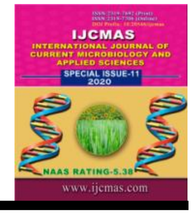
Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-11: 3848-3852

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 Special Issue-11 pp. 3848-3852
Journal homepage: http://www.ijcmas.com



Review Article

A Review on Selection of Moisture Content of Wheat on Particle Size Distribution of Flour Characteristics

Trishla Sahu*, Deenanath Paikara, Suman Sahu, Kavita Krishan and Himanshu Ekka

BRSM College of Agricultural Engineering and Technology and Research Station Mungeli, IGKV, Raipur-492012, C.G., India
**Corresponding author*

A B S T R A C T

Wheat is the main cereals crop of INDIA. INDIA is the second largest producer of wheat in the world. A study was undertaken to obtain average particle size of wheat flour under wheat milled at different moisture content. The average particle size of flour was determined using a set IS standard sieves and pan. The average particle size obtained on using screen having 21 mesh (opening/inch) was found to be 0.2233 mm, at 15% moisture content (db) found to be 0.2263 mm, at 16% moisture content (db) found to be 0.2393 mm and at 17% moisture content (db) was found to be 0.2324 mm. Similarly on using screen having 13 mesh (opening/inch) was found to be 0.3142 mm, 0.3046 mm, 0.3052 mm and 0.3035 mm for 13%, 15%, 16% and 17% (db) moisture content of wheat sample respectively. Similarly on using screen having 11 mesh (opening/inch) was found to be 0.2473 mm, 0.2487 mm, 0.3106 mm and 0.2918 mm for 13%, 15%, 16% and 17% (db) moisture content of wheat samples respectively. The finding of this study may be helpful in better milling quality of wheat under different areas milling. This study also provides idea about uniformity of flour particle size at given moisture content. The result may also be helpful for careful milling of wheat at different moisture content.

Keywords

Flour, Refined wheat flour, semolina etc

Introduction

Wheat is the main cereals crop of India. India is the second largest producer of wheat in the world, with production covering around 68-75 million tons for past few years. The latest estimated demand for wheat production for year 2020 is approximately 87.5 million tons. The major increase in the productivity of wheat has observed in the states of Haryana, Punjab and Uttar Pradesh. Higher area coverage is reported from MP in recent year. Wheat is one of the most common cereals which is generally consumed as staple food throughout the world. Its kernels is consumed in the form of flour, refined wheat flour, semolina etc. Generally milling of wheat means reducing its size from whole grain to broken grains, which can be coarse or fine. The size reduction of wheat is done by crushing rolls, attrition mill, hammer mill etc.

Whole wheat is scarce on the hydration, drying, milling process of whole wheat, process improvements, and sieve analysis studies. By focusing on more specific research on whole-wheat flour milling, it is believed that this additional information would provide direction for the wheat milling industry, wheat breeding industry and baking industry to provide a line of products that would meet the demand for increased fibre in today's consumer diet. This, along with a decreased manufacturing cost would potentially make this product more affordable and provide consumers with a lower costing whole grain alternative.

Impacts and Attributes to Different Processing Techniques

Hydration

Temperature has been shown to have the greatest effect, with an increase in temperature resulting in an increase in the rate of moisture absorption (Swanson and Pence, 1930; Fraser and Haley, 1932).

A general solution of the diffusion equation for a wheat kernel of arbitrary shape was developed by Becker, (1959).

Tempering results in a toughening of the pericarp, such that fewer small pericarp particles are formed during break. However, as tempering moisture within the kernel increases, the flour extraction rate decreases, thus necessitating that a balance be achieved between the tempering procedure and the acceptable level of bran in the flour (Butcher and Stenvert, 1973; Hook *et al.*, 1982).

Glenn *et al.,* (1991) measured the compressive strength, modulus of elasticity, and energy and strain to compressive failure of wheat endosperm cylinders (1-mm diameter × 3-mm length). As moisture content increased, the compressive strength, modulus of elasticity and energy decreased, while strain increased.

After Babbitt (1949) assumed a wheat kernel as a homogeneous sphere in order to calculate water vapour diffusion coefficient and moisture content, other researchers followed his method to obtain diffusion coefficient values for intact kernels subjected to soaking (Becker and Sallans, 1956; Jaros *et al.*, 1992).

Some drying experiments (Becker and Sallans, 1955; Chang *et al.,* 1994) were conducted to obtain diffusion coefficients of an intact wheat kernel using the same geometrical assumption.

Hydration is a complex process and indicates the physical and chemical changes caused by processing (Masken, 2000).

Drying

Moisture diffusion is used to describe mass transfer in the medium (Whi-taker, Barre & Hamdy, 1969; Young, 1969).

Mathematical models that describe drying mechanisms of foods can provide the required temperature and moisture information (Parry, 1985; Parti, 1993). Among mathematical models, thin layer.

