Cookie Flour Selection & Quality

Cookies are one of the world's most popular baked goods, characterized by their small, crispy, bite-sized form. They can be plain, or have inclusions such as chocolate chips, sprinkles, nuts, raisins, oats, among others.[1] No matter what size, it's important to use the proper ingredients to ensure high quality and uniformity.

Cookie formulations are commonly characterized by their high sugar, high fat and low moisture content, which results in their specific texture. The main difference between cookies and cakes is their reduced rise during baking due to a lower content of rising agent (e.g., baking powder, baking soda) and a lower protein content of the flour.[1]

The quality and composition of cookie flour significantly impacts the appearance and texture of the final product. Traditionally, testing cookie flour focused on protein quantity and spreadability. However, to make sure the analysis is fully comprehensive and insightful, it is best to complete the picture with the new approaches and tests covered in this paper that allow troubleshooting for all the main quality issues.

What is Cookie Flour?

Cookie flour is a low protein (gluten), soft, finely ground flour used mainly for the production of cookies, biscuits, pie crusts and tender-texture bakery products. It's characterized by a low protein content (8 - 10%) that allows for a slower hydration, which prevents extensive gluten development.

A lower amount of gluten development produces weak, inelastic networks to produce the recognizable tender texture of cookies, biscuits and pastries.[1]

Cookie flour is usually produced from soft milling wheat grains such as soft red or soft white wheat to obtain the recommended low protein content. This reduces the tendency for gluten formation especially for short-dough type cookies. Laminated cookies or biscuits can use flour made from a combination of both hard and soft wheat grains.[2]

Production of cookie flour starts with the removal of the bran and germ from the wheat kernels. Then, the starchy endosperm goes through a series of roller mills to obtain the desired particle size (approximately 150 microns). Further grinding may cause starch damage and increased dough stickiness.[1]

Other ingredients in cookie formulas are partially responsible for the performance of the flour as well. Fat or shortening acts as a lubricant and contributes to the plasticity of the cookie dough. Chemical leavening agents begin to react upon hydration, so, timing and the choice of leavening are key to proper cookie aeration and gas retention. Also, sweetener composition plays an important role in the softening properties of cookies.

Why is Cookie Flour Important?

Flour is one of the principal ingredients in cookie production, making up to 30-40% of the total formula. Therefore, its quality and properties are extremely important for the manufacturing of a high quality cookie. As mentioned, cookie flour is characterized by its low protein content that provides the functional properties required.[2]

COOKIE FLOUR IS RESPONSIBLE FOR:

- Structure
- Spreadability
- Color
- Texture (hardness, crispness, chewiness, cohesiveness and fracturability)

If high protein flour is used in a conventional cookie formulation, the end product will be hard and chewy, which may not be the desired result. So, cookie flour and the right fat to sugar ratio is a key factor in quality.[2] As the protein content decreases, the spreadability of the cookies increases due to the lower amount of structuring gluten present in the dough. This produces softer and more tender products.[2]

However, understanding protein content is not enough to ensure total quality for all the desired characteristics of the final cookie.

COOKIE FLOUR QUALITY TESTING FOR SPREADABILITY

Cookie flour quality is an important parameter of cookie production. The most common test in cookie production is the spreadability ratio of the cookie. This parameter is obtained by dividing the width of the cookie by the thickness. It is vital to its packaging requirement. A change in spreadability would cause an increase in waste levels and profitability of a high output cookie production line.

There are a number of traditional methods to test the protein quality and spreadability of a flour. These generally involve baking batches of cookies with different amounts of flour and comparing the final spread.[2] However, this can take considerable flour amounts and time. It also mainly gives information on spreadability, and little information on consistency, stickiness, shape, color, etc. So, while it may be a good starting point, there is much more to cookie flour quality.

Cookie Flour Quality Testing
Well-rounded Troubleshooting

As consumer's demand increases, so does the need for more accurate and speedy processing. This has caused the development of novel testing technologies to keep up. Conventional testing has expanded to include a wider range of flour quality parameters that may affect the production of standardized products in the baking industry. Traditional methods such as the AACCI (Cereal and Grains Association) methods can be used to describe other product characteristics that affect cookie geometry, such as cookie density, flour types, flour treatments, and ingredients.

