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Technical Notes
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Many Reasons to invest in an Extensograph®

Innumerable wheat varieties exist today, varying in terms of their agronomic and processing attributes. Without the assistance of a reliable test procedure, it is hard to screen the varieties conforming to the given requirements of a breeder, miller or product manufacturer. In the present world of competition, there are different frameworks of instrument based approaches to solve a given technical question. The difference between the varied approaches is how close they are to the real world. The Brabender® Extensograph® owns a distinguished reputation of solving such technical issues at various levels of wheat grain processing. Whenever a new instrument is purchased in an R&D facility, there are a few questions that come to the mind of a person making decisions. This technical note addresses such queries from different perspectives, elaborating on the capabilities and various feasibilities of the Brabender® Extensograph®.

Q: The cereal industry has witnessed remarkable changes in the last few decades in terms of technology, new ingredients, additives and baked products. Is the Extensograph® able to keep pace with the changes in industrial requirements and will it be able to maintain pace with future changes?

A: The Extensograph® has been used successfully in industry almost unchanged since it was invented with the exception of automated computerized data acquisition features. It has evolved and adjusted very well with the growing demands of the cereal industry. In the world of stiff competition, many new instruments are launched in the market every year and they end up marking their short life cycle in the next 7-10 years. Any instrument in an R&D facility is considered as an investment in terms of money and time spent on it and most importantly, experience gained in the due course of time. The Extensograph® is still young in its life cycle while its inventors are close to marking a century. It has a well established research portfolio with hundreds of references covering all spheres of the cereal industry. Therefore, the Extensograph® can be viewed as a valuable long term investment in any company.

Q: How simple or how tough is it to make an assessment on the Extensograph®?

A: The Extensograph® records the resistance of dough to stretching and the distance the dough stretches before breaking. A user friendly software system guides you step by-step and automated data acquisition draws the curve simultaneously as the test is performed, recording the extensibility of dough and its resistance to stretching. In addition to the curves, data is also presented in simple tabular form which can be easily interpreted at all the levels.

Q: Besides the resistance and extensibility parameters, what is the significance of the Extensograph® energy value?

A: The Extensograph® energy value expresses the resistance ability of dough against the deformation forces and correlates well with the gas retention capacity of dough, volume of the end product after baking, handling properties and it is also taken as a guideline parameter for flour blending operations at milling facilities.

Q: How far can Extensograph® data go in matching the experience of a baker checking the suitability of a flour variety for a given product and optimizing its recipe accordingly?

A: Gone are the days when industries would rely on the traditional knowledge of bakers to be carried on to the next generations. In the fast paced industrial environment and with the advent of new varieties and additives every day, it has become a necessity to rely on customized standards developed by instrument based approaches, such as with the Extensograph®, to ensure consistency among the different batches and in the years to follow.

Q : The Extensograph® makes measurements in the cold phase of bread making, how relevant are these measurements to bread which is baked at much more elevated temperatures?

A: Bread baking starts with mixing flour, water and the input of energy to form dough, followed by fermentation in a chamber at controlled temperatures. The Extensograph® fermentation chambers operate close to conditions used in the industry. By the approach of mathematical models, studies[1] have proved that among the various indicator variables, the best predictor for loaf volume is the extensibility at the point of rupture during uniaxial extension. (r^2=0.7).

Q : Usually the Extensograph® has been correlated with fermentation and baking applications, does it have any application for screening roles in the wheat breeding industry?

A: Changes in the properties of gliadin and glutenin as influenced by the environment, climatic fluctuations, fungicides and fertilizers have been very welJ elucidated by the Extensograph®. The Extensograph® has also been used to test the effect of various diseases like stripe rust (Puccinia striiformis) on the processing quality of wheat varieties[2] . Variations in different varieties owing to genetic origin can also be very well explained by the Extensograph®.

Q: An Extensograph® measures the properties of dough at cycles of 45, 90 and 135 min, isn't it a time consuming method?

A: This time factor is important because kneading and molding for the test cause a structural activation of the dough during which the mechanical energy of the mixing and molding is stored in the elastic component and greatly influences the result of the measurement [3,4]. In this state, resistance to extension is higher and extensibility lower. The stored energy subsides after about 45-60 min and the dough undergoes a structural relaxation or structural recovery so that its real, uninfluenced rheological properties can be measured. The stretching of a dough resulting from inflation and an increase in volume during fermentation and in the early part of the oven phase take place in a relaxed state. Yeast and other additives/improvers also take time to perform in a dough and thus alter the properties of the dough depending on time. Therefore, running the test at the three intervals of time is usually recommended to identify optimum consistency or state of the dough which is best suitable for handling and baking with optimum results.

Q : Can I modify the Extensograph® procedure to tailor it according to my requirements?

A: Apart from the standard methods, there are accepted short methods which allow the user to save time with reduced proving times that are similar to those in production and the results correlate very well with those from the standard methods. For example, for full formula frozen doughs, different resting / fermentation protocols have been successfully interpreted to indicate the properties of dough like loss of resistance and adjustments have been accordingly made to restore the dough properties better suited for the given baking application.

Q: Can the Extensograph® make an assessment of doughs required for flat breads?

A: Definitely, the Extensograph® can be used to assess dough quality of typical Indian flat breads like chapati, puri and parontha as well as Arabic flat breads. Extensograph® parameters-resistance to extension, extensibility and area under the curve, provide good information about the dough quality suitable for different types of flat breads.

