Designation: D8196 – 22

Standard Practice for Determination of Water Activity (a_w) in Cannabis Flower[1]

This standard is issued under the fixed designation D8196; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

The concept of water activity is more than 50 years old. For many years, researchers tried to equate bacterial growth potential with water content. William Jones Scott showed in 1953 that microorganisms have a limiting a_w level for growth (**1**),[2] thus being the first to establish that bacterial growth correlated with water activity, not water content of organic materials. It is now generally accepted that a_w is more closely related to the microbial, chemical, and physical properties of foods and other natural products than is total moisture (**2**). It is firmly established that growth of specific microbes is inhibited at or below specific water activity values (**3**).

Total water content (moisture) measurements do not necessarily reflect water available for microbial growth and thus are an inaccurate means for controlling microbial growth, because the water content sufficient for microbial growth is dependent on the substance being tested. Water activity measurement is more accurate than total water content (moisture) measurement as it relates directly to the water available to microbes. Safe a_w levels are constant relative to particular microbes, regardless of the substance being tested.

1. Scope

1.1 This practice covers the recommended procedure for determining the water activity (a_w) of a cannabis flower sample.

1.2 *Units*—The values stated in SI units are to be regarded as the standard. Water activity is a ratio, and thus is without unit designation.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D8197 Specification for Maintaining Acceptable Water Activity (a_w) Range (0.55 to 0.65) for Dry Cannabis Flower Intended for Human/Animal Use

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *cannabis flower, n*—the flowering or fruiting tops of the cannabis plant (excluding seeds and leaves when not accompanied by flowering or fruiting top) from which the resin has not been extracted. (adapted from the UN Single Convention on Narcotic Drugs, 1961[4])

3.1.2 *cultivator container, n*—packaging used by cannabis grower/harvester to store and/or ship product in large quantities after drying.

3.1.3 *dispensary container, n*—packaging used by a cannabis-dispensing establishment to provide the cannabis flower consumer a satisfactory storage container.

3.1.4 *packager container, n*—packaging used by the packager to store and ship product to dispensing establishments.

[1] This practice is under the jurisdiction of ASTM Committee D37 on Cannabis and is the direct responsibility of Subcommittee D37.04 on Processing and Handling.

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[2] The boldface numbers in parentheses refer to a list of references at the end of this standard.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] www.unodc.org/pdf/convention_1961_en.pdf, p1, accessed 2018.01.23

3.1.5 *water activity, a_w, n*—the partial vapor pressure of water in a substance divided by the vapor pressure of pure water at the same temperature which is calculated by dividing the partial vapor pressure of water in the substance (P) by the vapor pressure of pure water at the same temperature (P_o), that is, $a_w = P/(P_o)$. This describes quantitatively the capability of the cannabis flower in a sealed container to affect the humidity of the container's headspace air.

4. Summary of Practice

4.1 The water activity (a_w) of freshly sampled cannabis flower should be determined using a calibrated a_w meter. Water activity values are reported in a_w units ranging from 0.00 to 1.00.

5. Significance and Use

5.1 This practice is designed for use on cannabis flower by cannabis producers, processors, dispensers, testing laboratories, and end users. a_w testing at any point in the supply chain is an important element in ensuring the safety and quality of cannabis flower. Testing can occur spontaneously at any point in the supply chain by regulatory agencies, suppliers, and customers.

5.2 This practice is an important endpoint in determining whether a cannabis flower sample is being stored under optimal storage conditions (see Specification D8197).

5.3 Analysis of water activity should be considered an important quality control step in ensuring a cannabis flower sample is being stored under optimal storage conditions to prevent mold and/or other microbiological growth and/or breakage.

5.4 Maintaining the requisite a_w throughout the supply chain from completion of drying through merchandising ensures safety and quality for the consumer.

5.5 Water activity is used in many cases as a critical control point for Hazard Analysis and Critical Control Points (HACCP) programs. Controlling a_w should not be seen as a kill step.[5] Rather control of a_w focuses on preventing the growth and proliferation of microorganisms.

5.6 This practice is designed for use by trained technical individuals with minimal knowledge of complex analytical chemistry procedures.

6. Hazards

6.1 It is recommended that cannabis flower samples be handled with gloved (oil and moisture resistant) hands or tools to ensure no direct contact between skin and the sample.

7. Testing Facilities and Personnel

7.1 All testing shall be carried out in a location of stable temperature (constant ±1 °C and humidity (constant ±5 % relative humidity) in a temperature range of 15 to 50 °C (typically 25 °C) that has minimal drafts.

7.2 Personnel shall be trained in the proper handling of cannabis flower samples using gloved hands or tools to prevent skin contact, operation of the a_w instrument, and routine maintenance of the a_w instrument.

8. Apparatus

8.1 Use gloves of non-absorbent material or tools such as tongs or spatula that ensure no contact between skin and sample to prevent transfer of water (in the liquid state) to or from the sample.

8.2 Use an a_w measurement system (also known as a water activity meter) capable of: a_w measurement resolution of 0.001 a_w, a_w accuracy of ±0.005 a_w, temperature measurement resolution of 0.1 °C, temperature accuracy of ±0.1 °C, and an a_w measurement range of 0.40 to 0.80 a_w or greater. Instrument may be test cup based or probe based. Maintain the instrument per the manufacturer's directions.

8.3 If sample must be ground, use a cannabis grinder with a volume capacity approximating that of the flower to be ground to minimize impact on a_w due to evaporation or compression.

9. Calibration

9.1 Calibrate the a_w instrument per the manufacturer's instructions.

9.2 Calibrate using certified 0.50 and 0.76 a_w standards to bracket the desired a_w range.

9.3 *Calibration Frequency:*

9.3.1 If the a_w instrument is being used in a single location at the same temperature (±1 °C) and humidity (±5 % relative humidity), calibrate if it has been more than seven consecutive days since the last calibration.

9.3.2 If the a_w instrument is physically moved from one location to another, calibrate immediately following the move.

9.3.3 If the a_w instrument has been cleaned, then calibrate immediately following the cleaning.

NOTE 1—Some operators find it helpful to track room temperature and humidity by operating the instrument with an empty test cup or a probe suspended in the air to determine the a_w and temperature of the room where testing is taking place. If questions arise regarding accuracy of test results, room data can provide insight as to whether water in its liquid state, (that is, moisture) may or may not be transferring to or from the sample during testing.

10. Sampling and Handling Considerations

10.1 Sample directly from the original cultivator/packager, dispensary container. The sample shall be in that container until the testing procedure (11.1) is initiated.

10.2 Once removed from the container, testing shall be done in less than 10 minutes to minimize the impact of room temperature and relative humidity. Working in a temperature and humidity controlled glove box is recommended.

10.3 If a specimen of the sample needs to be submitted to a laboratory, select a clean, sealable container with adequate vapor barrier properties (for example, glass, metal, foil coated

[5] http://www.foodsafetynews.com/2009/12/the-kill-step-consumer/#.WodgT6jwY2w "kill step" is the term typically used to describe a point in the food manufacturing process where potentially deadly pathogens are eradicated from the product (usually by killing the pathogen). Traditionally the "kill step" has involved cooking, pasteurization, pathogen-killing washes, irradiation, etc. Accessed 2/16/2018.