Effects of Additives to Flour Quality Method

Scope

- Assess effect of additives on processing and bread baking quality and characteristics of dough.
- Quality control.

doughLAB

The doughLAB is a flexible dough rheometer with conventional z-arm mixing action. It includes automated systems to control bowl temperature and dispense water into the sample, and variable temperature and speed controls. The instrument uses standard or custom test configurations to determine water absorption, dough mixing profile, development time, stability and softening of wheat, rye, durum and composite flours for milling, baking, and foods laboratories.

Description

Formulations for breads, cakes and baked products usually include a combination of additives to improve dough stability, texture and organoleptic qualities. Some of the more common additives include reducing and oxidizing agents, salt, sugar, enzymes, and emulsifiers. The effects of these additives on dough quality can be examined on the doughLAB, by comparing a sample with and without the additive. A longer test profile is used to allow for the strengthening effect of some of the additives to be fully observed.

Addition of the reducing agents normally results in earlier peaks, while oxidizing agents act as dough improvers (strengtheners) by increasing the development time and stability. Salt is used in bread formulations not only to impart flavor, but also to increase dough strength, usually seen as an increase in mixing time. Sugar serves as a nutrient for yeast, being fermented into carbon dioxide, and other minor components. The carbon dioxide (gas bubbles) is the major contributor to loaf volume and crumb texture. The sugar also acts as a crust-browning agent (through Maillard reactions), stabilizer, and sweetener. Emulsifiers are commonly used in formulations to improve dough strength. Enzymes are used in baking to degrade complex carbohydrates into fermentable sugars. The effect of the enzymes is usually observed as a reduction in dough strength and stability.

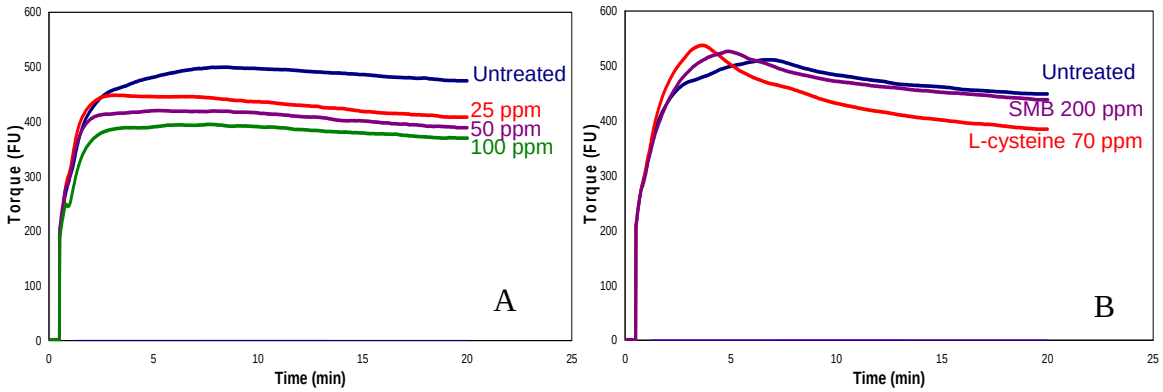

Fig. 1. doughLAB curves showing the effect of α-amylase (A) and reducing agents, L-cysteine and sodium metabisulfite (SMB) (B) on dough quality.

Method

Modified thirty minute mixing profile (Long profile) based on AACC International Method 54-21.01, RACI Official Method 06-02, ICC Standard No. 115/1. Run untreated flour to centre the peak torque on 500 FU. Use this water absorption (WA) for subsequent tests with additive for the same flour.

Sample Preparation

300.0 g (or 50.0 g) flour at 14% moisture. Most additives should be added in liquid form (in solution with water) rather than in powder form, to allow more even distribution through the flour/dough. Prepare a suitable dilution of the additive in water and manually add to mixing bowl. Adjust doughLAB water addition (ml) to compensate for volume of additive solution.

The following table may be used as a guide for typical or optimum dosages to achieve noticeable differences between the control and treated flours.

Additive	Dosage (in flour)*
Reducing agents	
L-cysteine	70-90 ppm
Sodium metabisulfite	200 ppm
Oxidizing agents	
Potassium bromate/iodate	75 ppm
Ascorbic acid	150 ppm
Salt	1-2%
Sugar	1-5%
Shortening/lipid	2-3%
Yeast	2-3%
Emulsifiers	
DATEM	0.4%
Mono- and diglycerides	0.5%
Enzymes	
α-amylase	25-100 ppm
Hemicellulase	10 ppm

*Different countries/regions will have different maximum permitted dosages.

Table 1. Example of dosage for various additives.

Profile

Time	Type	Value
00:00:00	Temp	30°C
00:00:00	Speed	63 rpm
00:30:00	End	
Premixing time: 60 s Premixing speed: 63 rpm		

Measure

PT: Peak torque (FU)
WA: Water absorption (%)
DDT: Dough development time (min)
Stab: Stability (min)
ST: Softening (FU)
MTI: Mixing tolerance index (FU)