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# This Week's Citation Classic®

**Wolf W J.** Soybean proteins: their functional, chemical, and physical properties.
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[National Center for Agricultural Utilization Research, Agricultural Research Service, US Department of Agriculture, Peoria, IL]

This review described the various edible-grade soybean proteins available commercially and summarized their functional properties in various foods. Physical and chemical properties were also reviewed to emphasize complexity of the proteins and the need to study the individual proteins in order to explain their behavior in food systems. [The *SCI*® indicates that this paper has been cited in more than 115 publications.]

## Physical and Chemical Properties of Soybean Proteins

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**On completing my graduate studies on isolation and characterization of soybean proteins at the University of Minnesota with D.R. Briggs in 1956, I joined A.K. Smith's group at the Northern Regional Research Laboratory in Peoria. Smith, along with S.J. Circle, had pioneered work on the properties of soybean proteins needed to isolate them on an industrial scale. When the Peoria laboratory opened in the 1940s, soybean protein research emphasis was on utilization (plywood glues, plastics, adhesives for paper coating, and textile fibers). However, inability to compete with petroleum-derived products made this line of work unproductive because of a lack of industrial interest. Smith's interests then turned to food uses of the proteins (soy flour in bread), but here too, there were problems—resistance from the wheat flour industry. About the time of my arrival, the work had shifted to basic research; consequently, I was able to continue the studies I began at Minnesota. Although my own work did not deal directly with food uses of soybean proteins, I followed the developments closely, and in 1961, Smith and I wrote a two part review on the food uses and properties of soybean proteins.[1,2] In the 1950s and 1960s, programs were underway by national and international organizations to deal with the "protein crisis" in developing countries faced with hunger and malnutrition. Because of their low cost and good nutritional properties, soybean proteins were identified as key ingredients for solving some of these problems. The protein crises and rapidly rising prices for meat also attracted the attention of many of the major US food companies. By 1970 when my paper appeared, there were a dozen or more companies developing or marketing foods for the domestic and international markets. Consequently there was a need for information on the physical and chemical properties of soybean proteins and how they might affect the functional properties (e.g., texture, emulsification, water binding, etc.) of foods. Much of the information on functional properties was scattered throughout the literature and often was not well documented. Nonetheless, I summarized the available information and tried to relate the physical and chemical properties to the functional characteristics of the proteins. This probably encouraged research on many of the functional properties and has resulted in extensive reviews by others.[3,4]**

**Reprints of my paper were in great demand (in the days before widespread availability of copiers). Our center distributed 800 reprints, and the paper was also selected for inclusion in an information packet given to more than 1,100 registrants at the World Soy Protein Conference held in Munich, Germany, in 1973. Later, it was also translated into Japanese.[5] Although more recent and more detailed reviews are now available,[3,4] my article is still cited.[6] Perhaps its appeal is in its brevity. In the meantime, the protein crisis has subsided, but soy proteins are found as ingredients in many processed foods. Research fashions have also changed (again). "New" research on soybean proteins now includes utilization in plastic foams and films, adhesives, and textile fibers!**

1. **Smith A K & Wolf W J.** Food uses and properties of soybean protein. I. Food uses. *Food Technol.* 15:4-6; 8; 10, 1961.
2. **Wolf W J & Smith A K.** Food uses and properties of soybean protein. II. Physical and chemical properties of soybean protein. *Food Technol.* 15:12-3; 16; 18; 21; 23; 26; 28; 31; 33, 1961.
3. **Kinsella J E, Damodaran S & German B.** Physicochemical and functional properties of oilseed proteins with emphasis on soy proteins. (Altschul A M & Wilcke H L, eds.) *New protein foods. Volume 5. Seed storage proteins.* New York: Academic Press, 1985. p. 107-79.
4. **Visser A & Thomas A.** Review: soya protein products—their processing, functionality, and application aspects. *Food Rev. Int.* 3:1-32, 1987.
5. **Wolf W J.** Soybean proteins: their functional, chemical, and physical properties. *New Food Ind.* 21:44-55, 1979.
6. **Campbell N F, Shih F F & Marshall W E.** Enzymatic phosphorylation of soy protein isolate for improved functional properties. *J. Agr. Food Chem.* 40:403-6, 1992.

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