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Refrigerated Dough Quality-Approaches, Challenges and Opportunities

Refrigerated dough is an unbaked hydrated flour formulation usually stored at 3-7°·C. It offers many advantages including extension of shelf life, convenience for the consumer to produce fresh baked product while saving labor and equipment costs. However, dough characteristics are dynamic and change during cold storage, thawing and other intermediary steps required for its application in a particular product. Refrigerated doughs tend to leak a syrup which is detrimental to their utilization in various product applications. This phenomenon is known as "dough syruping" and it has been linked to the arabinoxylans and endoxylanases of the flour[1]• However, recent studies[2,3] have proved that significant changes in the proteins and interactions between macromolecular components present in dough contribute to the changes in the rheology of refrigerated doughs. As rheological behavior is a direct outcome of the structural and chemical changes in the dough, the Brabender® line of rheological instruments can be used as reliable tools to interpret the refrigerated dough properties.

The challenges in the production of good quality refrigerated dough demand a step by step scientific approach to deliver extreme performance with unprecedented robustness and reproducibility in the expected outcomes of the refrigerated dough.

Step 1: Selection of good quality flour :
Flour is the most critical component of the entire process chain. For the refrigerated dough production, flours with high water holding capacity are usually preferred. Assessment of the flour attributes contributing to the water retention ability of the dough and stability must be evaluated before proceeding to other stages of the process. Screening of the right flour at the first stage reduces the dependency of flour on the other additives in the later stages.

Step 2: Optimization of the dough properties using additives:
In the second stage, the dough properties need to be optimized using various approaches like addition of hydrocolloids, enzymes etc. to produce consistent product quality. Hydrocolloids like xanthan gums have high water imbibing capacity, which stabilize the doughs against leakage during extended refrigerated storage[4]• The level of these additives in a particular formulation can be optimized by evaluating their effect on the rheological properties of dough.

Step 3: Evaluation of dough properties during refrigerated storage:
Prediction of variability in dough characteristics during cold storage is important for the success of its utilization in various products and other intended applications. The loss of water resulting in syrup formation indicates the weakening of the dough structure which depends heavily on the gluten network and its association with fiber and starch components. Weakening or stability of the dough structure during refrigerated storage and thawing can be visualized by the rheological assessment of the dough properties using following Brabender® instruments:

GlutoPeak®:
GlutoPeak® has good potential to predict the right flour meant for refrigerated dough applications. The instrument records the time (Peak Maximum Time, PMT) to reach peak torque on the formation of a gluten network. Sensitivity, short time of analysis (1-10 min) and low sample requirements (< 10 g) are the key features that make this test valuable for screening purposes. A recent study has proved that gluten aggregation time could be a valuable indicator for prediction of refrigerated dough quality. The study showed that flours with shorter gluten aggregation times (PMT) had higher dough consistency than the flours with longer aggregation times after refrigerated storage[3].

Farinograph®-AT:
The **Farinograph®** test is one of the most commonly used flour quality tests in the world . It measures flour quality attributes in terms of its water absorption, mixing.requirements to make dough and stability of the dough under various processing conditions. Typically, dough quality of any product relies on the network formed by interaction of protein, starch and fibers in which gluten plays a vital role in binding the other components. In general, weak gluten flour has a lower water absorption and shorter stability time than strong gluten flour. Flours meant for refrigerated dough applications usually need to be modified with certain additives to confer the expected rheological properties in handling and processing into finished product. When optimization of complex additives is performed flour quality, production procedure, process variables, effects of components on different dough properties and their synergism is very important. The **Farinograph®-AT** with temperature controlled automated titration features, permits the addition of ingredients/additives/enzymes in solution form allowing uniform distribution in the flour. The effect of various hydrocolloids (gums) on the dough rheology can be easily investigated with the **Farinograph®-AT**. The **Farinograph®-AT** is also a suitable tool to pre-evaluate the rheological behavior of ingredient matrices of the new product formulations, with greater accuracy and in a short time. In addition, it greatly facilitates the transition of new formulations from pilot plants to full commercial scale production.

Extensograph®
The **Extensograph®** records the resistance of dough to stretching and the distance the dough stretches before breaking. The refrigeration or freezing of the doughs results in some loss of gluten functionality leading to changes in the viscoelastic behavior of dough. The challenge to prevent the failure of refrigerated or frozen dough to deliver the desired attributes in the baked product lies in the pre-evaluation of its functionality. Extensogram parameters are powerful indicators of process variability and also correlate well with the gas retention capacity of dough, end product characteristics and handling properties. Tolerance limits for variability in the process can be defined in terms of loss in resistance of extension, energy value and increase in the extensibility of the refrigerated dough, which are critical to control batch to batch variability.

Every flour is unique and creating new formulations without knowing the properties of flours, ingredients and additives as well as the impact of processing technologies associated with them can act as potential hurdles. Understanding of these properties is a critical step for the successful performance of any type of dough. Scientific studies with Brabender® instruments provide an opportunity to screen the optimum flour quality for a specific application and overcome the processing barriers by leveraging the information to make better products.

References

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