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Technical Notes
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How to Make Reliable Prediction of Wheat Flour Functionality?

The major functional component of wheat flour conferring viscoelastic properties to the dough and thus enabling its utilization in a wide array of food products is *gluten*. Gluten is a complex mixture of proteins which vary in their proportions, structure and properties to impart different functional attributes to wheat flours. Gluten is essentially comprised of two protein fractions namely gliadins (alcohol soluble) and glutenins (acid or alkali soluble) . Gliadins impart extensibility while glutenins are responsible for elasticity in the wheat dough. Quantity and composition of polymeric glutenin storage proteins are generally considered to be the primary contributors to variations in functional properties among wheat cultivars. There are various disulfide bonds, electrostatic and hydrophobic interactions in the flour system that stabilize the structure of gluten and play a vital role in determining the functional properties of the dough.

Prediction of flour functionality is important at all levels of the wheat process chain, beginning with breeders followed by millers, product developers and ending with consumers. The key factors that a flour functionality test method should be able to interpret are the known properties of monomeric and polymeric proteins of flours and the critical role of different protein subunits in the development of dough. The success of **Brabender® rheological instruments** for test methods lies in the remarkable interpretation of the key phenomena leading to the formation of gluten and their interaction with other flour/ ingredient components such as the observed maximum resistance during mixing, stability, dough development time, credible mechanisms of elasticity that make the judgment of flour quality a simple picture to analyze. The automated data acquisition programs extract the relevant facts and present the data in a simplified version that enable understanding of the flour functionality at all levels.

Almost all of the flour utilization in the industry involves mixing of the flour into dough at a certain level. Nature of gluten macropolymer changes throughout the dough mixing process and these changes are also impacted by other flour components which interact with flour proteins. The chemical predictive techniques based on the principles of swelling of glutenin fractions and/or their sedimentation values cannot bring out the motion depiction of dough development as do the rheological instruments. The results of these chemical predictive methods lead only to a secondary indication of the dough quality. Similarly, the reliability of methods based on extraction of gluten or its fractions will depend on the extent to which convincing evidence of the extracted protein fraction reflects the properties of the same fraction observed in the native dough system.

Rheological properties of wheat dough depend largely on the structure of gluten. **Brabender® rheological instruments** describe the gluten polymer behavior in its primary form as it would perform later in the product development applications. The ultimate test of flour quality is evaluation of its ability to make good quality end products. The product development applications usually involve the impact of additions of different ingredients on the properties of dough to be observed. The automated data acquisition systems associated with the instruments trace the curves right from the beginning of incorporation of different ingredients, thus clearly showing the cause-effect relationships of the interaction of the additives with the flour components and their impact on dough properties during the entire course of mixing. Rheological test of different levels of flour-ingredient matrices can provide a fair view of trends, ranks and cut-off values, thus simplifying the process of new product development-saving labor, cost and time.

Rheological instruments testing the quality of dough and gluten basically fall in three main groups. Those that show the effect of water on dough consistency, those used to stretch a mass of dough to measure its resistance and extensibility until the strand breaks and finally, those involving heat which measure the slackening of a dough or batter and hence give a measure of the enzyme activity of the dough. **Brabender® rheological instruments** have a long history of serving the food industry with an established research portfolio. Rheological measurements of each batch in the production line are very useful and make online and in-time process adjustments possible with the following instruments:

The **Farinograph®** is one of the most commonly used flour quality tests in the world. The results are used to estimate the amount of water required to make dough, evaluate the effects of ingredients on mixing properties, flour blending requirements, tolerance to over-mixing, check flour uniformity and dough consistency during production. Farinograph® results are also useful for predicting finished product texture characteristics. For example, strong dough mixing properties are related to firm product texture.

The **Extensograph®** is a suitable instrument for measuring the stretching properties of dough to make reliable statements about the baking behavior of the wheat dough in practical industrial applications and in research. Results from the Extensograph® test are useful in determining the gluten strength, bread-making characteristics of flour, effect of fermentation time and additives on dough performance.

The **GlutoPeak** is a rapid shear based method that uses small sample size and demonstrates the differences in gluten protein characteristics. The GlutoPeak has wide array of applications covering breeders, millers and product manufacturers. It can sensitively segregate early generation wheat lines, predict flour quality, optimize milling operations, observe effect of new ingredients on the gluten aggregation and strength, rapidly test new formulations and accelerate innovative new product development.

The **Glutograph®-E** instrument enables reliable, objective, and reproducible measurement of the stretching and elastic properties of washed wet gluten and dry gluten. The Glutograph® can test flour quality with regard to its suitability for noodle production, recognition of drying and heat damage of flour and dry gluten, and surveillance of the quality of dough during production.

The **Viscograph®-E** measures the gelatinization properties of flour and native or modified starch, enzyme activity in flour (e.g. sprout), adjust the diastatic activity by adding enzymes (e.g. malt flour), influence of extrusion conditions onto the extruded product. Peak viscosity helps to predict flour quality to produce noodles with better texture characteristics.

Accurate prediction of dough rheology can provide many benefits to the baking industry for satisfying consumer demands. These instruments can be combined with the range of other quality analytical instruments available at **Brabender®** for a complete solution for your quality chain covering different stages of production.