Low carbon emission baking performance of the bread roll and cake

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Abstract:
Carbon emission is the biggest problem all over the world. The actualizing of low carbon emission in the bread kitchen and dessert shop segment permits the difference in its mechanical procedure through the improvement of an eco-proficient framework. This study was to line up bread and cake with fully completely different wheat quality, baking time, and temperature through low carbon emission. The prepared samples were chemically analyzed for wet content, ash content, compound content, and organoleptic. Among the four processed cake products based on each parameter tested organoleptically, cupcake products were the most preferable one. Bread products made with substitution of 50% have been received by consumer panelists. The results of this study were also in line with the research conducted by which resulted in a substitution of spinach flour substitution of up to 60% still acceptable by panelists. Sponge cake from flour can still be received by panelists with 50% substitution. 12% of moisture will help 5 days' self-life without chemical preservatives. The oven is the largest of the three consumers and typically accounts for between 35% and 45% of the total site carbon emissions. The dark cake pan, which holds in more heat than light-colored baking pans and bakes our cake batter faster. Considering that the most significant dark non-stick pan was suggested for baking low carbon emission, it will be reducing the baking temperature by 25° F. Good practice opportunities can be delivered for various plant/equipment utility serving could deliver on average a 10% saving in total CO2 emissions for the sector. This would speak to a CO2 decrease of 57 000 ton CO2 / year over the world.

Keywords: Bread; Cake; Baking Time; Moisture Content; Low Carbon Emissions.

1.0. Introduction

Health and biological process policies are presently promoting the rise of dietary fiber content in food particularly in bread, bread roll, and cake products. According to a study, Cake is batter baked which is made from such as flour, sugar, salt, shortening, milk, eggs, and aroma essential [1]. While Rosyadi mentions cake is baked batter or steamed batter made from flour, sugar, salt, leavening agents, fat, milk, eggs, and flavor [2]. Therefore, the writer concludes that cake is baked batter or steamed batter made from flour, sugar, salt, shortening, milk, eggs, and essential aroma or flavor.

However, incorporation of fiber in bread roll might cause quality problems so decreasing client acceptance. The objective of this study is too raised perceive however dietary fibers have an effect on the standard of bread roll product throughout baking [3]. The studies quantified the impact of supply and quantity of fiber properties. The target of this study was too raised perceive however dietary fibers have an effect on the standard of bread roll and cake product throughout baking. Baking may be an important method however is extremely complicated and somewhat troublesome to know and describe. The look of associate degree kitchen appliance is in the main a matter of warmth transfers and its management except for the baker what happens may be a matter of temperatures and turbulence at specific stages. Heat and temperature don't seem to be constant and may not be confused. It's comparatively straightforward to live temperatures in associate degree kitchen appliance however rather more troublesome to measure heat or heat flux that is that the rate at which heat is being transferred [4]. Heat is transferred rather more effectively if the air is moving close to the dough piece at a given temperature. Cakes are most loved nourishment over the globe but then little is thought about their ecological manageability. The accompanying fundamental item classes are considered: entire cakes cake cuts pies cupcakes and cheesecake. The outcomes uncover that entire cakes have the most minimal effects for 13 out of 18 classes considered. Cheesecake is ecologically the least manageable alternative with all effects however earthly ecotoxicity higher than some other cake type. Crude materials are the significant supporters of most of the effect classifications 22%–98% trailed by bundling and assembling.

Wheat flour sugar palm oil and milk-based fixings are the fundamental hotspots in the existence cycle. A scope of progress openings is considered over the production network [5]. For instance, diminishing sugar content in cakes by 30% would bring down the impacts by up to 3%–11% while diminishing the measure of bundling and vitality utilized in assembling would bring down the effects aggregately by 9%–23%. Limiting waste would diminish water ecotoxicity by 6%–28%. In light of yearly utilization in the UK, the area of the cake contributes 2% to the vitality utilization and 1% to the GHG emissions of the entire nourishment area [6]. The aftereffects of this work can help the business and government in benchmarking the segment and limiting its ecological effects. The discoveries will likewise hold any importance with shoppers in recognizing naturally increasingly maintainable cake choices.

