprehends terpenes, lactic acid, acetic acid, and smaller amounts of propionic, butyric and other acids. Regarding this, volatile compounds, such as terpenes are mainly responsible for the unique smell of Cannabis and in practice, this can be noticed by the loss of aroma of the sample after it is removed from the vacuum oven.

According to our findings, the obtained percentages of LOD were lower compared to the percentages obtained by the distillation method that could be explained by the fact that during the distillation, not only the extracellular water, but also a larger amount of plant cells water evaporates. Comparison between the obtained values with oven drying and water distillation method in legumes and grasses showed that the determined moisture values for water distillation were higher than that obtained by oven drying method (Luthern, 1981). According to literature data, those differences were related to low ammonia nitrogen levels, low volatile fatty acids levels as well as high lactic acid concentrations and it appreciable volatility (Philip et al, 1977). Some practical issues affect the uncertainties involved in the LOD method. For example, sample preparation and handling, sample size,

temperature, pressure, drying duration in oven, loss or gain of sample moisture in ambient environment, possible spillage in oven, burning, melting and chemical decomposition and so on. In the most cases, samples are cooled in a desiccator after they are removed from oven before re-weighing, but occasionally, the samples are cooled in ambient temperature, which may lead to mass gain from air humidity, hence an error in dry mass weighing. Despite that, LOD is still the most widely used technique for determination of water content, especially in analysis of foodstuffs and agricultural products, while on the other hand water distillation is not regularly carried out as a routine procedure in analytical laboratories mainly because of the toluene toxicity. Besides that, water distillation is still a method of choice in cases when the herbal material contains volatile components, most often terpenes, in amount larger than 2% (Miao et al, 2014).

Conclusion

Moisture content of Cannabis inflorescences was determined by two different methods, loss on drying and water distillation. The estimated values for moisture content obtained by water distillation method were higher than the values obtained by the vacuum oven drying method. Further examination which take these variables into account, will need to be undertaken, in order to determine more precise value of Cannabis inflorescences humidity.

References

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