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Hardness Tester-A Valuable Tool

Endosperm texture of cereal grains is an important defining quality attribute, facilitating their classification and also affects milling, processing and end-use quality. Physical and mechanical properties of cereal grains are derived from their chemical composition and inner structure. These properties are affected by moisture, quantity and quality of proteins, starch and pentosans. The similar important factors are the size of cells and adhesion between the starch granules and the surrounding protein matrix[1]. The **Brabender®** hardness tester is a versatile tool used for evaluating the quality of different grains like wheat, barley, rye, sorghum and corn. The instrument is used the **Farinograph®** instead of a mixer measuring head to determine the degree of hardness. The measuring instrument consists essentially of the hardness and structure tester and the evaluation software.

WHEAT

Hardness is a key determinant for classification of wheat and end product quality[2]. Wheat grain hardness appears to be determined by a degree of adhesion between starch granules and protein matrix. It is regulated by a protein called Friabilin that is isolated from starch granules and is linked with kernel softness[3]. Friabilin provides a biochemical basis for the distinction between hard and soft wheats[1].

Breeding programmes:

Screening of early generation breeding material is facilitated by tools like the **Brabender®** hardness tester, which categorizes wheat in the proper classes and order based on the average energy input. The hardness method provides a discrete numerical separation of qualitative classes of soft and hard wheat cultivars of different geographical origin and different botanical varieties. This categorization also forms the fundamental basis for differentiating the wheat grains according to their end product intended use. For example, durum wheat varieties have the hardest grain texture and are mostly used for pasta while common hexaploid wheat varieties with high protein content are preferred for bread making; and wheat varieties with soft texture are used for cakes, cookies, pastries and confections. Flour color is also an importance for specific products like noodles. Significant relationships have been found between flour color and hardness of the grains.

Milling properties

The texture of endosperm influences certain physical properties, for example the temering requirements, flour particle size, flour density, starch damage, water absorption and milling yield[4]. A Hardness tester is used in wheat grain mills for testing and recording the grain hardness. The results provide useful information about the necessity of technological treatment (conditioning/drying) of the grain charge prior to milling. Furthermore, the entire milling process can be optimized if the parameter, grain hardness, which is decisive for milling, is known early. The milling results can be improved and yield can be increased. Special software is available for easy evaluation.

Rheological and Baking properties:

Kernel hardness characteristics determine the suitability of specific flours for different products. The most important functional components of wheat grain are gluten proteins, which are also important determinants of the rheological properties of doughs. Grain hardness measured on a **Brabender®** hardness tester, has been reported[5] to be related to the valorimetric value of the grain, water absorption of the flour, and baking quality. Bread making quality is significantly altered by variation in different flour components such as starch, proteins and pentosans. The quality of pentosans is more important than the quantity in determining different hardness levels. Wheat hardness is directly related to both higher soluble and insoluble fractions of pentosans[6]. The damaged starch content in the flours is governed primarily by the degree of adherence of starch granules to protein matrix. The stronger the adherence, the more the starch content is damaged. The high damaged starch in hard wheat flours has a higher water absorption capacity. The lipids also play a very important role in different processes such as milling, dough mixing, bread making and staling. The decreasing amount of free polar lipids is also strongly correlated with increasing hardness in some wheat cultivars[7]. Variation in these properties affect the physical properties of doughs like consistency and extensibility, which ultimately alter the texture of the baked products.

BARLEY / MALT

Malting and brewing quality of barley is an extremely complex character. The most important factors contributing to barley / malt quality are extract content, protein content, protein solution value, grain hardness and grain fullness. Accurate prediction of malt quality requires direct or indirect measurement of the complex physical and biochemical changes governing the transition of barley from grain to malt. The **Brabender®** hardness tester enables an accurate evaluation of the hardness of a malt on laboratory scale. Various reports have confirmed that **Brabender®** values are useful to predict malt texture and suitability for brewing from grain hardness. Combining the determination of the hardness with the mash test on coarsely ground grain, provides a clear conception about the solubility of malt. This information is of important value for the brewer for the grinding and mashing process in the brewing house. The hardness of a malt is evaluated within only a few minutes by passing the ground sample through the hardness tester and recording the resistance of the material by means of a torque-time-diagram. The measure for the mellowness of a malt is the area of the diagram, which is proportional to the power required to crush a crtain quantity of malt. Values of kernel hardness measured by the hardnes tester have been observed to be significantly correlated with final attenuation of laboratory wort from malt and soluble nitrogen of malt. Grain hardness expressed by area under curve can distinguish the cultivars by their malting quality. It can be used as a selection trait in the breeding programs of malting barley.

Micellaneous Grains: The tribe *Triticaceae* comprising some 300 species has been classified into 22 genera including several important crops (barley, rye and triticale) and a number of important forage species. The **Brabender®** hardness tester has also been successfully used to predict milling quality of these grains like maize, barley, sorghum and rye. Crushing energy input (area of the **Brabender®** diagram) can serve as a guide to dry milling productivity in maize and usefulness for snack production. Extraction yields of sorghum flours can also be reliably predicted by the **Brabender®** hardness tester.

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