2.0. Materials and Methods

The ingredients used in the cake batter preparations were based on a traditional Spanish formulation 10. ingredients used included the following percentages based on flour 100% plain white flour 13.9% moisture 9.7% protein (Golden Dawn, ADM Milling ltd.) 27% pasteurized liquid egg yolks and 54% egg whites (Frampton ltd.) 100% white granulated sugar (British Sugar PLC) 50% skim long-life milk (Tesco PLC) 288 November–December 2019 vol. 59 no. 6 46% sunflower oil (Olympic oils ltd.), and 1.5% salt.

2.1. Methods

1. Raw materials test for quality control

2. Moisture analysis for Flour

3. Specification of Moisture Analyzer

4. Gluten test for flour:

Gluten is flour protein. It is very important for bread and cake making. It is essential for the human body. But gluten cannot dissolve in water. But it is dissolved in alcohol.

The procedure of gluten test: At first take 50 g flour by measuring analytical balance. Make the dough by using a 25 ml 2 % NaCl solution. After making the dough it dissolves in one beaker 2% NaCl solution. After 45-50 minutes later it washes thoroughly in water. After washing it dry by the cotton cloth. Then measuring weight by using analytical balance and get a result.

5. Milk power test:

In the laboratory milk powder test in different characteristics these are for example:
Fresh milk powder.
Manufacturing date: 20-07-2018
Expiry date: 20-01-2019
Solubility properties: Properly dissolve in water
Flavor: Milk flavors
Color: Off white

6. Sugar test for brix analysis

Equipment & apparatus:
Refractometer
Sugar
Beaker
Spoon
Thermometer
Tissue paper
Conical flax
Thermometer
Distilled water
Method: Take one drop sample on refractometer then close cover and take reading. Sugar brix is 99.89%.

7. pH- test in potable water

pH is the negative logarithms of hydrogen concentration

$pH = - \log_{10}[H]$

pH scale extends from 1-14. When pH is natural while pH = 6.9 represent the acid range and pH 7-14 represent an alkaline range.

8. Finished product test for quality control

Test some characteristics that are given below:
Color > Brown
Flavour > Vanilla
Texture > Smooth
Bite > Crispy
Metallic > None
Sour > None

9. Shelf life study

Some bread roll keeps in the quality control lab after weekly, quarterly, and monthly tests the bread roll moisture. Sometimes moisture increases day by day then finds out what is the cause of increasing moisture.
Weight control: Every bread roll has stranded weight. Measure the bread roll weight by maintaining time by batch-wise.

10. Result for raw material test

11. Moisture analysis result for flour

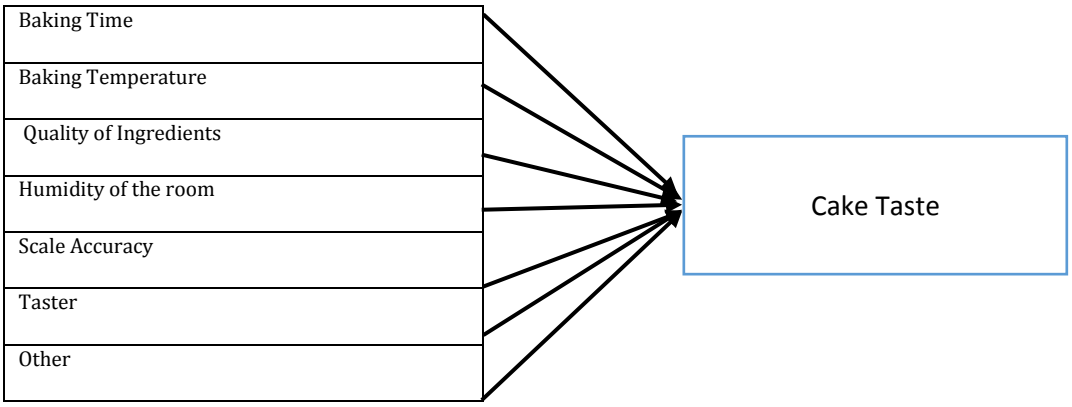
12. Result for brix analysis

13. Result of Finished product test

14. Moisture test of the Bread roll

3.0. Experiment Design

The quality of a cake is affected by several factors such as quality of ingredients baking temperature and time humidity of the room taster and other. The factors are displayed in the diagram below.



