Designation: D8197 – 22

Standard Specification for Maintaining Acceptable Water Activity (a_w) Range (0.55 to 0.65) for Dry Cannabis Flower Intended for Human/Animal Use[1]

This standard is issued under the fixed designation D8197; 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 and metabolism of microbe associated toxins are inhibited at or below specific water activity values (**3**, **4**).

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 measurement as it relates directly to the water available (in liquid form) to microbes and is constant relative to the particular microbe, regardless of the substance being tested.

1. Scope

1.1 This specification covers the recommended range of a_w suitable for safe and efficacious storage of cannabis flowers or portions thereof.

1.2 *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.*

1.3 *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]

D8196 Practice for Determination of Water Activity (a_w) in Cannabis Flower

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *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. Significance and Use

4.1 This specification is designed for use on cannabis flower by cannabis producers, processors, dispensers, testing laboratories, and end users.

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

Current edition approved Oct. 1, 2022. Published November 2022. Originally approved in 2018. Last previous edition approved in 2021 as D8197 – 21. DOI: 10.1520/D8197-22.

[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.

4.2 Analysis and control 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 or other microbiological growth and breakage.

4.3 All constituent testing, other than water activity in accordance with Practice D8196, shall be carried out on the cannabis flower sample that has been equilibrated to this specification in accordance with 6.1 and 6.2.

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

4.5 Water activity (a_w) is often used as a critical control point of Hazard Analysis and Critical Control Points (HACCP) programs. Controlling a_w should not be seen as a kill step.[4] Rather control of a_w focuses on preventing the growth and proliferation of microorganisms.

5. Testing

5.1 Refer to Practice D8196.

6. Chemical Composition—Specification for Storing Cannabis Flower

6.1 a_w shall be less than 0.65 to ensure against undesirable growth of microorganisms such as mold.

6.2 a_w shall be greater than 0.55 to ensure against physical damage (breakage) in routine handling and storage.

7. Special Considerations

7.1 a_w values shall be between 0.55 and 0.65.

7.2 If a_w is greater than 0.65, further drying of the cannabis flower(s) shall be required to ensure the a_w is 0.55 to 0.65.

7.3 If a_w is less than 0.55, moisture should be added to bring the cannabis flower into the desired range. Add moisture by a suitable means such as humidity control of storage facility or placing the flower(s) in a hermetically sealed container with a humidity control device appropriate to the container and contents to effectively bring the stored cannabis flower(s) into the specified 0.55 to 0.65 a_w range. (Do not spray liquid water directly upon the flower as this may induce damp spots sufficient to promote localized mold growth.)

7.4 If the a_w of the cannabis flower is between 0.55 and 0.65, the cannabis flower should be stored in a humidity controlled environment such as a humidity controlled room, or in hermetically sealed containers with a humidity control device appropriate to the container and contents to ensure/maintain product safety and quality.

[4] *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. (5).

8. Keywords

8.1 a_w; cannabis; cannabis flower; mold; physical damage; water activity; water content

REFERENCES

(1) Scott, W. J., "Water Relations of *Staphylococcus aureus* at 30°," *Australian Journal of Biological Sciences*, Vol 6, 1953, pp. 549–564.
(2) Chirife, J., and Fontana, A. J., "Introduction: Historical Highlights of Water Activity Research," *Water Activity in Foods: Fundamentals and Applications*, Barbosa-Cánovas, G. V., Fontana, A. J., Schmidt, S. J., and Labuza, T. P., eds., Blackwell Publishing Ltd, Oxford, UK, 2007.
(3) Russell, N. J., Leistner, L., and Gould, G. W., "Solutes and Low Water Activity," *Food Preservatives*, Russell, N. J., and Gould, G. W., eds., Springer 2012, p. 119ff.
(4) Naresh, M., and Aldred, D., "Post-Harvest Control Strategies: Minimizing Mycotoxins in the Food Chain," *International Journal of Food Microbiology*, Vol 119, Nos. 1–2, 2007, pp. 131–139.
(5) Caywood, C., "The"Kill Step" Consumer," Food Safety News (FSN) online, Dec. 3, 2009, http://www.foodsafetynews.com/2009/12/the-kill-step-consumer/#.WodgT6jwY2w. Accessed Feb. 16, 2018.

RELATED MATERIAL

Walker, W., "Fungus in Medical Marijuana Eyed as Possible Cause in California Man's Death," CBS San Francisco KPIX5 online, Feb. 6, 2017, http://sanfrancisco.cbslocal.com/2017/02/06/medical-marijuana-fungus-death-uc-davis-medical-center. Accessed Sept. 3, 2017.
Holmes, M., Vyas, J. M., Steinbach, W., and McPartland, J., and references therein, "Microbiological Safety Testing of Cannabis," Cannabis Safety Institute, May 2015.
Ledward, D. A., "Water Activity: Theory and Applications to Food," *IFT Basic Symposium 85 Series*, Rockland, L. B., and Beuchat, L. R., eds., *Meat Science*, Vol 21, 1987, pp. 157–86, 158.
Marcoli, C., and Peter, T., "New UNIFAC Parameterization," *Atmospheric Chemistry and Physics*, Vol 5, 2005, pp. 1545–1555.
Pitt, J. I., "Xerophillic Fungi and the Spoilage of Foods of Plant Origin," *Water Relations of Foods*, Duckworth, R. B., ed., Academic Press, New York, 1975, pp. 273–307.
Troller, J. A., "Trends in Research Related to the Influence of "Water Activity" on Microorganisms in Food," *Advances in Experimental Medicine and Biology*, Vol 302, 1991, pp. 305–313.