Measurement of α-Amylase Activity with the Amylograph

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Objective

This method uses the amylograph to estimate α-amylase activity (diastatic activity) in an aqueous suspension of flour as it gelatinizes during heating. The high viscosity of the starch gel is counteracted by the action of α-amylase, which liquefies starch granules as the slurry is heated. The amylograph value, or *peak viscosity*, also called *malt index*, is therefore inversely correlated with α-amylase activity. The method measures α-amylase that naturally occurs in flour or is added as malt; it does not respond to fungal α-amylase.

Apparatus

Visco/Amylo/Graph.

Reagent

Buffer solution. Make concentrated buffer by dissolving and diluting 14.8 g anhydrous disodium phosphate (Na_2HPO_4) and 10.3 g citric acid monohydrate to 1 liter with water. Dilute 46.0 ml concentrated buffer to 460 ml with water (pH 5.3–5.35). Store in refrigerator to prevent mold growth. Prepare fresh buffer at least every month.

Procedure

Adjustment of instrument

Adjust recorder pen to read zero on graph paper with bowl empty, but with spindle in place and bowl in operation. For those instruments with spindle bearing on bottom of bowl, a drop of thin oil placed on pivot point is helpful. Alignment of pins of both bowl and spindle should be checked with template provided by manufacturer. If instrument is equipped with cooling probe, have probe in raised position.

Determination

1. Place 100 g flour (14% moisture basis) in 1-liter Erlenmeyer flask. (For soft wheat flour, use 65 g [14% moisture basis] with buffer solution or 60 g [14% moisture basis] with water.) Add 360 ml dilute buffer and enough water to adjust flour moisture to 14.0% (see **Example**); shake with wrist motion for 0.5 min (100 shakes per min). Alternatively, mix flour and water in a stainless steel bowl, using a whisk. Do not use antifoaming agents.

2. Pour flour slurry into amylograph bowl. Rinse flask with remaining 100 ml buffer and add this to amylograph bowl. Place spindle in bowl and move head of amylograph into proper position. Adjust starting temperature to 30° by hand, with clutch in neutral position, or set electronic controller to 30°. Set clutch on increase temperature position and start amylograph bowl in motion. "Record

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viscosity of slurry as temperature increases from 30 to 95°; temperature should increase 1.5°/min. Read maximum viscosity in Brabender Units (BU) at center of peak. This value is called the malt index of the flour. Standard error for single determination for individual instrument should not exceed 10 BU.

3. For studying effect of different concentrations of cereal malt α-amylase on viscosity of flour, add different increments of malt flour (0.1–1.0 g) to unmalted flour, total weight of mixture being 100 g (14.0% moisture basis), and determine malt index as described above.

4. Different malt flours can be compared by adding same amount of different malt flours to standard flour and determining malt index as described above.

5. For determining malt index of unmalted red spring or unmalted hard red winter wheat flours, use 65 g (14.0% moisture basis). For these two methods, use 460 ml buffer and enough water to adjust flour moisture to 14.0%.

Example

If flour sample contains 12.5% moisture, place 98.3 g flour in flask, add 1.7 ml water and 460 ml diluted buffer.

$$\frac{100-14}{100-12.5} \times 100 = 98.3$$

If flour sample contains 15.0% moisture, place 101.2 g flour in flask and add 458.8 ml diluted buffer.

$$\frac{100-14}{100-15} \times 100 = 101.2$$

Notes

1. A rapid amylogram method can be obtained from the manufacturer.

2. Existing instruments can be retrofitted to be analyzed by computer, or new ones can be obtained from the manufacturer with computerized analysis.

References

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