Only some of the factors can be controlled. For example, we cannot control the humidity of the room the cakes are baked. The ingredients also can be varying quality from package to package. In my experiment I consider the impact of two of the above factors: baking time and temperature on the taste of a cake made from a mix introduced in section 2 [7]. The responses are ratings of the taste of the cakes given by tasters. Assume that the range of temperatures to be studied is 300 °F to 350 °F and the range of times is 55 minutes to 65 minutes. A possible experimental strategy is to study the recommended times and temperatures and the extremes of the ranges. With this strategy the three temperature levels are to be studied are 325 °F 350 °F and 375 °F and the three time levels to be studied are 55 minutes 60 minutes and 65 minutes [8]. The responses are ratings of the taste of the cakes given by tasters. The tasters score the cakes on a seven-point scale, with 0 meaning well below average, 1 below average, 2 somewhat below average, 3 average,

4 somewhat above average, 5 above average, and 6 well above average. This implies that 9x3=27 tasters and cakes are involved in the experiment. Avoid bias, the randomization process used in the experiment.

The process consists of the following steps:

1. Developed a protocol (that is, a detailed list of instructions) for preparing the cake mix and the oven so that the cakes are prepared under essentially identical conditions.

2. Prepare 27 identical dough's according to the protocol specified in 1. Assign numerical labels

   1, 2… 27 to the dough's and mark each of them clearly.

3. Assign randomly the 27 dough's to the nine treatment groups, three doughs' in each group. This can be done by creating a deck of 27 cards, three for each of the nine combinations, and laying the well-shuffled cards down in a row or by using the table of random digits.

4. Bake the cakes at combinations chosen in random order. This is done for two reasons. First, if there are effects that carry over systematically from one baking to the next, moving systematically through the table of combinations introduces these carryover effects into the data. Second, the random selection of combinations creates a sound theoretical basis for the use of statistical inference methods in analyzing the data. Use an oven and a timer that provide extremely precise and accurate settings. Substantial error in the experimental equipment compromises the precision of the experimental findings.

The baked cakes are assigned to tasters at random by arranging the tasters' names in random order and giving one cake to each taster in that order. Offering cakes to the taste testers in a random order allows you to avoid carryover effects from test to test.

3.1. Moisture analysis for flour

Moisture analysis covers a variety of methods for measuring moisture content in both High level and trace amounts in solids, liquids, or gases. Moisture in percentage amounts is monitored as a specification in commercial food production. There are many applications where trace moisture measurements are necessary for manufacturing and process quality assurance.

Specification of moisture analyzer:

The analysis covers a variety of methods for measuring moisture content in both High level and trace amounts in solids, liquids, or gases. Moisture in percentage amounts. There are many applications where trace moisture measurements are necessary for manufacturing and process quality assurance.
Heating element: Single 400 wart halogen heater

Heating option: Standard step stet up to three temperature seating.

Display: Backlight Led display dual digits and capacity taker 24 mm high digits.

Power supply: Power cord factory set for 110 v or 220v 50\60 Hz operating temperature 30-104 F \ 0-40c.

Overall dimension: (300*250*180) (L*W*H)

Accessories:

Rs_332 cable
USB cable
USB memory stick
Adam data collection
Printer paper

solids particles are used for moisture analysis.

Equipment:

Moisture analyzer
Aluminium pan
Spoon

Procedure:

At first Press, the start baton after a few minutes open the cover and place the aluminium pan and press zero batons and convert the zero balance. After converting zero balance give five-gram flour in the aluminium pan by using a spoon and after fixed the weight press the start baton. In 111°c temperature, it gives a result. After showing the result when the temperature below 50°c then it is switched off.