The first takes into account only internal resistance to moisture transfer while the other two consider only external resistance to moisture transfer between product and air (Henderson, 1974; Whitaker *et al.,* 1969; Fortes & Okos, 1981; Bruce, 1985; Parti, 1993).

Drying is one of the processes occurring during roasting operation and is related with textural changes during roasting. (Mayer, 1985; Perren & Escher, 1996).

Drying models have been found wide application due to their ease of use and lack of required data in complex theoretical models (such as phenomenological and coupling coefficients) (Madamba, Driscoll & Buckle, 1996).

Milling

The wheat pearling article by Mousia and others (2003) reviews how removing the outer layer of bran helps with microbial counts and changes particle size of the flour. There may be an optimum to pearling, grinding, and reconstituting back in the pearled wheat bran after hammer milling to control excessive starch damage or to keep granulation more consistent.

The technical manual "Wheat Flour Milling", Posner and Hibbs (2005), provided a good overview of the grinding process and the machinery involved. The grinding process is the most important step in milling.

The four main forces used in grinding are compression, shear, friction/abrasion, and impact (Posner and Hibbs, 2005).

It is forced through the perforated screen by hammers, creating heat and friction. This causes the product to be heated up and to lose moisture (Posner and Hibbs, 2005).

Dziski (2008) concluded that crushing the kernels before the hammer mill process may decrease the energy needed and change particle size distribution of the final flour.

Sieve Analysis

Betty, Engebretson and Merlin, (1960) described the relation of particle size to certain flour with different characteristics such as protein content, maltose ash content and gassing power. It is reported that ash content increases tremendously with the reduction in particle size.

Irani and Fong, (1961) describe a gravitational sedimentation procedure for determining flour granularity for particle size distribution by weight for a sample of flour from sedimentation in various solvents. Wilson and Donelson, (1962) described the comparison of flour particle size distribution measured by electrical resistivity and microscopy. The data indicate the presence upto 8-10 µm of micron sized particle in the flour, which was tested using both the method (electrical resistivity and microscopy).

Paul *et al.*, (1984) described the analysis of sand measurement by sieving and settling-tube techniques and they concluded that, these procedures avoids the artificiality of pretending that the grains are perfect spheres, that is expressing the grain sizes as "sieve diameters" and "sedimentation diameters". The same can be applicable in case of flour particle analysis.

Kakooei and Marioryad, (2005) in their study highlighted the issues related to professional diseases associated with flour dust. The study indicated relevance of occupational exposure to flour dust in flour mill and respiratory symptoms to the different types of organic dust as well as lung infection while working due to considerable exposure.

In this study soaking, drying, milling at different moisture content and sieve analysis of wheat were investigated. The wheat samples of moisture content of13%,14%, 15%, 16% and 17% (db) for the milling sample in different screens (i.e. screen having round opening of 0.21 mm screen having round opening of 0.25 mm and screen having round opening of0.3mm). The moisture affected the average particle size of the flour.

The result shows that average particle size distribution of wheat flour at different moisture content, the uniformity particles was maximum at 16%moisture content (db), one thing also observed that initially particle size gradually increases up to 16% moisture content (db) then on further increase in moisture content particle size decreases. The finding of this study may be helpful in better milling quality of wheat under different areas of milling. This study also provides idea about uniformity of flour particle size at given moisture content. The result may also be helpful for careful milling of wheat at different moisture content.

References

Abu-Ghannam & McKenna (1997). The application of Peleg's equation to model water absoption during the soaking of red kidney beans (*Phaseolus vulgaris* L.). Journal of Food Engineering. 32(4), 391-401.

Association of officials Analytical Chemists (1990). Official Methods of Analysis of the Association of officials Analytical Chemists (15th ed.).

Babbitt, J. D. 1949. Observations on the adsorption of water vapour by wheat. Canadian J.Res. 27F:55-72.

Betty, S., Enebretson,W. E. and Merlin L.A., The relation of particle size to certain flour characteristics.(1960) 436-455.

Becker, H. A., and Sallans H. R. 1956. A study of the desorption isotherms of wheat at 25°C and 50°C. Cereal Chem. 33(2): 79-91.

Bruce, D. M. (1985). Exposed-layer barley drying, three models ®tted to new data up to 150°C.Journal of Agricultural Engineering Research, 32, 337±347.

Butcher, J. and Stenvert, N. L. 1973. Conditioning studies on Australian wheat. I. The effect of conditioning on milling behavior. J. Sci. Food Agric. 24(9): 1055-1066.

Chakraverty, A.2012, Post Harvest Technology of Cereals, Pulses and Oilseeds, Third Edition. Oxford & IBH Publishing CO. PVT. LTD, pp. 181-185.

Chang, C. S., Converse, H. H. and Steele J. L. 1994. Modeling of moisture content of grain during storage with aeration. Transactions of the ASAE 37(6): 1891-1898.

