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Effects of Moisture Variation on Biscuit Manufacturing Mixes and Method to Calculate its Standard Batch Net Output

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1. Abstract

Moisture in aggregates can be difficult to control and can cause large variations in the consistency of any food manufacturing mix being made. This in turn can lead to problems with the final output of the mix, which in turn causes final product quality problems meaning waste of materials and extra costs of raw materials. This paper details the effects of this variation and explains methods of controlling the quality according to standard.

2. Introduction

One biscuit producing mix/batch have different types of raw material which have own moisture content. After extensive testing manufacturer determined their standard moisture percentage, so to perform at least according to standard it should be cost saving. Using moisture control this gives a very fast return on investment for the equipment and has the added benefits of higher quality food and more efficient production.

3. Moisture Content

Moisture is simply water diffused in a relatively small quantity. Nearly all materials contain at least a diminutive volume of moisture as a component of the molecular makeup. Moisture is a given in the mass of materials, however the relative percentage is dynamic and therefore not constant.

Materials from the perspective relation to moisture content, generally a sample of material will continually increase or decrease in weight because of hygroscopic action. Hygroscopic action is the amount of moisture a material will absorb relative to ambient temperature and humidity conditions. Temperature and humidity can be controlled in laboratory environments. However in processing, transportation and storage facilities they are impractical to control. If random sampling is correctly administered, the representation will closely reflect the properties of the whole batch.

3.1 Moisture Calculation

Moisture content is the quantity of water contained in a material and is expressed as a ratio, which can range from 0 (completely dry) to the value of the materials' porosity at saturation, is defined mathematically as: Vw/Vt, where Vw is the volume of water and Vt is equal to the total volume of the wet material.

The only accurate moisture test is to take each sample of material and weigh it, then to bake it in an oven and re-weigh it. The loss in weight is the weight of water in the material, and this can be used to get the dry-based moisture value using the following equation:

$M = (W_{wet} – W_{dry})/ W_{dry}$

Where M is the moisture, Wwet is the wet weight and Wdry is the dry weight. It is important to carry out the laboratory test as accurately as possible, using weighing equipment which is accurate to 0.01kg in 5kg and making sure that the oven baking has been performed for long enough (this can be done by placing the sample of material in to the oven again and repeating this until there is no further loss in weight).

3.2 Net Weight & Gross Weight

Net weight and gross weight are two important concepts that are used by manufacturers, to inform the amount of the contents. Gross weight is the total of actual weight of the product plus the packaging weight. Net weight is the actual weight of the product without any packaging material.

4. Biscuit Manufacturing Mixes/Batch Standard Net Output

Batch production is a technique used in manufacturing, involves the production of identical products made in groups (batches). The group remains together as it passes through each stage of production until all processes are complete. Where a mix/batch is made from multiple raw materials. There are many methods to find out standard net output of a batch. For any food manufacturing process like biscuit manufacturing, the steps are as below;

Step01: Set the Bill of Materials (BOM) with their standard moisture percentage

Step02: Calculate the dry output of each materials according to their standard moisture percentage