While traditional methods can provide information about parameters like spreadability, other considerations in cookie formulation and operational parameters (i.e. temperature and baking time) should be taken into account depending on the cookie type. New tests allow for a more complete understanding of flour quality and its impact on the final product. In the highly-competitive cookie and biscuit market, improved quality and consistency goes a long way.

Cookie Flour Quality Testing
Well-rounded Troubleshooting (cont).

Aside from the spreadability ratio determined in the traditional methods, other parameters of cookie flour quality have an important role in high speed baking. Other extremely important quality parameters to consider in industrial cookie manufacturing are:

1 Spreadability

This is one of the most important parameters to consider in cookie production. A higher spreadability or spread ratio is commonly desired in most types of cookies. Spreadability is usually associated with wheat proteins that undergo their glass transition during baking. Cookies made with low protein flours (< 12%) tend to spread more rapidly and for longer periods of time than cookies made with high protein flours.

2 Consistency

Consistency is dependent on the water absorption capacity (WAC), or the amount of water the flour can absorb to obtain a particular consistency. WAC greatly impacts several dough and final product characteristics. Consistency and viscosity of the dough depend on the amount of water absorbed by the flour. If a lower amount of water is used, the dough may become hard and dried. However, if the dough has a larger amount of water than necessary, it may become sticky and hard to handle; this will not allow for the formation of the cookies.

It is important to mention that not only is the amount of water absorbed by the dough important, but also the components responsible for the absorption of the water. Damaged starch, pentosans and glutenins contribute to the water holding capacity, and affect other flour quality parameters as well.

3 Blisters & Cracks

These are considered final product defects caused by the amount of water evaporated during baking. They are influenced by the amount of water in the final dough and in the strength of the protein network.

Cookie Flour Quality Testing
Well-rounded Troubleshooting (cont).

4 Stickiness

Stickiness is the adhesion of the dough to surfaces. This may cause several processing problems such as larger cleaning operations and lack of formation of the cookies. This issue is mainly caused by the leaking of water from the dough, which occurs due to the incapacity of damaged starch to hold the previously absorbed water in further processing or mixing steps. Or, the absence of available protein to absorb the leaking water. Increasing damaged starch content requires more protein to maintain appropriate product consistency and stickiness.

5 Shape

Cookie shape is mainly determined by the thickness and diameter of the product. The appropriate shape is accomplished by controlling two main characteristics: dough extensibility and elasticity. Extensibility is the capacity of the dough to be stretched without breaking, showing if the dough is capable of keeping its form. Elasticity is the tendency of the dough to return to its original position after deformation. Both of these characteristics are influenced by the quality of the protein.

6 Color

Cookie color is an important organoleptic factor in the consumer's acceptance of the final product. It is caused by the browning reactions, Maillard reaction and caramelization. Both reactions depend on the amount of available sugar and thus depends on the amount of damaged starch available, amylase activity, and of course, product formulation.

Tools for Testing Quality

When considering these quality parameters, novel technologies are required to measure them. Some manufacturers, such as KPM Analytics and its CHOPIN Technologies brand, have addressed this issue and offer a full range of solutions to meet these challenges:

Quality Parameter	Measured Parameter	Measurement Instrument
Spreadability	Tenacity Elasticity Baking strength Resistance of dough to deformation Extensibility	Alveograph
Consistency	Moisture and protein content	NIR
	Water Absorption Capacity	Mixolab 2
	Damaged starch, glutenins and pentosans contribution to WAC	SDmatic
	Damaged starch content	SDmatic
Stickiness	Moisture and protein content	NIR
	Damaged starch, glutenins and pentosans contribution to WAC	SDmatic
	Damaged starch content	SDmatic
Shape	Elasticity and extensibility	Alveograph
Color	Damaged starch content	SDmatic
Blisters and cracks	Moisture and protein content	NIR
	Water Absorption Capacity	Mixolab 2
	Damaged starch, glutenins and pentosans contribution to WAC	SDmatic
	Damaged starch content	SDmatic

What is the lowest protein quantity of flour required for cookies?

