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Dimensions: 8.5 inch wide, 11 inch tall

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Colors: Color Print on White

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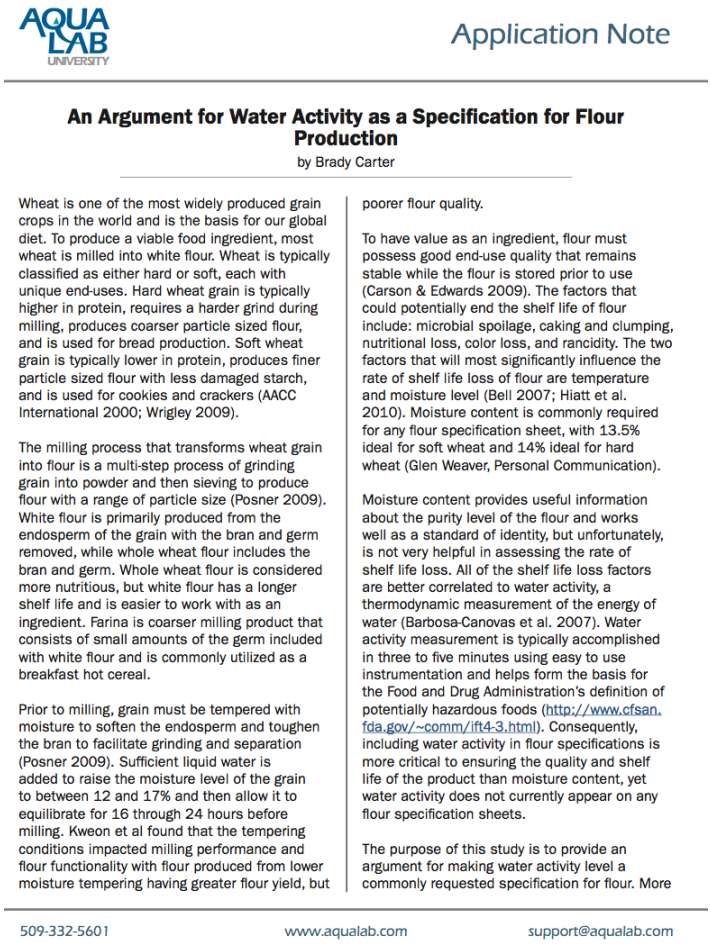
Special Notes: Illustrations are Ref Only ** Not to Scale **



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Application Note

An Argument for Water Activity as a Specification for Flour Production

by Brady Carter

Wheat is one of the most widely produced grain crops in the world and is the basis for our global diet. To produce a viable food ingredient, most wheat is milled into white flour. Wheat is typically classified as either hard or soft, each with unique end-uses. Hard wheat grain is typically higher in protein, requires a harder grind during milling, produces coarser particle sized flour, and is used for bread production. Soft wheat grain is typically lower in protein, produces finer particle sized flour with less damaged starch, and is used for cookies and crackers (AACC International 2000; Wrigley 2009).

The milling process that transforms wheat grain into flour is a multi-step process of grinding grain into powder and then sieving to produce flour with a range of particle size (Posner 2009). White flour is primarily produced from the endosperm of the grain with the bran and germ removed, while whole wheat flour includes the bran and germ. Whole wheat flour is considered more nutritious, but white flour has a longer shelf life and is easier to work with as an ingredient. Farina is coarser milling product that consists of small amounts of the germ included with white flour and is commonly utilized as a breakfast hot cereal.

Prior to milling, grain must be tempered with moisture to soften the endosperm and toughen the bran to facilitate grinding and separation (Posner 2009). Sufficient liquid water is added to raise the moisture level of the grain to between 12 and 17% and then allow it to equilibrate for 16 through 24 hours before milling. Kweon et al found that the tempering conditions impacted milling performance and flour functionality with flour produced from lower moisture tempering having greater flour yield, but poorer flour quality.

To have value as an ingredient, flour must possess good end-use quality that remains stable while the flour is stored prior to use (Carson & Edwards 2009). The factors that could potentially end the shelf life of flour include: microbial spoilage, caking and clumping, nutritional loss, color loss, and rancidity. The two factors that will most significantly influence the rate of shelf life loss of flour are temperature and moisture level (Bell 2007; Hiatt et al. 2010). Moisture content is commonly required for any flour specification sheet, with 13.5% ideal for soft wheat and 14% ideal for hard wheat (Glen Weaver, Personal Communication).

Moisture content provides useful information about the purity level of the flour and works well as a standard of identity, but unfortunately, is not very helpful in assessing the rate of shelf life loss. All of the shelf life loss factors are better correlated to water activity, a thermodynamic measurement of the energy of water (Barbosa-Canovas et al. 2007). Water activity measurement is typically accomplished in three to five minutes using easy to use instrumentation and helps form the basis for the Food and Drug Administration's definition of potentially hazardous foods (http://www.cfsan.fda.gov/~comm/ift4-3.html). Consequently, including water activity in flour specifications is more critical to ensuring the quality and shelf life of the product than moisture content, yet water activity does not currently appear on any flour specification sheets.

The purpose of this study is to provide an argument for making water activity level a commonly requested specification for flour. More

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