

The loaf was baked on a stationary reel.

Electrical resistance oven. A thermocouple was placed about 10 mm from the bottom of the loaf (He and Hosoney 1991).

CO₂ Determination

Dough was baked in an electrical resistance oven (ERO). During baking, N₂ gas flowed over the dough and to an infrared CO₂ analyzer. Details of the procedure were given previously (He and Hosoney 1991).

Differential Scanning Calorimetry

Temperature for starch gelatinization in bread dough, made with a full formula except yeast, was determined by differential scanning calorimetry (using a Perkin-Elmer DSC-2). About 10 mg of mixed dough was placed in aluminum sample pans. The experiments were conducted at a scanning rate of 10°C/min.

Fractionation and Reconstitution

The fractionation and reconstitution procedure for flour-water dough is given in Figure 2. Flour-water doughs were heated in an electrical resistance oven (ERO) to 45, 60, 70, and 85°C. The heated doughs were immediately fractionated into a water-soluble fraction, gluten, and starch. Gluten could not be completely separated from starch when the dough was heated above 70°C. Therefore, to test the effect of heat on gluten baking quality, gluten was washed from unheated flour-water dough by the procedure shown in Figure 3. The fresh wet gluten was then heated in a small ERO (Creighton 1988) to 45, 55, 60, 65, 70, 80, 90, or 100°C. Each heated fraction (water-soluble, starch, or gluten) was separately lyophilized, ground, and reconstituted with the other two unheated fractions to obtain a flour with the same ratio of components as unfractionated flour.

Scanning Electron Microscopy of Dough

Preparation of mixed and fermented dough for scanning electron microscopy involved freezing a small portion of dough in liquid nitrogen, cyrofracturing, and freeze-drying with an Edwards tissue freeze-dryer at -50°C for 48 hr. The dried dough samples were mounted on specimen stubs with silver paste and

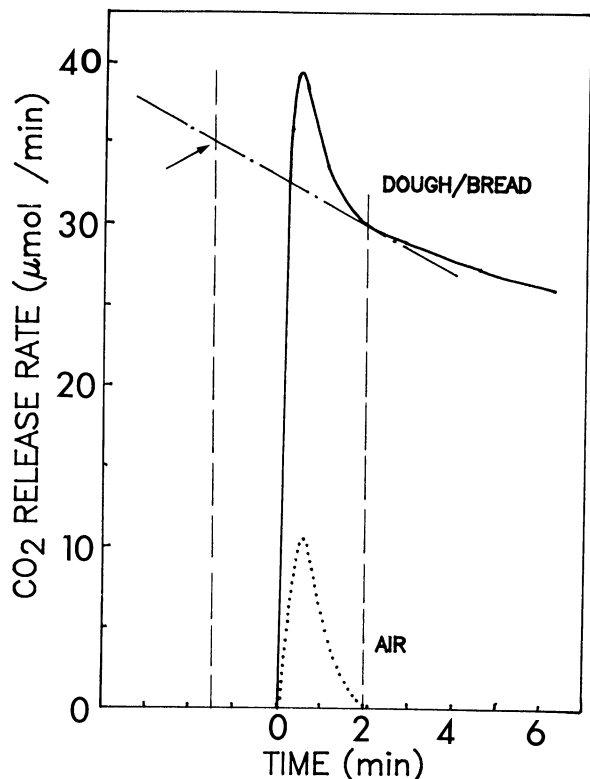


Fig. 1. A typical profile of carbon dioxide release from dough removed from a conventional oven after baking.

coated under vacuum with approximately 60 Å of carbon and then with about 100 Å of gold-palladium. Samples were viewed with an ELEC U-1 auto scan scanning electron microscope operating at an accelerating voltage of 5 kV. Images were photographed on Polaroid film, type 55.

RESULTS AND DISCUSSION

Transformation of Dough to Bread

When dough is baked in a conventional oven, heat is transported from the surface to the center mainly by the Watt principle

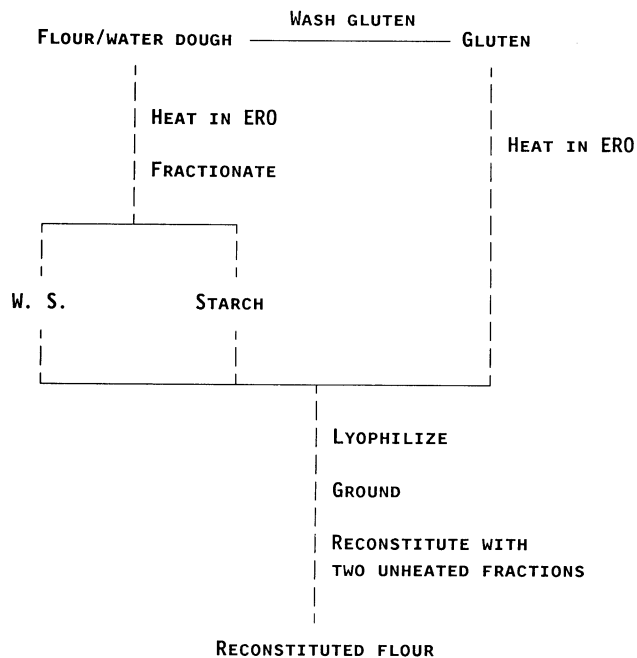


Fig. 2. Fractionation and reconstitution procedure. ERO = electrical resistance oven, W.S. = water-soluble fraction.

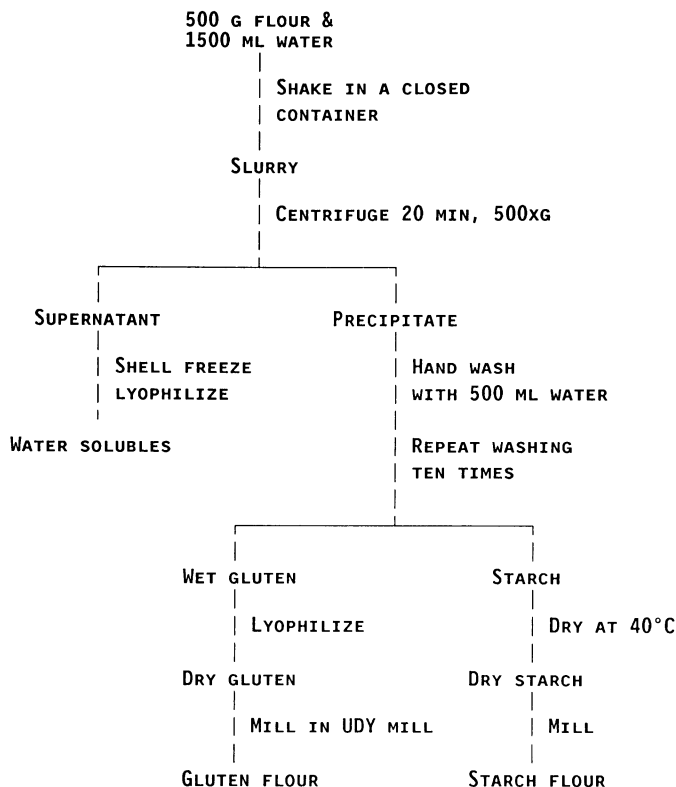


Fig. 3. Procedure for preparing gluten.