3.2 Baking process carbon emissions

The focus of the stage 1st work is to identify opportunities to deliver carbon savings through innovation to the baking process. Breakdown of the carbon emissions from each process on a typical bread bakery site. We will see that the largest single site energy consumer is the baking oven. Other significant uses include proving cooling processes and also space heating and electrical power for ingredients handling conveyors and compressed air. Overview of Bakery Processes, Carbon Emissions and Energy Use.

By focusing on the proving, baking and cooling operations my investigations covered a major part of the carbon emissions for a typical bakery – typically from around 50-60% of total site emissions. The oven is the largest of the three consumers and typically accounts for between 35% and 45% of the total site carbon emissions [9]. The remaining carbon emissions for a bakery site relate to plant operation, such as the mixers, conveyors, tray wash operations and also building services such as lighting and heating and ventilation. For these operations there are efficiency opportunities which can be realised through established 'good practice' activities. Proving, baking and cooling operations are a continuous process. Exact operating regimes for bakeries vary in terms of total operating hours. For example, a well-used plant will run continuously, with short gaps as required, and a single maintenance shutdown for maybe 8-12 hours each week – so energy demands are reasonably.

4.0. Bakery process specific good practice opportunities

Overall estimate that the good practice opportunities below alongside improvements that can be delivered for various plant/equipment utility serving could deliver on average a 10% saving in total CO_2 emissions for the sector. This would speak to a CO_2 decrease of 57 000-ton CO_2 / year.

The Carbon Impression Could Be Diminished All Things Considered By 25% By Abstaining from Toasting and Refrigerated Stockpiling of Bread. Further Decreases (5-10%) Could Be Accomplished by Diminishing the Measure of Waste Bread Disposed of By Buyers. The Commitment of Transport and Bundling to The General Outcomes Is Little. Comparative Patterns in The Outcomes Are Likewise Found in The Investigation Dependent on The Auxiliary Information and Following The Iso 14044 System.

5.0. Result and Discussion

5.1. Result

Mass height and diameter of industrially manufactured bread rolls were measured as standard during the trial period. My production was 12 rolls in total the average mass was in the specification min. 20 g max. 25 g average 22.5 g ± 2.3 g the bread roll height 47.0 mm 2.0 mm and diameter 100.4 mm 1.6 mm were also consistent and within specification. A positive correlation was observed between all pairs of parameters although very small for height and diameter 0.05 and most significant for mass and height 0.70. Wheat flour was primarily carbohydrates in the form of starch averaging about 70% of the total flour. The total protein content was 12.5%. Without chemical use, after 5 days our product was very good whereas local product already spoiled due to low moisture content.

Result for raw material test

Table-1: Result of the test which is done in the sustainability centre

List of raw materials	Test	Result
Flour	Gluten	36%
Flour	Moisture	12%
Flour	Colour	White
Flour	Flavour	Pleasant
Sugar	Colour	White
Sugar	Brix	99.89%
Yeast	Activity	± 95%
Dalda	Colour	Yellow white
Dalda	Flavour	Pleasant
Dalda	Odour	Nil

5.2. Finish product test

The results of an organoleptic test of processed products can be divided into 2 types of data, they were the ordinal and interval scale. If the assumption of data type was ordinal scale, the result can be seen in Figure 1, while the interval data type can be seen in Figure 2. Sensory Evaluation Test.

