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FISH PROTEIN CONCENTRATE--A HIGH QUALITY ANIMAL PROTEIN [1/]

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Fish protein concentrate or fish flour--a new high-quality animal protein product--is potentially of economic significance to our fishing industry, political significance to our Nation, and sociological significance to the world. The domestic fishing industry should be given the opportunity to produce a satisfactory low-cost fish protein concentrate meeting general nutritional standards for worldwide use in human diets. Aiding the fishing industry to obtain the know-how and technical knowledge needed to produce this new product is the goal of the research on fish protein concentrate at the College Park Technological Laboratory of the U. S. Bureau of Commercial Fisheries.

Let us examine some of the factors that make this new product so important. Let us also examine what has been done and what is still needed in order to realize the goal of the Bureau's research on fish protein concentrate.

NEED AND VALUE

Hunger is the biggest problem of the century. More than half of the world's total population suffers from lack of food, adequate in quality and quantity to sustain health, growth, and physical vigor. Progress to relieve this condition has largely been offset by the alarming and accelerating rate of population growth. By the year 2000, the population of Asia, Africa, and Latin America will increase by about three billion people--an addition equal to the total world population of today. The task we face is staggering.

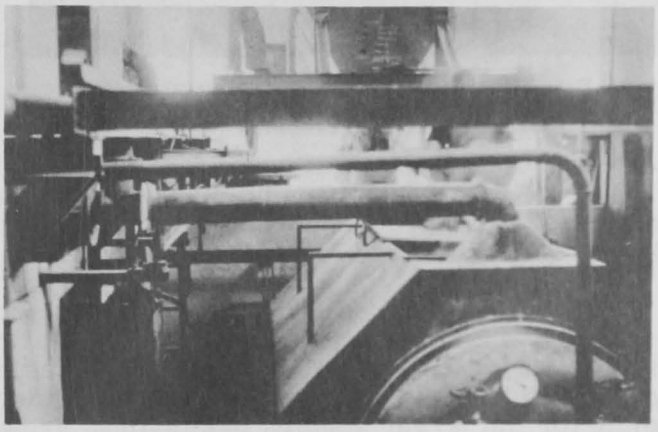

Fig. 1 - Extractor of UNICEF-ISESA experimental fish protein concentrate or fish flour plant in Quintero, Chile.

Malnutrition, undernutrition, is largely the result of an inadequate consumption of high-quality animal protein which is needed to complete and to balance the diets of peoples of developing nations, diets containing preponderantly vegetables and cereals. Sadly enough, young growing children and expectant mothers suffer most from a lack of proteins containing sufficient quantities and correct proportions of the required amino acids. Milk, eggs, beef, chicken, and the usual fishery products all contain high-quality animal protein, but those products are not universally available or they cost too much.

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Other sources of proteins of high quality must therefore be found--and fast. The fishery resources of the sea are an important source. Wisely managed, the sea with its great population of fish represents a vast reservoir of animal protein, proteins of exceptionally high quality that can be supplied in the form of concentrated fish protein.

The above concepts are by no means new, yet today, fish represents only a minor percentage of the food consumed by human beings. This is the more surprising in view of the fact that more than 70 percent of the surface of this planet is covered by oceans and seas and that, furthermore, the sea is considered by many authorities to be, acre for acre, about as productive as arable land.

Systematic efforts to farm the seas on a rational, industrial scale with a view of producing concentrated protein for human consumption have lagged far behind similar efforts to harvest and utilize the fruits of the land. The time has now come, however, when we can no longer leave this opportunity unchallenged, when old ideas have to be translated into action, and when the pursuit of the production of concentrated fish protein has become an obligation to mankind.

Aside from the purely humanitarian issues, the production of a satisfactory fish protein concentrate would provide much-needed economic stimulation for our domestic fishing industry. Such production would provide the all-important diversification needed by the industrial fisheries segment of our fishing industry--eliminating such market conditions of imbalanced supply and demand as was experienced a short time ago in the fish-reduction industry. The fishing industries of other nations of course would eventually produce fish protein concentrate as well. If 2 years ago Peru had diverted only 100,000 tons of their fish meal production into fish flour to feed their own people, we would never have witnessed--as we did--the collapse of the world market for fish meal.

Fig. 2 - Dehydrated protein concentrate elevators used in UNICEF-ISESA experimental plant in Quintero, Chile.

Industrial fish as well as waste products from edible fish could be converted into fish protein concentrates. It is estimated that over one-half of the catch of the North Pacific is discarded at sea before the fishing vessels dock--a protein waste that could feed thousands. In many areas, periods of glut lower the price of the catch, and often no market is available. If however the processors were able to manufacture fish protein concentrates during times of surplus, markets would stabilize and a low-cost protein food for the hungry would be available.