Protein content is one of the most important parameters to consider when baking cookies. Cookie flour typically contains around 7-12% protein content depending on the desired product to be made. Protein content may vary from the lower to higher end of the range previously mentioned. Crackers may require flours with protein content on the higher end of the range due to their characteristic crispy texture and established shape. Short-doughs use flours with lower protein content to obtain their desired soft and tender texture.[5]

Enzymes such as protease can be added to cookie formulation to aid in the inhibition of gluten formation and elasticity. This helps prevent dough shrinkage after molding and sheeting. The potential effect of enzymes such as proteases in cookie production can be measured with equipment such as the Alveograph and the Mixolab that aid in the determination of dough extensibility, elasticity, and water absorption capacity commonly commonly associated (for all or part) with the protein content and protein quality.[7]

What enzymes can I use to correct my flour for cookies?

Several studies have found that the addition of enzymes to cookie formulation can have beneficial effects on the cookie spreadability and tenderness. The addition of alpha-amylase to flours significantly increases the spread factor and decreases the hardness of cookies made with the addition of 100 units of the enzyme in a 100 grams of flour. Beta-amylase produces a similar effect to alpha amylase on a lower level, due to the lower starch damage commonly found in cookie flours. Other enzymes that may contribute to a better cookie spread are cellulase, which ruptures the linkages between starch and protein molecules allowing cookie dough to spread further.

Finally, protease is used to rupture the bond between peptide bonds of proteins and inhibit gluten development improving cookie spreadability and tenderness.[7]

How can I ensure the right water absorption for cookie dough?

Cookies are characterized by their low moisture content (3-5%) and by their soft and tender texture. This is accomplished using low protein flour with low starch damage and low pentosan content that reduces water hydration capacity. Typical cookie flour content should be between 12-14% to assure proper water hydration. Other ingredients that contribute to water content should be taken into account (e.g., eggs, vanilla essence) so the formulation is balanced. [2]

Dough consistency can be measured by instrumental methods like the Mixolab which evaluates the effect of water addition to obtain the desired consistency. This method may aid in industrial environments where formulation precision is vital.[2]

Other relevant methods to measure a flour's water absorption solvent retention capacity are the AACC method 56-11-02 or other automated ones. These methods give an understanding of how flour components bind water and how they contribute to the dough formation.[6]

References

1. "Cookie Flour | Baking Ingredients | Bakerpedia." Bakerpedia, 2022, https://bakerpedia.com/ingredients/cookie-flour/.
2. Cauvain, Stanley P., and Linda S. Young, eds. The ICC handbook of cereals, flour, dough & product testing: methods and applications. DEStech Publications, Inc, 2009.
3. "Cereals & Grains Association." Cerealsgrains.Org, 2022, https://www.cerealsgrains.org/resources/Methods/Pages/10BakingQuality.aspx .
4. Bosc-Bierne, L. How to Better Control Cookie & Cracker Flour Quality. BAKERpedia: BAKERview, 2022, https://bakerpedia.learnupon.com/store/2772579-cookie-and-cracker-flour-quality-bakerview.
5. Cauvain, Stanley P. Baking problems solved. Woodhead Publishing, 2017.
6. "A Faster, Simpler Method For Cookie Manufacturers To Analyze Water Absorption In Flour | KPM Analytics." Kpmanalytics.Com, 2022, https://www.kpmanalytics.com/news-events-stories/a-faster-simpler-method-for-cookie-manufacturers-to-analyze-water-absorption-in-flour#:~:text=Water%20absorption%20directly%20affects%20the,to%20produce%20the%20final%20product.
7. Panghal, Anil. "Effect of Enzymes on Cookies Quality Anil Panghal, Navndhi, Namita Singh1 and BS Khatkar." Annals of Agri-Bio Research 16.1 (2011): 75-78.