

pH Measurement of Rice

InLab Expert Pro-ISM Sensor

pH measurement of cereal grain like rice becomes difficult due to its sample nature. Moreover, a conventional pH sensor can easily get clogged and lead to problems like inaccurate and sluggish response while measuring pH. Herein, are mentioned a few methods to measure the pH of rice samples. METTLER TOLEDO's InLab Expert Pro-ISM is a suitable sensor, when it comes to the pH measurement of uncooked rice samples. It is a maintenance free and easy to use pH sensor with an open junction to avoid clogging. Alternatively, InLab Solids Pro-ISM is recommended to measure the pH of cooked rice samples.

Read this application note to find out all the additional benefits that this sensor provides, as well as various methods for pH measurement of rice.



Introduction

Rice is one of the most important and widely consumed cereal grains, since it is the staple food for over half of the world's population. There are different varieties of rice as in white, brown, red and even some wild types. Culinary preferences also vary from place to place. Rice is used as an ingredient in a variety of dishes as in soups, wraps, stuffing's, desserts, sushi, and so on. USDA (US, Department of Agriculture) has set levels for micronutrients in fortified milled rice. Similarly, FSSAI (Food Safety and Standards Authority of India) set up standards for fortification of rice with iron, folic acid, zinc, vitamin B12 and vitamin A.

Importance of pH Measurement

Rice samples are slightly acidic in nature. Normally, pH value of rice is in the range of 6 to 7 pH, though it can vary with different types. The inorganic content of the rice may also contribute to its pH value. pH of a rice maybe analyzed as part of a testing requirement for certain processes or simply as a characteristic parameter during routine testing.

Measurement Challenges

The solid nature of rice makes it a difficult sample to test pH. The following table outlines some of the challenges and impacts on the pH measurement results during the analysis of rice samples.

Sample Challenge	Sample Impact
Solid sample nature	Difficulty in sample measurement
Particulate nature of rice solution and semi-solid nature of cooked rice	Sample nature can lead to junction clogging
Reading fluctuations	Inaccurate pH results
Cleaning of sensor after measurement	Sensor fouling due to inefficient cleaning leads to deposition on the pH sensitive membrane, causing sluggish response

Sensor for fast and accurate pH measurement

Selection of a suitable sensor depends on the methods used for testing pH of rice. Normal sample preparation procedures for testing the pH of rice is mentioned in the subsequent method section. While using these methods, the resultant sample nature can be a highly

particulate or slurry form. InLab Expert Pro-ISM (30014096) is an ideal sensor for measuring such rice sample solutions. The sensor has Intelligent Sensor Management (ISM) technology that offers data security, stores calibration history and monitors maximum temperature exposure of the sensor. 'Pro' stands for a built-in temperature probe in sensor that helps to capture the sample temperature accurately and supports the ATC (automatic temperature compensation) functionality.

This pH sensor is made of PEEK shaft that makes it robust for lab and field applications. Thanks to the solid XEROLYT®EXTRA polymer reference system no refilling of electrolyte is required. The open junction avoids clogging and makes it easy to clean. The overall sensor technology helps with a faster response. InLab pH sensors has an improved reference system, ARGENTHAL™ that helps to avoid junction clogging caused by sulfides or proteins.



Figure 1: InLab Expert Pro pH sensor

Alternatively, rice can be cooked as required in some test method or would be the final form of consumption, hence it is checked for its pH in this form. InLab Solids Pro-ISM (51344155) is a specialized sensor for measuring the pH of cooked rice with accuracy and precision. It is an easy to clean pH sensor specially designed for semi-solid samples. The pH sensing membrane of this sensor is spear shaped such that it can be easily inserted into semi-solid samples. The solid XEROLYT®EXTRA polymer reference system offers a clog-free open junction, making it easy to clean. They are maintenance free sensors, since refilling of electrolyte is not required.

Procedure and Method

Calibrate the sensor using MT buffers that bracket the anticipated pH value of the sample (in this case pH 4.01 and 7.00). Record the calibration slope and offset value for the electrode. A slope value of 95 -105 % and an offset of 0 ± 30 mV ensures reliable measurement.

To measure the pH of rice, any one of the following three methods can be used.

1. Soaking method:

Weigh 20 grams of rice and soak it in 80 mL of DI water for a period of half hour. Measure the pH of the supernatant with InLab Expert Pro-ISM pH sensor.

2. Homogenized slurry method (Dispersed)

Weigh 20 grams of rice and add 80 mL of water in a blender/ homogenizer to make a homogeneous slurry of the rice samples. Continue stirring the sample while measuring the pH using InLab Expert Pro-ISM.

3. Cooked Rice method

The rice is first cooked using a microwave or as per the cooking instructions. Take a sample portion of this cooked rice and measure the pH using InLab Solids Pro-ISM pH sensor. Make sure the junction of the sensor is well covered by the rice samples. To check for homogenous pH value, measure from three different sections.

Standard deviation within ± 0.05 pH units indicates a fair variance in pH measurement of the sample. After pH measurement, rinse the pH sensor thoroughly using deionized water so as to prevent any accumulation of rice particles on the pH sensor. For a systematic cleaning of the sensor, a mild soapy solution is recommended followed by rinsing it with deionized water.

Results and Discussion

Various rice samples were prepared as per the methods mentioned. pH analysis comparisons of all these samples prepared with different methods, yielded similar results with slight variations. The slurry method can be relied on for a more accurate pH value of rice, when compared between uncooked methods. A difference

of approx. 0.1 pH units was observed between the pH measurement of the soaking and the slurry method of rice samples being used. pH value of cooked rice measured using InLab Solids Pro-ISM sensor were similar to pH obtained for the slurry method.



Figure 2: Measurement of cooked rice using InLab Solids Pro-ISM pH sensor

Samples were analyzed for pH at an ambient temperature of 25 ± 2 °C. Average pH values for the samples (performed in triplicates) while performing slurry method using InLab Expert Pro-ISM pH sensor are shown in the table below.

Sample	Mean pH value	Std.Dev.	Avg. time (s)
Rice Sample 1	5.98	0.05	06
Rice Sample 2	6.29	0.02	20
Rice Sample 3	6.39	0.02	06
Rice Sample 4	6.67	0.03	12

Table: pH values of rice samples measured with InLab Expert Pro-ISM pH Sensor.

A standard deviation of less than ± 0.05 pH units and response time within 30 seconds were observed for the pH measurement of these samples.

Expert Tips

- After the electrode has been dispersed in the homogenized sample, rinse it with de-ionized water, and afterwards keep the electrode immersed in tap water while stirring for a minimum of 20 seconds, this is to cleanse the electrode properly. Do not let the rice sample dry on the electrode.
- Use of mild soapy water is recommended for a thorough cleaning of the sensor. Afterwards, remember to rinse it off properly with distilled water.
- InLab Expert Pro-ISM sensor should be reconditioned in 0.1M HCl once a week or every 15 days depending on the usage.
- In-between measurements or when the electrode is not being used for brief periods, it is best to keep the electrode in the wetting cap filled with InLab storage solution.
- Never store the electrode dry or in distilled water as this will affect the pH-sensitive glass membrane and thus shorten the lifetime of the electrode.
- Ensure usage of buffers in the correct sequence, use fresh buffers, and always check the expiry date before using.

Further Information

- Electrode handling movies on:



- Comprehensive range of pH meters, electrodes, solutions, and accessories:

► www.mt.com/pH

References

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