Step03: Calculate total dry output of the batch

Step04: Add Baked Biscuit Standard Moisture (2%) with total dry weight = **A**

Step05: Production/Normal Loss (2% of A) = **B**

Step06: Manufacturing Defects (1% of A-B) = **C**

Step07: Packing Defect (1.5% of A-B-C) = **D**

Step08: Dust Reuse (50% of Manufacturing Defect + 90% of Packing Defect) = **E**

Step09: Calculate GOOT (good oven output) = **A-B-C-D+E**

Step10: Calculate General Allowance (1.5% of GOOT) = **F**

Step11: Net Output/Return per Batch = **GOOT – F**

SL	Name of Materials	Quantity (Kg)	Moisture Rate in %	Moisture Qty in Kg	Dry Output in Kg
1	Palm Oil	60.00	0.10	0.06	59.94
2	Sugar Powder	85.00	0.10	0.09	84.92
3	Ammonium Bi Carbonate	2.00	100.00	2.00	-
4	Sodium Bi Carbonate (SODA)	1.00	100.00	1.00	-
5	Salt Refined	1.50	1.00	0.02	1.49
6	Corn Starch	6.00	12.50	0.75	5.25
7	Glucose Liquid	10.00	15.00	1.50	8.50
8	Skim Milk Powder (SMP)	7.50	5.00	0.38	7.13
9	Whey Powder	3.00	4.00	0.12	2.88
10	Fresh Milk Flavor	0.40	100.00	0.40	-
11	Flour	300.00	13.00	39.00	261.00
12	Water	30.00	100.00	30.00	-
	Total	**506.40**		**75.31**	**431.10**
	Dry Output				**431.10**
	Add: Biscuit Moisture @2% to dry weight				8.62
	Total Output (A)				**439.72**
	Less: Production/Normal Loss **(B)**				8.79
	Less: Manufacturing Defect **(C)**				4.31
	Less: Packing Defect **(D)**				6.40
	Add: Dust (50% of Manufacturing Defect+90% of Packing Defect) **(E)**				7.91
	GOOT (Good Oven Output)= **A-B-C-D+E**				**428.13**
	General Allowance **(F)**				6.42
	Return Per Batch (RPB)				**422**

5. Effects of Moisture Variation

The variation in moisture in the raw materials leads to two effects in the mixer itself. The first is that the dry weight of raw materials in the mix is less/increase than that specified (if the mix design is calculate with dry weights) which is effect on total net output and the second is that there is an unknown amount of extra water in the mixer that has not been accounted for in the mix design.

The lack of dry material in the mix leads to an under-yield in the final mix. Under yielding also increase the production cost of the finished goods as this is based on a set amount of dry material being in the mixer to make a certain size mix and also on quality. On the other hand the increase of dry material in the mix leads to an over-yield in the final mix. Over yielding also decrease the production cost of the finished goods and effect on quality.

Where a mix is made from multiple raw materials (for example, Flour, Sugar, Palm oil, etc.), moisture variations in each of the raw materials will be different and this will lead to variations in the proportioning of the materials. This can cause changes in the consistence, appearance and overall quality of the product. If colors' are being used, then the difference in the proportioning of the raw materials can lead to variations in the colors' of the final product as the surface area of the materials in the product changes.

For example, if we used 15% moisture content Flour instead of standard 13% then its dry output should be 255kg instead of standard 261kg and return per mix should be 416kg (decrease 6kg from standard). On the other hand if we used 11% moisture content Flour instead of standard 13% then its dry output should be 267kg instead of standard 261kg and return per mix should be 428kg (increase 6kg from standard). In both case the variation of moisture in the raw materials causes variation in the water/materials ratio and this has a direct relationship with the final product quality.

6. The Solution with Moisture Control

In order to work effectively, the moisture sensors first need to be calibrated to read dry based moisture values. This value can then be used in the control system to adjust the target weight of the material. This is a critical part of the installation and commissioning of the sensors and can cause problems if not done correctly. Samples are being collected of the material being batched. These samples should then be tested using a laboratory test and the result matched to the standard.

During the batching process, it is important to make an average measurement of the material being measured as the moisture may vary a lot within a stock. This average should then be used to adjust the target weight to account for the weight of water held in the material.

7. Conclusion

By utilizing moisture control technology, it is possible to reduce the waste, control and improve the quality of finished product and reduce the amount of rework, production cost and productivity.
To give an example of the cost savings in flour only, with correctly calibrated moisture control (reducing the moisture error after correction by 2% from standard) it is possible to have 6 kg of output per batch of dough to achieve the correct water/flour ratio.

If a plant were making 50 batch par day then it have 300kg extra then standard, if the value is 100Tk/Kg then it have cost savings thirty thousand taka per day and nine lac taka per month. It can be seen that installing moisture measurement equipment can quickly return the amount that was invested, typically in less than 3-6 months.

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REFERENCE

Neal Cass. (November 24-26, 2012): SEPT, 10th International Conference on Concrete Block Paving Shanghai, Peoples Republic of China

Thikshani -Martin -Marian Zboraj-Festus (February 03, 2017): Determining Moisture Content. Food, Quality & Safety

Suzanne Nielsen, S., (2010), Food analysis, Springer, Fourth edition, 602p.

MoistTech (November 04, 2018): Raw Material Moisture Control, Raw Material Moisture Sensors