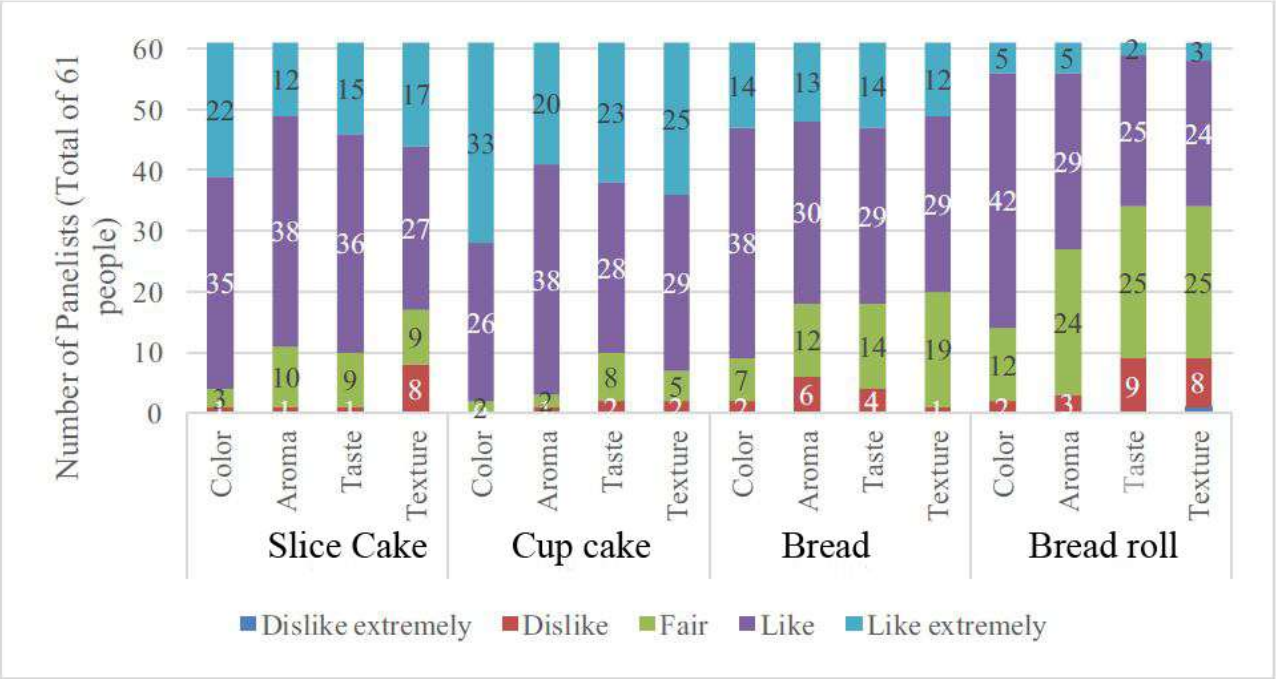


Figure 1: Result of Organoleptic Test on (Ordinal Data)