Dabhi, M. N. & Dhamsaniya, N. K. 2010, Agricultural Processing and Food Engineering. Kalyani Publishers, Ludhiana, pp.78-81.

Dziski D. 2008. The crushing of wheat kernels and its consequence on the grinding process. Powder Tech 185:181-86.

Fortes, M., & Okos, M.R. (1981). Non-equilibrium thermodynamics approach to heat and mass transfer in corn kernels. Transactions of American Society of Agricultural Engineers, 22,761±769.

Fraser, C. W., and Haley. W. L. 1932. Factors that influence the rate of absorption of water by wheat. Cereal Chem. 9(1): 45-49.

Glenn, G. M., and Johnston, R. K. 1994. Water vapor diffusivity in vitreous and mealy wheat endosperm. J. Cereal Sci. 20(3): 275- 282.

Glenn, G. M., Younce, F. L. and Pitts, M. J. 1991. Fundamental physical properties characterizing the hardness of wheat endosperm. J. Cereal Sci. 13(2): 179-194.

Henderson, S. M. (1974). Progress in developing the thin layer drying equation. Transactions of American Society of Agricultural Engineers, 17, 1167±1172.

Hook, S. C. W., Bone, G. T. and Fearn, T. 1982a. The conditioning of wheat. The influence of varying levels of water addition to UK wheat on flour extraction, moisture and colour. J. Sci. Food Agric. 33(7): 645-654.

Hook, S. C. W., Bone, G. T. and Fearn, T. 1982b. The conditioning of wheat.

The effect of increasing wheat moisture content on the milling performance of UK wheats with reference to wheat texture. J. Sci. Food Agric. 33(7): 655-662.

Hook, S. C. W., Bone, G. T. and Fearn, T. 1982c. The conditioning of wheat. An investigation into the conditioning requirements of Canadian Western Red Spring No. I. J. Sci. Food Agric. 33(7): 663-670.

Jaros, M., Jayas, S. D. S. and Pabis, S. 1992. A method of determination of the diffusion coefficient based on kernel moisture content and its temperature. Drying Technol. 10(1):213-222.

Irani R. R. and Fong, W. S. Measurement of the particle size distribution of flour. (1961) Chem. 38: 67 -75.

Kakooei, H. And Marioryad H. 2005. Exposure to Inhalable Flour Dust and Respiratory Symptoms of Workers in Flour Mill in Iran. Iranian J Env Health SciEng, Vol. 2,No.1, pp. 50-55.

Kalia, M. & Sood, S. 2012. Food Preservation and Processing. Kalyani Publishers, Ludhiana, pp. 362-363.

Madamba, P. S., Driscoll, R. H., & Buckle, K. A. (1996). Thin-layer drying characteristics of garlic slices.Journal of Food Engineering, 29, 75±97.

Maskan, M. (2000). Microwave/air and microwave finish drying of banana. Journal of Food Engineering, 44(2), 71-78.

Nagi, H. P. S., Sharma S. and Sekhon, K. S. 2012, Hand Book of Cereal Technology. Kalyani Publishers, Ludhiana, pp. 1-3.

Mayer, K. P. (1985). Infra-red roasting of nuts, particulary hazelnuts. Confectionary Production, 51, 313±314.

Parry, J. L. (1985). Mathematical modeling and computer simulation of heat and mass transfer in agricultural grain drying. Journal of Agricultural Engineering Research, 32, 1±29.

Parti, M. (1993). Selection of mathematical models for drying grain in thin layers. Journal of Agricultural Engineering Research, 54, 339± 352.

Paul, D. K. 1884. The analysis of grain-size measurement by sieving and settling-tube techniques, Journal of sedimentary petrology, Vol.54, No.2 June, 1984. 0603-0614.

Perren, R. & Escher, F. (1996). Rosttechnologie von Haselnussen, Teil III: Optimierung des rostverfahrens furnusse. Zucker und SusswarenWirthschaft, 49, 142±145.

Posner, E.S. & Hibbs A.N. 2005. Wheat Flour Milling. 2nd ed. St. Paul, MN. AACC. p 125-53.

Sahay, K. M. & Singh, K. K. 2010, Unit Operations of Agricultural Processing, Second Revised Edition. Vikas Publishing House PVT. LTD., pp. 103-110, 219-223, 239-240.

Singh B. & Modda M. (1979). Studies on the preparation and nutrient composition of bulgar from triticate. Journal of Food Science, 44(2), 449-452.

TSE, (1978). Unshelled hazelnuts (®lberts). In Turkish standards (1st ed., TS 3074), TSE, Ankara.

Whitaker, T., Barre, H. J. & Hamdy, M. Y. (1969). Theoretical and experimental studies of diffusion inspherical bodies with a variable di€ usioncoe • cient. Transactions of American Society of Agricul- tural Engineers, 11, 668±672.

Wilson J. T. and Donelson, D. H. (1962). Comparison of Flour particle size distributions measured by electrical resistivity and microscopy. Chem. 47.126.