Determination of pH in hummus by the potentiometric method

Using the Thermo Scientific™ Orion™ Pro Star PH211 pH Bench Meter

Testing the pH of prepared food products is an essential component of the food manufacturing process. It plays a vital role in helping to ensure food safety, quality, shelf life, preservation methods, enzymatic activity, product formulation and regulatory compliance. As a fundamental analytical parameter, pH testing enables food manufacturers to provide safe and high-quality products to consumers.

Hummus is a popular food product made from cooked and mashed chickpeas blended with ingredients like tahini, olive oil, lemon juice, garlic and various spices. pH measurement is crucial during the production of hummus as it impacts the taste, texture and microbial stability of the final product. Maintaining the desired pH range is essential to food safety, extending shelf life and achieving the desired flavor profile.

The pH level of hummus during processing and packaging determines its quality and consistency, ultimately impacting its shelf life and flavor profile, and how safe it is to consume. When acids are added, they impart a pleasant, tart taste and can function as a preservative by stopping or slowing the growth of food poisoning and spoilage bacteria.

How pH impacts food safety

pH plays a significant role in inhibiting the growth and toxin production of *Clostridium botulinum*, the bacterium responsible for botulism. Botulism is a severe and potentially life-threatening illness caused by the ingestion of botulinum toxin, which is produced by these bacteria. The growth of *C. botulinum* is strongly influenced by the pH of the environment. The bacteria thrive and reproduce under specific pH conditions, typically between pH 4.6 and 7.6. Within this range, bacterial spores can germinate, and the bacteria can multiply, producing toxins that cause botulism when consumed.

C. botulinum is particularly sensitive to low pH levels, specifically acidic conditions. As the pH decreases below 4.6, the growth and toxin production of *C. botulinum* is significantly inhibited. This is because the acidic environment disrupts the bacteria's metabolism and prevents the production of botulinum toxin. In the United States, the Food and Drug Administration (FDA) has set a maximum pH of 4.6 for packaging certain acid, acidified and fermented foods. This pH can control the risk of botulism. Acid may not be the sole control measure, but is combined with other control measures such as heat, salt, sugar, preservatives, or other "hurdles" to control the growth of unwanted microorganisms.[1,2]

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pH measurement criteria for hummus production

A pH electrode and meter are used for accurate pH testing, especially in the critical range from pH 4.0 to 4.6.[2,3] Temperature measurement is needed to verify the sample temperature and to automatically adjust the pH calibration based on temperature changes. To help ensure precise and reliable pH measurement in hummus production, it is essential to use a pH meter with an electrode design that's suitable for food applications. Look for a pH meter and electrode kit that provide the following:

- **Accuracy and precision:** For pH readings that are accurate, within your specifications and repeatable, you'll need an electrode that is designed to resist clogging and provide good contact between the junction and the sample. Opt for a precise meter that can read to +/- 0.01 pH and accepts two or more calibration points.
- **Ease of calibration:** Choose a meter that is simple and easy to calibrate. Capabilities should include automatic recognition of pH calibration buffers, on-screen instructions to help with calibration and automatic logging of calibration data.
- **Durability and maintenance:** Durable pH meters will be rated for splashes, spills and dust intrusion with a rugged screen that is easy to clean. Look for a generous warranty to safeguard your investment.
- **Automatic temperature compensation:** Temperature impacts pH measurements during calibration and when testing samples. Select a meter with automatic temperature compensation to provide more accurate and reliable results across a range of temperatures.

Recommended products for hummus production

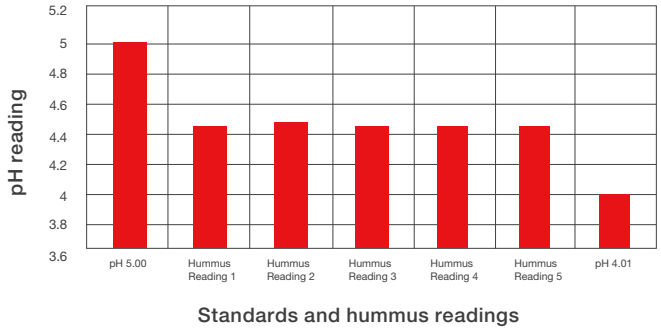
Thermo Scientific™ Orion™ Pro Star PH211 pH bench meter kits can provide easy, accurate analysis for the pH testing of hummus. Designed to provide a convenient solution, they remove the guesswork of selecting the right products for your analysis. Orion Pro Star pH bench meter kits include the Thermo Scientific Orion Pro Star PH211 pH/ORP bench meter, Thermo Scientific™ Orion™ ROSS pH electrode, Thermo Scientific™ Orion™ solutions and required accessories to get started with your pH testing.

