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BAKERY FORMULATION

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ABSTRACT OF THE DISCLOSURE

The addition to a bakery formulation of a mixture of 1 part soy protein concentrate with ½ to 2 parts soy flour having a Nitrogen Solubility Index of over 66% results in an improved yield of bread because of increased water absorption in the dough while maintaining the other physical and chemical characteristics of the dough and bread at least of equal character.

SUMMARY OF INVENTION

Historically, non-fat dry milk has been used to impart certain desirable characteristics to such bakery products as bread. The protein added through the vehicle of the milk solids results in a better yield of bread because of improved absorption of water. The total water content permissible in bread is regulated under Government standards but breads made with milk solids and various combinations of other ingredients therewith have seldom been able to reach this standard without affecting dough machinability and bread quality. The presence of the standardized amount of water is advantageous in developing both physical and chemical properties, improving shelf life, as well as making the bread more economical to produce.

The presence of optimum amount of water, made possible through the introduction of non-wheat protein, prevents the dough from drying up so that it does not stick to the baker's hands. Milk solids also have a favorable effect on crust color through participation in browning reactions, buffer the dough so as to prevent gas formation during proofing, improve the grain and texture of the bread, and are important in machinability—the dividing and molding of the dough (essentially the handleability). Still further, the protein additive is advantageous from the standpoint of improving the nutritional quality of the bread.

Because of the continually increasing cost of nonfat dry milk, bakers have, in the past, attempted to substitute various protein materials for the milk solids—in whole or in part. One commonly utilized expedient is to substitute a soy flour-whey solids combination for a portion of the nonfat dry milk. This, of course, lowers the cost but at the same time one has to reduce the water absorption also, otherwise the dough will be more difficult to machine. It also causes the grain and texture of the bread to deteriorate somewhat.

This invention is based, in part, upon the discovery that a particular soy protein, soy protein concentrate, in combination with a soy flour having a high water-soluble protein content is effective as a complete substitute for the non-fat dry milk, and further, gives a significant increase in water absorption when employed in the preparation of bread. Soy protein concentrate contains not less than 70% protein ($N \times 6.25$) on a moisture-free basis. It is "a product prepared from high-quality, sound, clean, dehulled soybeans by removing most of the oil and water-soluble, non-protein constituents therefrom." (As defined by the National Soybean Processors Association; also found in the Soybean Digest Bluebook of March 1966, line 26, No. 6, p. 20, as edited by American Soybean Association; and accepted by the Meat Inspection Division of USDA.)

The increase in water absorption was particularly unexpected since the soy protein concentrate fraction employed may or may not be high in water-soluble protein. In the past, only proteins with high water-soluble protein content were used to obtain desirable grain and crumb color. Furthermore, the absorption increase was found to be relatively higher than that which could be predicted on the basis of protein increase alone when substituting the soy fluor additive with a soy flour-soy protein concentrate composition in the bread formulation. Thus, I find a synergism between the soy flour and soy protein concentrate employed in whole or in part as a substitute for the non-fat dry milk used heretofore in the preparation of bread.

The soy protein concentrate employed is that derived from defatted soy flour or flakes by removing the sugars, mineral matter, etc. by leaching with a suitable solvent.[1] Resulting therefrom is a product which has a total protein content of about 67% and of which 5%–70% is water-soluble, depending upon the method of preparation. In contrast to this, the soy flour of this invention has a total protein content of the order of about 53% and of this amount 66% is water-soluble protein as determined by the AOCS "Nitrogen Solubility Index." [2]

Optimum results are obtained in the practice of the invention when the composition substituted for the non-fat dry milk has the two elements—the soy flour having a high water-soluble protein content and the soy protein concentrate—present in about equal proportions. By this, I refer to proportions in the range of 45%–55%.

An approach to optimum occurs when the two elements are present in the ratio of about 1:2 to 2:1, either one part flour to two parts protein concentrate or vice versa. The testing of various formulations indicated that if the level of soy flour is increased beyond the 2:1 ratio, the dough becomes slack and difficult to handle. This requires a reduction in water absorption from the optimum that is attainable by using a lower than 2:1 ratio. Also, there is a need for using more dusting flour to machine the dough, coupled with the need for opening of the bottom sheeting rolls, which in turn reduces the degassing process with the result of undesirable open grain and poorer textile. Using a ratio where the flour is less than one third of the total ingredient composition, results in a greyish texture and a loss of crust color, both undesirable characteristics for commercial white bread. The crumb color also changes from an off-white to a creamy yellow and the grain texture becomes more open and coarse when the water-soluble protein content of the soy flour goes below 66%.

The laboratory and commercial testing were made utilizing commercially-available products for the composition substituted for the non-fat dry milk. The flour employed had a water-soluble protein content of about 68%, and the soy protein concentrate employed was obtained from three different commercial sources, and had water-soluble protein contents of 65%, 6% and 2%,

[1] Suitable solvent:

(1) U.S. 2,881,076; Apr. 7, 1959. L. Sair (Griffith Labs). Proteinaceous Soy Composition and Method of Preparing.

(2) "Flash Desolventizing Defatted Soybean Meals Washed With Aqueous Alcohols To Yield a High-Protein Product." G. C. Mustakas, L. D. Kirk and E. L. Griffin, Jr. J. Am. Oil Chemists' Soc., 39, 222–26 (1962).

(3) U.S. 3,142,571; July 28, 1964. J. K. McAnelly (Swift & Co.). Method for Producing a Soybean Protein Product and the Resulting Product.

(4) "A Bland Protein From Soybeans." J. E. Long. Paper presented at the meeting of the AACC, St. Louis, Mo. (Abstract 67 of Program for 47th Annual Meeting), May 23, 1962.

(5) Method of Preparing Edible Soybean Characterized by Greatly Enhanced Water Absorption. U.S. 3,268,503, G. C. Mustakas and E. L. Griffin.

[2] American Oil Chemists' Society Tentative Method Ba 11–65 "Nitrogen Solubility Index (NSI)."