From a biological standpoint, the manufacture of fish protein concentrate would help us realize our goal by achieving efficient utilization of resources compatible with sustained optimum yield. Our fishermen would also be able to reestablish a favorable balance on our fishing grounds between the predatory fish and the grazing types of fish. Many years of selective fishing for the larger species has favored growth of smaller, less desirable kinds of fish until, in many areas, the latter are now relatively overabundant.

POTENTIAL MARKET AND POLITICAL SIGNIFICANCE

A fair market might exist for fish protein concentrate even in the United States--for instance as a supplement to breakfast cereals and baby foods. Cookies, doughnuts, noodles, and similar foods could almost magically be transformed into sources of good-quality protein if properly supplemented with fish protein concentrate--resulting in less parental worry over the starch-consuming teen-ager. From another point of view, our industrial fisheries

alone could supply in one fishing season more than the protein needed by our entire population during a 2-week period of a nuclear emergency.

It was estimated at the recent FAO Conference on Fish in Nutrition that 600 million people receive the major share of global animal protein, whereas 2 billion people, mostly in developing countries, lack this important nutrient. Clearly, 2 billion people represent an immense market--and one ready today.

Obviously, 2 billion people cannot continue to be denied animal protein without the possibility of dire, explosive, and politically obvious consequences[2/]. The other side of the coin is just as obvious. If adequately fed, these people may turn toward the goal of economic stability that we all seek as a basis for enduring world peace.

RESEARCH ON FISH PROTEIN CONCENTRATE

Although many attempts have been made to develop methods to manufacture fish protein concentrate, none of these efforts have yet met with complete success. Either these methods are still beset with processing problems or they have not been approved in good conscience by nutritionists, pediatricians, FAO, and the like.

Also, with few exceptions, the United States is not conducting, as other nations are, the scientific experimental studies designed to achieve a satisfactory product. For these reasons, Congress appropriated $50,000 for fiscal year 1962 to the Bureau of Commercial Fisheries for a research project designed to study existing methods, and if necessary, to improve these or to develop new concepts for the manufacture of fish protein concentrates suitable for worldwide incorporation into human diets.

Fig. 3 - Bagged fish protein concentrate in experimental plant at Quintero, Chile.

BUREAU PROGRAM: Our objectives are designed to specify ultimately methods that:

(1) Require low initial capitalization.

(2) Are economical in operation.

(3) Are flexible for both large-scale and small-scale operation.

(4) Are flexible enough to permit operation in those parts of the world where public utilities are limited.

(5) Result in the production of an end product that will be acceptable to peoples who may have varying taste preferences, cultures, and taboos.

(6) Result in the production of an end-product that will be approved as being fully satisfactory and suitable by world-recognized experts in the field of protein supplementation.

(7) Result in the production of a product that could be cheaply shipped to distant parts and that could be stored for varying periods of time without quality loss, and that could be easily incorporated into the local diets of undernourished peoples.

The project is supported, not only by some members of the United States Congress, and the fishing industry, but is also endorsed and assisted by United Nations Agencies, such as

2/Venter turpissima pars corporis (Sallust)--the stomach is the wickedest part of the body.

the Food and Agriculture Organization, the United Nations International Children's Emergency Fund, and the World Health Organization. It is being conducted with the support and approval of the Food for Peace and of the Freedom from Hunger campaigns and operates in cooperation with the Interdepartmental Committee on Nutrition for National Defense and the National Academy of Sciences Food and Nutrition Board.

The over-all Bureau program, set up for this extended research project, consists of the following three phases:

1 - Comprehensive Survey: To ensure that the funds allocated by Congress to this project will be used in the most effective manner, the Bureau is conducting a general survey of methods, used or studied, for the manufacture of fish protein concentrates for human consumption. Part of this survey, which is still under way, has been completed. Labor, time, and funds spent upon this preliminary work are insignificant compared to the labor, time, and funds that would be required to establish, by independent experiments, the knowledge that will in this way, be gathered from different sources. On completion of this general survey, a detailed monograph will be prepared for the United States industry. This monograph will constitute a record of scientific data concerning the partial successes and failures of the different attempts to develop a satisfactory manufacturing process.