Q: Is it feasible to test wheat flours substituted with non-wheat flours?

A: The influence of wheat flour blends consisting of other cereal flours , chick pea, lentils, soybean, fenugreek, amaranth, oil seed flours, corn germ, oat meal, fibers, industrial by products - spent grains, apple pomace etc. on dough properties have been studied by various researchers. The Extensograph® has been successfully used to optimize the baking quality of breads, cookies, muffins, pies and other products produced with such flour blends.

Q: Dough preparation for the Extensograph® test involves the addition of salt to flour. Following the current trends and dietary guidelines to reduce salt at all the levels of product formation, would I encounter any technological problems to run the Extensograph® tests at low salt level conditions and how relevant will my results be?

A: The role of salt cannot be neglected in terms of its effect on yeast activity, strengthening the gluten network and thus the gas retention of dough. However, studies[5] have proved that there are no technological difficulties in the handling of doughs with reduced salt levels as low as 0.3% and they do not significantly affect the rheological properties of dough.

Q: Can I test traditional herbal additives on the Extensograph® ?

A: Herbs, spices and their derivatives such as essential oils, decoctions, hydrosols and oleoresins are widely used due to their antioxidant and antimicrobial properties in various foods. Various studies have successfully demonstrated the effect of herbs like summer savory (Satureja hortensis L.), majorana (Origanum vulgare L.), sage (Salvia triloba L), rosemary(Rosmarinus officina/is L.), pickling herb (Echinophora tenuifolia L.), laurel (Laurus nobilis L.), thyme as well as essential oils and oleoresins on the Extensograph® characteristics of wheat flour doughs.

Q: While the Extensograms of some flours might show good results with respect to the product quality, the machinability of the dough during different process times could lead to serious problems in production. Is the Extensograph® able to give any information regarding machinability and handling properties of the dough?

A: The Extensograph® is an effective tool for optimization, modeling and prediction of complex processing problems. In the production process, the dough should not stick to metal surfaces and it should smoothly flow through the processing lines. Modification of dough properties suitable for good handling and machine-bility can be achieved by the use of various additives like surfactant gels and can be optimized using the Extensograph®. Complex physicobiochemical interactions in the dough system lead to different viscoelastic behaviors of dough at various stages of processing. A correct description of such changes as a function of time or temperature is very important to maintain efficient handling and machinability in a fast paced processing environment. Extensogram parameters such as resistance to extension and energy are powerful indicators to retrieve information relevant to best handling practices.

Q: The Extensograph® stretches the dough in uniaxial mode while an Alveograph expands the dough in all directions. Isn 't it more practical and relevant to measure biaxial extension than uniaxial? Apart from an Alveograph, how is the Extensograph® superior to its other competitive instruments?

A: Although from a physical point of view, biaxial extension equates well with gas cell expansion in a rising dough but because of technical reasons, a constant amount of hydration is used in an Alveograph while the Extensograph® works with doughs prepared with optimum hydration levels suited for different processing applications as in the real industrial world. Stretching properties of dough vary with the level of hydration of proteins in the flour and also their interaction with other flour components is also influenced greatly by the amount of water. Thus it is more relevant to make an assessment at the optimized level of hydration as done in the Extensograph®. Although most of the other competitive instruments use small sample sizes and short times, it has been proven that deformation results using the sample sizes that are used in the Extenso-graph® are more representative, reproducible and match the behavior of dough in bulk lots. Moreover the effect of ascorbic acid, enzymes and emulsifiers added as flour improvers or baking ingredients can naturally be identified better after a longer time of action than after a short one. This effect is therefore only visible to a certain extent in instruments using short time. Several researchers[6] have confirmed and justified the Extensograph® method as a practical and informative procedure to judge the flour quality.

In short, all of the activities connected with the product characterization, in one way or another, are dependent on the behavior of dough at different stages of processing. The results of the Extensograph® tests are very promising at yielding such information. In a fast paced industrial environment, the goal always remains one of addressing the technical issues as quickly and as efficiently as possible since ongoing production and economic considerations rest on its resolution. Consequently, the extent to which technical issue can be solved depends crucially on the success with which the underlying processing hurdles connected to flour quality and the behavior of dough at various processing stages have been investigated. The Brabender® Extensograph®, with its support team, can help you solve any technical issues along the process line. If you have any further questions, please feel free to contact us, we'll be happy to arrange product demonstrations and solve your issues with our established scientific infrastructure.

References

1. *Ktenioudaki A., Butler F., Gallagher E. (20 I 0) Journal of Cereal Science 51: 402408.*
2. *O'Brien. L.; Brown. J. S.; Panozzo. J. F.; Archer, M. J. (1990) Australian Journal of Agricultural Research 41 (5): 827-833.*

3. *Rasper VF and Preston KR. 1991. The Extensograph handbook. AACC, St. Paul, MN, USA.*

4. *Weipert D, 1981.. Getreide Mehl Brot 35(I):S-9*

5. *Lynch E.J., Dal Bello F, Sheehan E.M, Cashman K.D, Arendt E.K. (2009) Food Research Internationa/42: 885-891.*

6. *Weipert D. (1992) Cereal Foods World 37(1): 15-24.*