

Gliadins Treated with Trifluoroacetic Acid Are Water Soluble

To the Editor:

Most extraction conditions for flour proteins are based on the classical Osborne solvent separation system: water is used to extract the albumins, sodium chloride solutions for globulins, 70% ethanol for gliadins, and acidic or basic solutions for glutenins. The extraction yield of each protein fraction is quite variable and dependent on flour, vigor of shaking, concentration of solutions, and times used for each process. The extraction or solubilization of gliadins has been studied many times, and controversy still exists over which method extracts only gliadins and what a gliadin really is. Shogren and co-workers (1969) described a procedure for extracting gliadins with repeated copious amounts of water. However, the ability of gliadins to be readily soluble in distilled water has not been described. This communication reports that ethanol-soluble gliadins are soluble in water at 20° C following the addition of 0.1% trifluoroacetic acid (TFA) and lyophilization or following separation by high-performance liquid chromatography (HPLC) and freeze-drying. Furthermore, the electrophoretic and chromatographic patterns are unchanged by either process,

Gliadins from closely related (sister) wheat lines Shawnee (C.I. 14157) and the cultivar Ottawa Selection (KS619042) were extracted with 70% ethanol and separated on a C₈ HPLC column at 65° C by the method of Lookhart et al (1986). The total eluent from injection of 30 μ l of extract was collected and lyophilized, and then water was added to the vial. The effect of HPLC analysis on the water solubility of the gliadin proteins is shown in the polyacrylamide gel electrophoresis (PAGE) patterns of Figure 1. Because the gliadin PAGE pattern of each line is the same whether the sample applied was a 70% ethanol extract or a water-solubilized HPLC collection, the gliadins are not deleteriously affected by HPLC analysis, and the apparent size and surface charge combination parameters are also unaffected.

To determine the effect of TFA on the solubility of gliadins in water at 20° C, gliadins were extracted with 70% ethanol (500 mg of flour with 1.50 ml of solvent) and with 70% ethanol containing 0.1% TFA by weight. Those extracts were lyophilized and the dried material was taken up in 0.90 ml of water at 20° C. Electrophoresis of the proteins solubilized in water from the ethanol plus TFA extract gave a band pattern identical in intensity and position to that of a 70% ethanol extract (data not shown). However, the electrophoregram of the water-solubilized proteins from the ethanol extract without TFA showed only very faint bands at few positions. These data show the ability of TFA to aid in the solubility of gliadins in water.

The means by which TFA causes this solubility of gliadin proteins in water is unknown. The TFA molecules may attach via hydrogen bonding or ionic bonding to the proteins' side chains making the outer surface of the proteins more ionic, which would make the proteins more readily soluble in water. The TFA-protein compound may be similar to the acid-protein compound formed by the peptization of gliadin by acetamide-water solutions (Dill and Alsberg 1925). There are other possibilities that may explain the improved solubility, including dissociation of the protein lipid complex by TFA and conversion of glutamine to glutamic acid by acid hydrolysis.

ACKNOWLEDGMENT

I thank L. Albers for excellent technical assistance.

G. L. LOOKHART
USDA-Agricultural Research Service
U.S. Grain Marketing Research Laboratory
1515 College Avenue
Manhattan, KS 66502

LITERATURE CITED

- DILL, D. B., and ALSBERG, C. L. 1925. Preparation, solubility, and specific rotation of wheat gliadin. *J. Biol. Chem.* 65:279.
LOOKHART, G. L., ALBERS, L. D., and BIETZ, J. A. 1986. Comparison of polyacrylamide gel electrophoresis and high-performance liquid chromatography analyses of gliadin polymorphism in the wheat cultivar Newton. *Cereal Chem.* 63:497.
SHOGREN, M. D., FINNEY, K. F., and HOSENEY, R. C. 1969. Functional (breadmaking) and biochemical properties of wheat flour components. I. Solubilizing gluten and flour protein. *Cereal Chem.* 46:93.

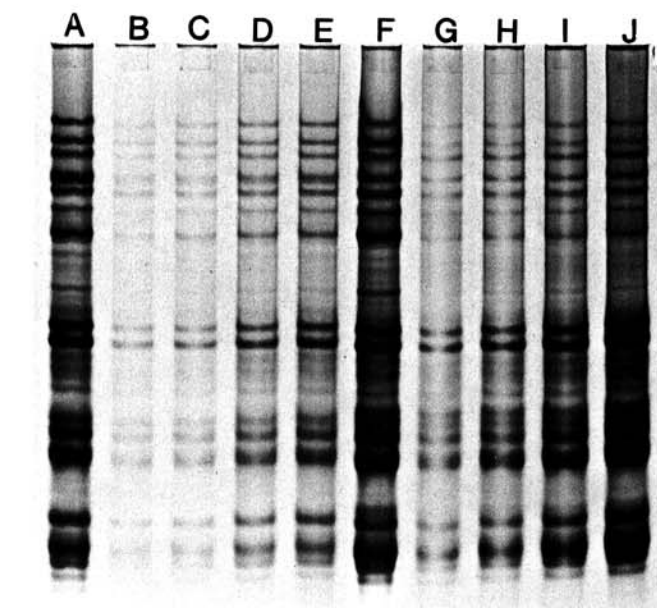


Fig. 1. Polyacrylamide gel electrophoresis patterns of closely related lines Shawnee (good quality) and Ottawa Selection (poor quality) that were soluble in water following passage through high-performance liquid chromatography analysis and lyophilization and the original 70% ethanol soluble fraction. The original 70% ethanol extracts of Shawnee and Ottawa Selection were separated in lanes A and F. Lanes B through E contain 5, 10, 20, and 30 μ l of Shawnee gliadins solubilized with water following collection of total chromatographic analysis eluent, lyophilization, and dissolving in 1 ml water. Lanes G through J contain the same amounts of the Ottawa Selection gliadins that were treated identically.

[Received June 11, 1987. Revision received August 6, 1987. Accepted August 6, 1987.]