Solvent Retention Capacity Profile

Proposed November 3, 1999

Objective

Solvent retention capacity (SRC) is the weight of solvent held by flour after centrifugation. It is expressed as percent of flour weight, on a 14% moisture basis. Four solvents are independently used to produce four SRC values: water SRC, 50% sucrose SRC, 5% sodium carbonate SRC, and 5% lactic acid SRC. The combined pattern of the four SRC values establishes a practical flour quality/functionality profile useful for predicting baking performance and specification conformance. Generally, lactic acid SRC is associated with glutenin characteristics, sodium carbonate SRC with levels of damaged starch, and sucrose SRC with pentosan characteristics. Water SRC is influenced by all of those flour constituents.

Apparatus

1. Centrifuge.
2. Centrifuge tubes, 50 ml, polypropylene conical bottom with screw caps.
3. Balance, accurate to 0.001 g.
4. Timer.
5. Test tube rack.

Reagents

1. Deionized water.
2. Sucrose solution, 50% (w/w). Weigh 500 g of reagent-grade sucrose into a 1-liter container. Add water to make 1,000 g. See Note 1.
3. Sodium carbonate solution, 5% (w/w). Weigh 50 g of reagent-grade anhydrous sodium carbonate into a 1-liter container. Add water to make 1,000 g. See Note 1.
4. Lactic acid solution, 5% (w/w). Using assay value given on reagent bottle, calculate the weight of reagent required to give 50 g of lactic acid. See Note 2. Weigh that amount of reagent into a 1-liter container. Add water to make 1,000 g. See Note 1.

Procedure

1. Weigh 50-ml centrifuge tubes with screw caps.
2. Weigh 5.000 ± 0.050 g flour of known moisture content into each tube.
3. Prepare a corresponding set of tubes containing 25.00 ± 0.05 g of appropriate solvents.
4. Start timer and add solvent to each tube containing flour.
5. Put cap on tube and shake vigorously to suspend flour (≈ 5 sec).
6. Allow to solvate and swell for 20 min, shaking at 5, 10, 15, and 20 min (≈ 5 sec each time).
7. Immediately transfer tubes to centrifuge. Centrifuge at exactly 1,000 × *g* for

doi: 10.1094/AACCIntMethod-56-11.01

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15 min, after reaching the speed. Allow centrifuge to stop without braking. See Note 3.

8. Decant supernatant and drain tube at 90° angle for 10 min on a paper towel.
9. Put cap back and weigh tube, cap, and pellet.
10. Determine weight of gel by subtracting weight of tube and cap from total weight of tube, cap, and gel.
11. Calculate SRC value for each solvent:

$$\%\text{SRC} = \left[\frac{\text{gel wt}}{\text{flour wt}} - 1\right] \times \left[\frac{86}{100 - \%\,\text{flour moisture}}\right] \times 100$$

Notes

1. Make sucrose solution 12 hr in advance. Reagents can be stored at room temperature up to 7 days. Replace solutions after 7 days.

2. For example, if lactic acid is 88.50% concentration, add 50 ÷ 0.885 (= 56.497 g) lactic acid.

3. Exact centrifugal force (× *g*) as well as proper centrifuge tube type and size are critical to the repeatability and reproducibility of data.

4. Over time, new users of SRC values should compare the profile of the four SRC values with mixing, handling, and other baking characteristics of flour as well as with baked product geometry and texture response. Flours with less successful performance are likely to be identified by change in one or more of the SRC values. Only one or two SRC solvents may be sufficient to monitor flour quality of the same wheat source. A change in all SRC values may indicate a change in wheat source.

5. Flour quality for baking performance, in different end-use applications, is related to behavior patterns of SRC values. Different patterns are optimally suited for different products. For example, a cookie flour may perform well with water SRC ≤ 51%, sucrose SRC ≤ 89%, lactic acid SRC ≥ 87%, and sodium carbonate SRC ≤ 64%. A sponge and dough system may perform well with water SRC ≤ 57%, sucrose SRC ≤ 96%, lactic acid SRC ≥ 100%, and sodium carbonate SRC ≤ 72%. However, conformance of bakery production will be improved if SRC values change little among different flour lots.

6. In contrast to Method **56-10.01**, the use of 5% (w/w) sodium carbonate in this method increases the pH to > 11, which is above the pK of starch hydroxyl groups. This allows a distinction to be made between damaged or pregelatinized starches and undamaged or native starches.

References

1. Slade, L., and Levine, H. 1994. Structure-function relationships of cookie and cracker ingredients. In: The Science of Cookie and Cracker Production, H. Faridi, ed. Chapman & Hall/AVI, New York, pp. 23-141.
2. Gaines, C. S. 2000. Collaborative study of methods for solvent retention capacity profiles (AACC Method 56-11). Cereal Foods World 45:303-306.