Utilization of High Levels of Soy Protein in Comminuted Processed Meat Products

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Due to increased availability of several new proteinaceous additives (soy flours, concentrates, isolates, and extruded and spun textured soy), the meat processor has been faced with the onerous task of deciding which one of these protein products will best serve his purpose as a functional additive in a given meat system.

For more than a decade U.S. processors have introduced soy proteins in finely comminuted meat emulsion systems primarily at relatively low levels as an "insurance ingredient." In this type of usage the processor, for economic reasons, may use skeletal meats high in myosin content sparingly in his formulation. The reduction of myosin in the meat emulsion system may lead to an emulsion breakdown during the manufacturing cycle. This potential instability of the emulsion may result from the reduction of myosin since myosin is the primary constituent in the meat emulsion responsible for emulsifying and binding the fat.

Here is when the processor may choose to add, as an "insurance ingredient," 1-3.5% of a low cost, non-meat functional protein with emulsifying capacity. This additional emulsifying capacity will alleviate the stress on the system caused by the reduction of available myosin, thus ensuring a stable product with little or no fat migration during or after the cooking cycle.

Another way soy proteins can be advantageously utilized by a meat processor is as a direct replacement for high levels of meat protein. U.S. meat processors are beginning to recognize the potential of this type of utilization.

This second type of utilization, which requires new considerations with respect to nutritional and functional aspects, involves the replacement of high levels of available meat protein in a particular meat emulsion product by soy protein. In this situation it not only becomes obviously critical to use a soy product with a high degree of emulsifying capacity (comparable to the emulsifying capacity of the meat protein replaced), it also becomes a paramount consideration to use a soy product capable of imparting a characteristic meat-like texture. The possession of this important structure-forming property of the soy protein is not as important when the protein is used as a mere "insurance ingredient." In this latter type of usage, there is still enough functional meat protein available to impart the desirable meat-like textural structure of the final cooked emulsion product. When soy protein is used as a replacement for 40-75% of the available meat protein, there is an insufficient amount of available meat protein in the formulation to provide the characteristic textural properties. Although the soy protein may have emulsifying capacity, if it does not possess structure-forming properties, the final product will be unacceptable because the available proteins in the emulsion system will not result in a physically "desirable" structure, that is the texture which is characteristic of certain recognized food items. For example, in frankfurters this "desirable" texture may be one which provides a certain degree of resiliency (springiness) and firmness during mastication—two of the properties which constitute what is more commonly referred to as "bite."

It is my opinion that the traditional manner of evaluating soy proteins for their functionality in potential usages is insufficient. This "traditional" method essentially has consisted of determining the protein's nitrogen solubility index, and/or its emulsifying capacity, and/or its water holding capacity, and/or its rate of water absorption. For reasons previously mentioned, a more meaningful and valid approach in the evaluation and screening of soy proteins for potential uses in comminuted meat systems must include a method by which the protein's structure-forming properties can be studied, measured, and categorized.

Although the protein's water solubility, water absorption, and emulsifying properties, along with its gelling and coagulating properties, have been known to influence directly, or at least indirectly, the type of structure formation realized, there is no method which can be used to predict the type of textural structure the soy proteins will impart when incorporated into meat emulsion systems. This absence of an effective means to screen proteinaceous additives for their structure-forming ability has provided the main impetus for many workers to explore the feasibility of developing a method enabling this to be accomplished.

One of the methods employed by Armour to study and characterize the structure-forming ability of soy proteins has been referred to as the canned meatless emulsion test. This involves making a meatless emulsion in which the soy protein in question is incorporated into the system at a specific protein:water:fat ratio. The resultant emulsion is processed to temperatures similar to those the soy protein will ultimately be subjected to when finally used in the appropriate meat product.

After processing the canned emulsion, the resulting textural structure of the emulsion product is evaluated by use of the Instron Universal Testing Instrument in which a dual measurement of firmness and resiliency is utilized.

Work involving establishment of a statistical correlation between data from this model system test and tests in which the same proteinaceous additive is incorporated (at high protein replacement levels) in frankfurters is still in progress. Results to date are encouraging for they indicate that meatless emulsions containing non-meat proteins which impart low resiliency characteristics and/or low firmness characteristics will impart similar "poor" textural properties in the meat emulsion products containing the tested non-meat protein.

Soy Proteins in Meat-like Products in Japan

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INTRODUCTION

My assignment is to talk about spun and textured soy protein in Japan. However, I am not really in a good position to cover the whole area, and since my time is