

the plants authorized. The domestic industry has further expressed interest in FPC plants in other countries.

In spite of this increased interest, there continue to be plausible reasons why industry is not ready to develop the process and product. These are: (1) the potential advantages of products manufactured by improved extraction methods or methods not yet approved, such as the enzymatic digestion method; (it is possible that such products may serve as foodstuffs in their own right as opposed to use only as protein supplements); (2) the high capital cost combined with lack of information concerning acceptance and demand for the product; and (3) the need for further research on species not covered in the FDA regulation.

Alternatives

Many of the inexpensive bulk foods available in developing countries contain almost no protein. This applies to cassava, sago, polished rice, bananas, etc. In many countries, such foods may contribute up to 70% of the caloric intake. Other vegetable foods such as soy beans, peanuts, sunflower seed, cotton seed, etc., while containing fairly substantial proportions of protein, are almost always deficient in certain essential amino acids and cannot fulfill all the dietary needs for protein. Dry milk, while a good protein source, is produced only as a residual product, after milk needed for higher valued uses has been met. Thus, a significant increase in dry milk production is unlikely. Production in the United States in recent years has only kept abreast of population increases. Yet world needs for low cost animal protein continue to expand rapidly. Thus, the question is not how well FPC competes with dry milk, but how products supplemented with FPC or dry milk compare in price and nutrient adequacy with other types of foods.

Application of science and technology

Methods have been developed to manufacture FPC by utilizing three different processes: (1) solvent extraction procedures to remove water and fat and fat-like substances from the raw material; (2) enzymes, micro-organisms, or specific biological agents to break down the protein of the raw material, render them water-soluble, and separate the fish protein product from the raw material; (3) physical methods to effect separation of protein from nonprotein material of the raw fish.

In the development of FPC much has been done in the area of chemical extraction methods for which 20 or 30 different approaches have been made available. Products produced by the chemical extraction procedures are essentially insoluble in water and have either bland tastes or are almost odorless and tasteless. The chemical methods which have been studied use a variety of solvents. However, the most promising of these solvents are alcohols, because these substances do not require as high a temperature for dissolving and for distillation. These chemicals are more stable and less toxic than other solvents. Among the alcohols that have been used, ethyl alcohol and isopropanol are the most popular because their toxicity levels are relatively low and supplies are ample.

Biological processes offer considerable promise and are of great interest because they result in water-soluble products which can have distinct and desirable characteristics of color, odor and taste. These processes yield end products in greater variety than those obtained by the solvent method. There are a number of different biological procedures, none of which has yet received significant attention.

Objectives

The objectives of the long-range program are: (1) to alleviate human hunger by a plan carefully designed to extract more usable food from the sea, (2) to strengthen the international posture and leadership of the Nation by policies that look to peaceful, cooperative uses of the sea and that make new and improved technology available to the developing nations, (3) to upgrade and assist domestic fishing and fish processing industries through development of markets for species not now caught, new fishery products, and expanded knowledge of the oceans.

The overall program concept is broad and comprehensive: it considers all facets of a total system for providing ocean resources to consumers; it anticipates multiplying the presently used food resources of the ocean by a factor of perhaps five, processing and distributing these resources effectively in many forms suitable to the particular needs abroad and even in this country; it contemplates active participation of United States and foreign governments as well as private enterprise, using technology, capital, and promotion to establish a self-sustaining industry.