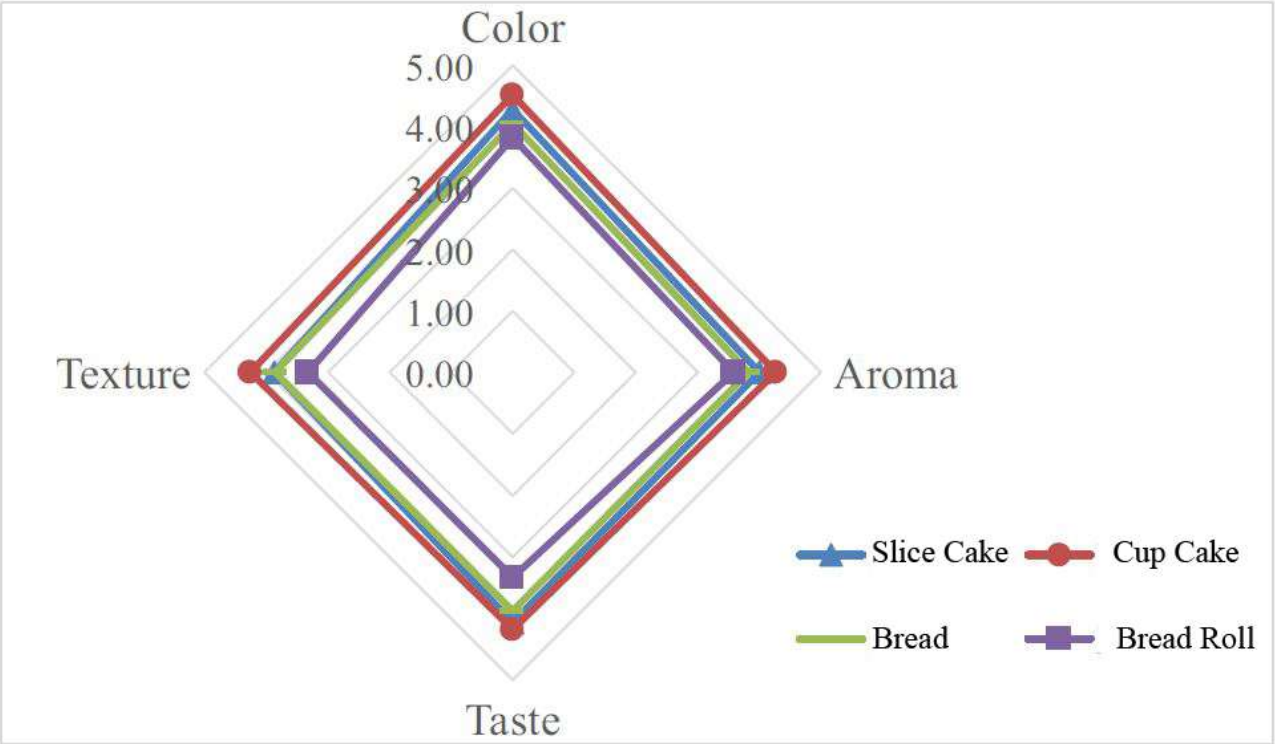
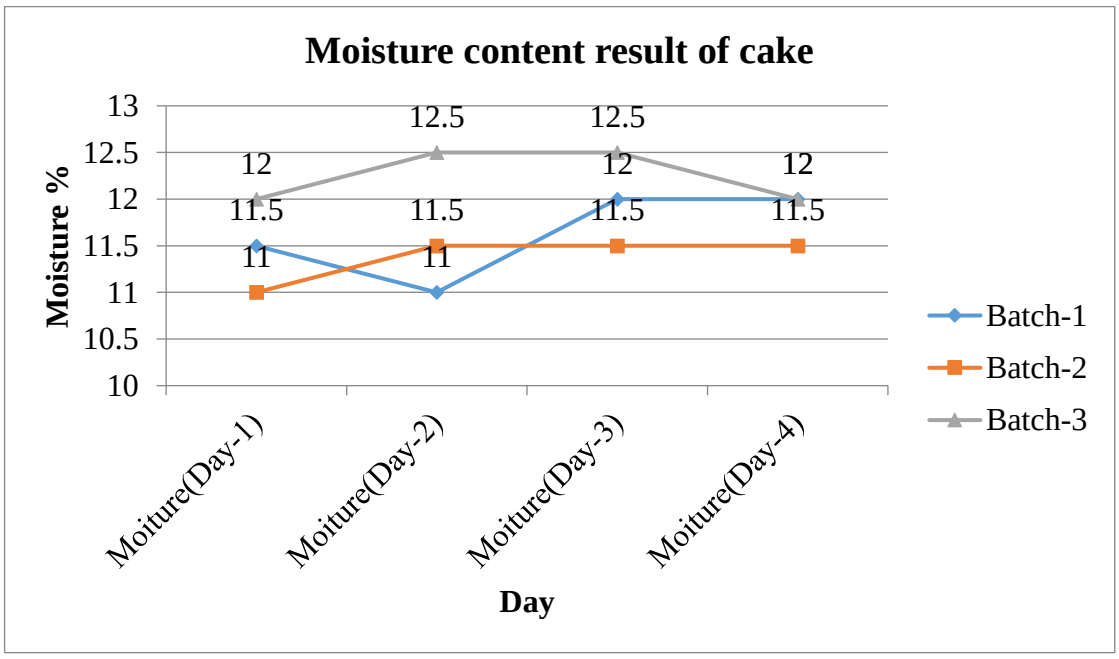


Figure 2: Result of Organoleptic Test on (Interval Data)