2 - Formation of an Expert Consultant Group: As the second phase of the program, the Bureau plans to request assembly of a panel of expert consultants who will be presented with the findings in the monograph. The panel members will be asked to examine critically the facts contained in the report in order to be able to assist in the further programming and planning of the Bureau project. Experts from a wide field of scientific disciplines would be asked to participate in this consultant group, the formation of which is considered to be an essential condition for the success of this highly complex project. It is envisaged that the group will meet at least once a year, after the initial assembly, to advise us on our research program. The urgency, magnitude, and significance--both domestic and international--of our aims are ample justifications for calling upon the foremost scientific and technical authorities that this country has to offer. It is, furthermore, realized that before any method can finally be considered as being fully successful and satisfactory, it has to be conscientiously approved by an inter-disciplinary body of scientists such as the Protein Advisory Group of the United Nations. Some of the members of the latter organization will participate in the work of our panel and in this way help to assure the global approval of our work. Failure to work in close cooperation with such a group has proved to be a great handicap in previous trials carried out by private industry.

The survey and, it is hoped, the initial formation of the consultant group is expected to be accomplished in 1962.

3 - Laboratory Development of a Satisfactory Process: With the assistance and advice of the panel of experts just mentioned, the final phase of the research program will be designed either to attempt to improve existing methods, or if indicated, to develop, on a laboratory scale, a new process or processes that when satisfactory will be turned over to the fishing industry for further pilot-plant and commercial development.

Accomplishments: As already indicated, the first part of the general survey has now been completed. During this initial phase, plants in this country, Canada, Central and South America were studied. Although details of these studies will be published in a monograph, let us examine two groups of facts learned--in Canada and in South America--that will indicate the value of this survey approach to our research.

Canada: Scientists at the Technological Station of the Canadian Fisheries Research Board in Halifax have been working for some time now on the problem of fish protein manufacture. At the moment, the Station's research program is directed towards the production of the best fish protein concentrate that can be manufactured, irrespective of cost. Only cod fillets are being used. The Canadian scientists hope to produce a product that might be introduced on the United States market, both for use as a protein fortifier in various food prod

ucts and in an attempt to compete on the casein and egg albumen markets. We should note that the Canadians believe in a United States market--and they are preparing for it. The careful and scientific manner in which the fish flour program is conducted at Halifax is highly impressive. They are actively striving to produce a product of uniform quality.

South America: Characteristic of the independent and energetic efforts that are being made to develop manufacturing methods is a process developed by Dr. Bertullo, a staff member of the University of Montevideo, Uruguay. During a survey of micro-organisms associated with marine life, Dr. Bertullo isolated a new strain of yeast from a local species of fish. He discovered furthermore that this yeast had proteolytic activity; that is, that it was capable of breaking down proteins into amino acids. Inoculation with this yeast of a mass of comminuted fish, to which a small amount of molasses had been added, leads, within about 72 hours, to the production of a liquid mass. Bones, scales, and so on have disappeared during this process and so has the characteristic fishy odor and taste of the raw material, which is rich in Vitamin B_{12}. The product appears, on the basis of present experience, to have a remarkably long shelf life. It is believed that this type of product may become increasingly important, not only because it lends itself, by a process of spray-drying, to the production of a cheap dehydrated protein (or amino acid) flour, but also because it has, so far, shown itself to be of excellent nutritive value.

CONCLUSION

The successful, large-scale extraction of proteins from the seas for use in the human diet is today the goal of engineers and scientists in many countries--including Soviet Russia. Once successfully developed, the resulting product would constitute the beginning of an entirely new segment of the fishing industry. It will develop as explosively as the growth of the world population. It will rank foremost in importance with but a few other industries, capable of producing a cheap, high-quality food, available to everyone, everywhere. A most vigorous effort should be made for the United States to be in the vanguard on this potential advance in human nutrition.

SEAWEED CHEMICAL DERIVATIVE AS SUBSTITUTE FOR BLOOD PLASMA

Researchers for years have been looking for a plentiful substance which can be substituted for whole blood or blood plasma in the giving of emergency transfusions to disaster or accident victims. A new discovery is a chemical derived from the tiny cells of giant brown seaweed.

This whole blood substitute was reported by two Japanese surgeons of the Kyushu University Medical School in Fukuoka, Japan. Up to this time an accident victim who lost a great deal of blood and received no transfusion went into shock, which could prove fatal. Hasty transfusions of whole blood or blood plasma usually prevents the rapid drop in blood pressure which produces this shock. In emergencies, injection of salt water or sugared water have been used for this purpose. The newly discovered mixture comprising water plus the seaweed chemical is said to be superior to salt water or sugared water for transfusions to prevent shock, as it does not break down in the blood stream. (Canadian Fisherman, February 1960.)