A popular choice is the Thermo Scientific Orion Pro Star PH211 pH durable bench meter kit (PSTAR2116). It includes the Thermo Scientific™ Orion™ ROSS Ultra™ Refillable pH/ATC Triode™ combination electrode (8157BNUMD), which features a built-in temperature sensor and a protected pH bulb. Another good choice is the Thermo Scientific Orion Pro Star PH211 pH bench meter difficult sample kit (PSTAR2114). It includes a separate temperature sensor and a Thermo Scientific™ Orion™ ROSS™ Sure-Flow™ pH electrode (8172BNWP) with a flushable junction that's designed to help resist clogging and is easy to clean and maintain. An optional pH bulb protector is also included.

Both the Orion ROSS Ultra Refillable pH/ATC Triode and Orion ROSS Sure-Flow pH electrodes performed well when testing hummus. Calibration slopes were 99.1% or better. The calibration verification standards (measured before and after testing) were all within +/- 0.04 pH of the expected value. The standard deviation of the five hummus readings on each electrode was 0.03 pH or better. The two electrode models measured average pH readings that were within +/- 0.04 pH.

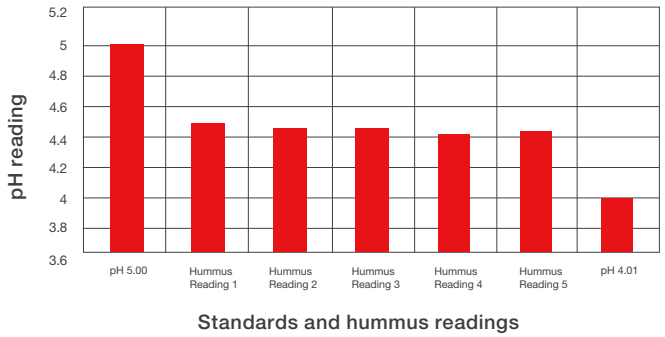
pH testing in hummus

Orion ROSS Ultra Refillable pH/ATC Triode Combination Electrode (8157BNUMD)



Standards and hummus readings

Orion ROSS Sure-Flow pH Electrode (8172BNWP)



Standards and hummus readings

Conclusion

Orion Pro Star PH211 pH/ORP bench meter kits provide accurate and reliable pH measurements that help ensure the quality, safety and regulatory compliance of hummus. With features such as automatic temperature compensation and ease of calibration, the Orion Pro Star PH211 pH bench meter paired with Orion ROSS pH electrodes delivers consistent and precise pH readings.

Ordering information

Product	Description	Cat. No.
Bench meter kits	Orion Pro Star PH211 pH durable bench meter kit; includes meter with stand (PSTAR2110); ROSS Ultra Triode refillable epoxy-body pH/ATC electrode (8157BNUMD); pH 4, 7, 10 buffers and rinse solution pouches; pH electrode storage solution and cleaning solution; pH electrode storage sleeve and base	PSTAR2116
	Orion Pro Star PH211 pH bench meter difficult sample kit; includes meter with stand (PSTAR2110); ROSS Sure-Flow refillable glass-body pH electrode (8172BNWP); stainless-steel ATC temperature probe (927007MD); meter-controlled stirrer probe (096019-WA); pH 4, 7, 10 buffers and rinse solution pouches; pH electrode storage solution and cleaning solution; pH electrode storage sleeve and base	PSTAR2114
Solutions	Orion pH 4.01 buffer standard	910104
	Orion pH 7.00 buffer standard	910107
	Orion pH 5.00 buffer standard	910105
	Orion ROSS pH electrode storage solution	810001
	Orion ROSS pH electrode filling solution	810007
Laboratory grade water	Thermo Scientific™ Barnstead™ Smart2Pure™ 12 UV water purification system	50129890*

**Contact a Thermo Fisher Scientific representative for additional support ordering a water purification system for your application.*

References

1. Carson City Health and Human Services, Carson City, NV USA. Acidification and Fermentation HACCP Guidance.
2. 21 CFR § 114.90 (2017). Food and Drugs, Part 114—Acidified foods, Subpart E, Production and process controls.
3. Pennsylvania Department of Agriculture, Bureau of Food Safety and Laboratory Services, Harrisburg, PA USA. Canning of Acid, Acidified, and Fermented Foods Guidance for Commercial Food Establishments Licensed by PDA. Rev 12/2022.

Learn more at **thermofisher.com/prostarph211**

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