Organoleptic testing is a test to assess the quality and safety of a food and drink organoleptically, on a scale of 1-5 the panellists/ respondents tend to value slice cake, cupcake, bread, and bread roll in every color, flavour, taste, and texture parameter. When viewed on an ordinal scale, most of the panellists/ respondents like the processed products whether slice cake, cupcake, bread, or bread roll in any color, flavour, taste, and texture parameters (Figure 1). Whereas, when viewed on an interval scale, overall panellists/ respondents favoured processed products on any color, aroma, taste, and texture parameters with average values between 3,33-4,51 on a scale of 1-5 (Figure 2). Among the four processed products of based on each parameter tested organoleptically, cupcake products were the most preferable one [10]. Whereas the other products that was low incomes compared to the other three processed products is bread roll in each parameter tested, especially texture. This was because it has not been brewed by milk as the way of presentation in general, so the texture of the product was still considered hard. Bread products made with substitution of 50% have been received by consumer panellists. The results of this study were also in line with the research conducted by which resulted in a substitution of spinach flour substitution of up to 60% still acceptable by panellists. Sponge cake from flour can still be received by panellists with 50% substitution. While other studies using mango pulp and mango peel flour were most preferable one in the substitution treatment of 10%.

5.3. Statistical & Graphical Analysis of Result

Chart-1: Statistical & Graphical Analysis Result of Moisture Content



Product moisture was 12% so, no need any preservatives. It helps to keeping good quality of products for 5 days.

6.0 Discussion

Relative Density: Changes in the relative density of cake batters during mixing are shown in Figure 3 Relative density increased during the first 2 min of multistage mixing and first 4 min of all-in mixing because at those times the ingredients were not yet fully mixed.

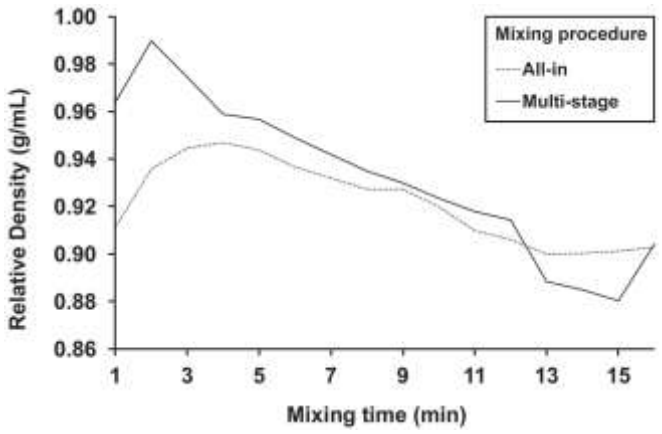


Figure 3: Changes in Relative Density During Cake Batter Mixing.

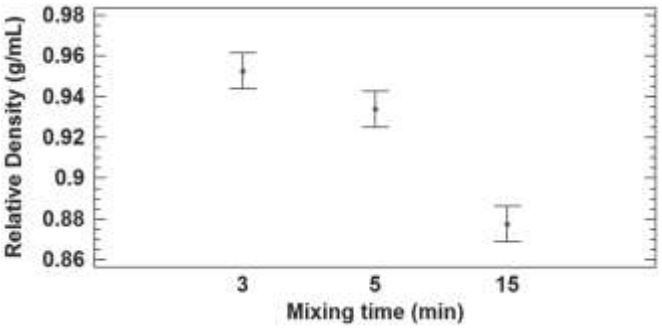


Figure 4: Mean Plot, With 95.0% LSD Intervals, of Relative Density of Cake Batters at Three Mixing Times.

6.1 Baking time & temperature

The difference between average bread roll and excellent bread roll usually has less to do with the ingredients being used than the process involved in making it. Once we are comfortable with the basic process of mix, knead, rise, shape, and bake, our experimentation can be done very smoothly. The two variables are used in this work. Below we discuss how time and temperature change the character of our cake and then show how minor adjustments to the process can improve the quality of our bread roll significantly.

Time: High temperature takes less baking time on the other hand low temperature takes long baking time.

6.2. Temperature's impact on rising

The hotter the temperature, the more dynamic our yeast will be. The more dynamic our yeast is, the sudden the mixture rises. Basic enough, yet we can utilize this in a huge number of ways. For instance:

•If we need to accelerate an ascent, turn our stove on for 30 seconds, turn it off, and afterward place our batter into the marginally above-room-temperature broiler. It should rise to recognizably snappier.

