



ARIZONA INSTRUMENT LLC

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Exclusive Manufacturer of Computrac® Moisture Analyzers and Jerome® Toxic Gas Analyzers

Computrac® Moisture Analysis in the Baking Industry

Introduction

Providing a quality product is a complex problem that bakers must solve to be successful in a competitive market. Concerns about the taste, texture, appearance and freshness are just a few of the riddles, and at the heart of these is moisture. Too much water in a baker's product can lead to problems with shaping, a soggy texture, and mold and spore formations in packaging. Too little water creates stale, brittle and hard goods.

Along with the obstacles associated with water content, determining the moisture level has proved to be just as complicated. Deciding when to test, what parts of the product to test and where to test are all difficult choices that need to be made, and changes in these decisions will affect the results obtained from testing. For instance, does the baker test the loaf of bread immediately after it is removed from the oven, before water migration is complete and estimate the moisture of the product; or does the baker wait until the migration has occurred and then test for moisture? Additionally, the historical methods used for moisture determination are lengthy processes that hinder the flow of information needed to decide if a product is ready for release or if there is a problem in the baking process.

While the decision when to test is still left up to the baker, advances in moisture analyses have dramatically reshaped the antiquated methods of the past. Arizona Instrument LLC has led the way on this front, developing rapid loss on drying instrumentation that provides reliable results in minutes instead of hours. These versatile instruments improve process efficiency which will allow for an increase in production, as well as provide vital information which can be used to make adjustments and optimize the quality of the baked goods that are produced.

Traditional Methods

The application of traditional test methods of moisture determination is considered to be elementary by bakers and scientists alike. Often the procedure involves taking a small random sample from a product, measuring its mass, placing it in an oven for a specified time at a specified temperature, removing it and letting it cool to ambient temperature, then reweighing the sample. The % moisture is determined using the following equation:

$$\%M = \frac{(\text{initial mass} - \text{final mass})}{\text{initial mass}} * 100$$

Where the initial mass is determined prior to oven treatment and the final mass is determined after the sample has been in the oven and cooled to room temperature. Ease of use is certainly helps make this a desirable method, but it also has drawbacks. These methods frequently take hours to conduct, which can slow production down. Also, there are no *in-situ* measurements being taken to optimize the procedure. These types of measurements would help reduce cost and improve energy management and efficiency.

Rapid Loss on Drying

Rapid loss on drying instruments operate using the same principle as traditional oven methods, but are able to address the drawbacks associated to them without changing the ease of use. Users of these instruments place a prescribed amount of

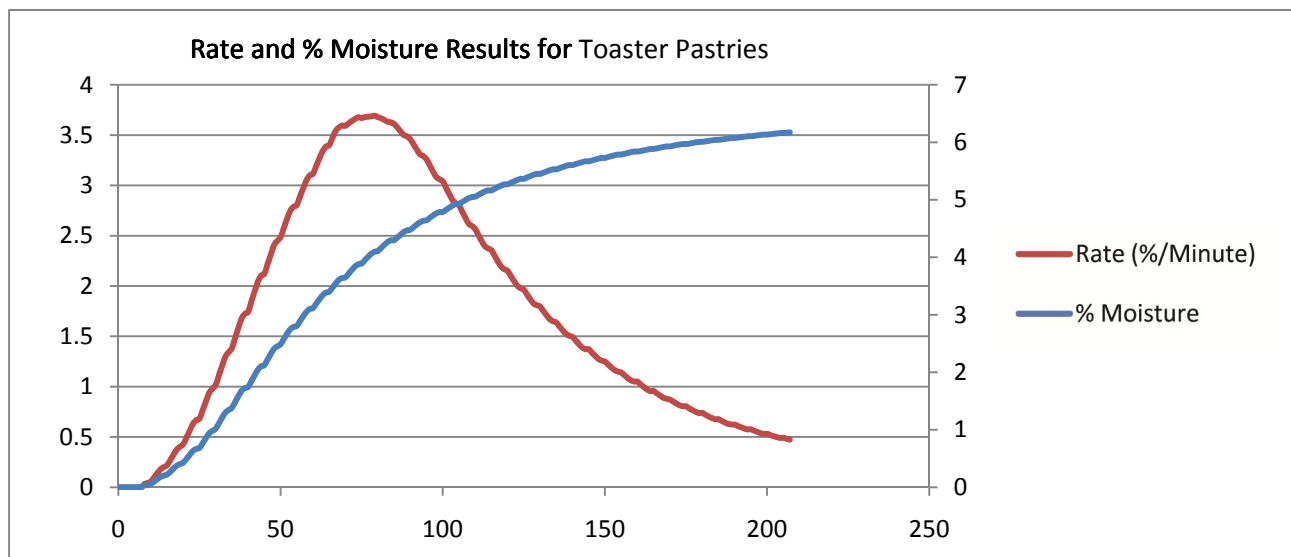
material onto a pan that is sitting on a balance. Once the correct amount of material is on the pan the instrument heats up to a specified temperature and the water is evolved off of the sample. Multiple criteria can be used to end the test, but frequently tests are ended when the change in mass is determined to be negligible. These tests provide the user with real time measurements and often tests take a few minutes instead of hours.

Moisture Testing

Sample	% Moisture Oven Test	Oven Test Time	% Moisture Computrac®	Computrac® Test Time
Bread	38.901	1 hour	38.88	5:26
Pound Cake	44.824	2 hours	44.618	12:10
Cracker	2.869	18 hours	2.922	4:20
Toaster Pastry	6.749	16 hours	6.874	5:45
Chocolate Chip Cookie	5.5679	16 hours	5.6618	4:49

Table 1. Comparison of average test results and test times between the Oven reference method and the Computrac® Moisture Analyzer. Test times for the Computrac® are given in mm:ss.

Table 1. describes some common baked goods' moisture content. The Computrac® and the oven tests provide similar results with a large difference in test time.



Graph 1. Real time measurement data from rapid loss on drying instrumentation.

Graph 1. shows *in-situ* measurements for both rate and total moisture. The test ends after 200 seconds when the change in loss is small and is adding a negligible quantity to the total moisture that is measured.

Conclusion

Rapid loss on drying instrumentation has proven to provide a more desirable method of moisture measurement when compared to traditional loss on drying techniques. It addresses the drawbacks associated with conventional loss on drying and while maintaining the ease of use application. The reduction in test times increases manufacturing efficiency while simultaneously reducing energy costs. Additionally, this instrumentation is able to provide real time moisture measurements to help users optimize moisture measurement methods.