• If we have to leave part of the way through getting ready to heat, we can toss it into the ice chest. It'll keep on ascending in there at a much slower pace.

7.0. Conclusions

The dark cake pan, which holds in more heat than light-coloured baking pans and bakes our cake batter faster. Through using a dark non-stick pan for baking, we can reduce our baking temperature by 25° F. The most bread roll is chemically leavened baking products. They are stable foods and have advantages such as long shelf life and the good eating quality. The physical properties of the dough and the recipes in bread roll making depend on the type of bread roll and the method used in the dough formation. Quality standards from the raw materials to the end product are essential in bread roll making. Temperature also has an impact on how our bread roll bakes. The general rule is that crusty bread roll should be baked at as high a temperature as possible. Soft-shelled bread rolls should be baked at lower temperatures. When we increase the temperature of our oven our bread roll bake quicker. In the study, we have prepared the different kinds of bread rolls according to different recipes and findings taste, texture, baking color, flavour, & nutritional values of sample 1 is comparatively best among 3 samples. On the other hand, Sponge cake is assessed for volume outer and inside qualities and surface. The outcomes are communicated as a numerical score dependent on correlation with a control test. Sponge cake is gauged and estimated for volume. The outcomes are communicated in grams for weight and in cubic centimetres for volume. Outside attributes are assessed by visual assessment for shape covering shading and cake appearance. Inner attributes are assessed by visual assessment for cell consistency cell size and cell divider thickness. The surface can be resolved for delicate quality with the ta.xt2 texture analyzer.

In this work, sponge cake baking was studied considering three convection modes (NC, FC and SFC) and three different oven temperatures (140°, 160° and 180 °C). A mathematical model was implemented to study the process heat transfer dynamics coupled with volume expansion. As it was observed from height evolution results, volume expansion is significant and strongly depends on the radial position and the baking time. Besides, an increase in oven temperature, airflow and steam injection produces an increase in volume expansion. An empirical fitting equation was proposed to take into account this volume increase in the mathematical model. Simulated results adequately represent the observed evolution, that is, height and shape, of the sponge cake during its baking. Concerning product temperature, both experimental and simulated profiles verified that the last region to achieve a correct degree of baking is the one near the crust around the axial axis. In consequence, the minimal baking time was defined as the average time at which this region reaches 95–98 °C. Finally, this process variable was strongly affected by the effective oven temperature, with a slight influence of the convection mode, that is, natural vs. forced ones.

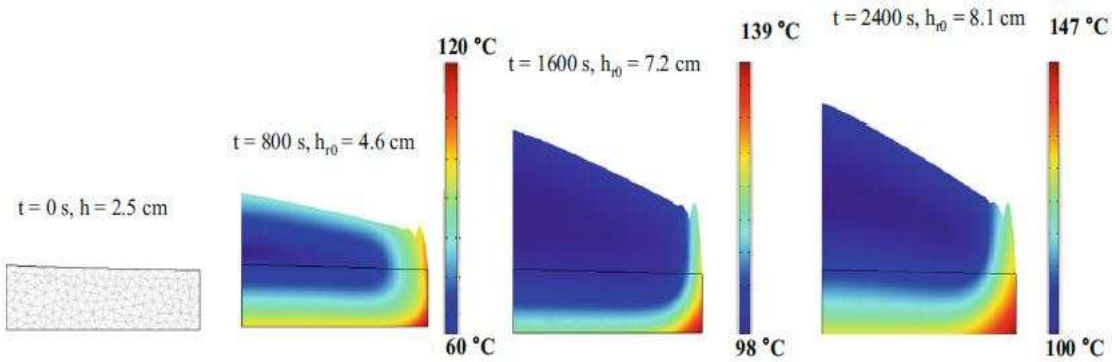


Figure 5: Volume Expansion Simulated at Different Stages of Baking, Steam-Assisted Forced Convection, Effective Oven Temperature 151.2 °C (SFC1 Condition)

8.0. Acknowledgement

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