Summary of Discussions on Session K

Preparation of Proteins from New Sources

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Eight potential new sources of vegetable proteins were described in short presentations; texts of 11 are reproduced in these Proceedings.

Discussion of Hagenmaeier's paper on Experimental Coconut Protein Products pertained to his statement about the added cost involved in producing defatted flour from this source. The increased cost is largely attributable to capital investment required for extraction equipment, and the question is whether or not this investment might not be more than repaid in the long run by the value of the oil recovered.

Potatoes offer a particularly intriguing potential new source of protein concentrates and isolates. Development of such products from this crop, which yields more protein per acre per year than any other plant species so far domesticated, was discussed by Meuser of the Technische Universität Berlin. He called attention to the possibility of exploiting a by-product from the potato starch industry and at the same time helping to solve a pollution problem. Water from the first processing step in the manufacture of two million tons per year of potato starch contains 100,000 tons of protein. If diverted before further dilution in subsequent processing steps, this solution can be treated by direct steam injection to coagulate half of the dissolved protein. The resulting precipitate contains 80-85% protein, which is 8% lysine and 2.6% methionine. Dr. Meuser passed around samples of this "concentrate" and a 95% potato protein isolate prepared from it in his laboratory. Among problems to be overcome are pronounced "cooked-potato" flavor and odor notes and "horny" protein particles that cause a sandy mouthfeel.

The third paper in this Round Table Discussion dealt with field peas and broad beans. Apropos of the feasibility of the latter source, attention was called to the relevance of information about favism given by Dr. Liener in Plenary Session H. *Vicia faba* proponents emphasized that susceptibility to this malady is very limited. Cited as an example was the fact that canned broad beans have been marketed for several years in Canada, and only seven confirmed cases of favism have been documented there.

Table III of Dr. Betschart's paper shows projected cost-to-make data for safflower protein isolates lower than those for soy protein isolates. In her oral presentation, she emphasized that her cost estimates were tentative and approximate. She concluded with the observation-referred to be several later discussants-that acceptance of any new oilseed protein depends on social and political as well as nutritional factors.

The value of by-product oil is apt to be a major factor in the future of *Lupine* proteins for human consumption. Similarly, effectiveness and economic feasibility of removing polyphenolic constituents will be critical in the case of grapeseed. Good agronomic aspects and a protein content with amino acid spectrum complementary to that of soy protein are strong points favoring sesame as a potential new protein source.

A series of papers on leaf proteins was initiated by an overview prepared by N.W. Pirie of the University of Reading and read by Dr. Lusas. This paper contains a statement to the effect that there is little prospect of popularizing a leaf protein in a particular community unless the people there already eat the plant in question as a leafy vegetable. The discussion group did not feel as strongly as Dr. Pirie about this.

All three originally scheduled papers on leaf protein reflected general optimism about their future. At Chairman Lusas' request, Kinsella of Cornell University (first speaker in Plenary Session D) made some impromptu remarks to put this optimism in perspective. Afterwards he submitted the accompanying printed statement. In his oral remarks he made the following points:

1. The often quoted 2000 kg/Ha leaf protein yield is really at the high end of the reasonably expectable range.
2. As a family of products, crude leaf proteins are highly variable in their functional and nutritional properties.
3. Presence of polyunsaturated lipids leads to oxidation which results in poor flavor quality and may cause destruction of limiting amino acids.
4. Diverse antinutritional factors of plant origin must be eliminated. For example, residues of the chlorophyll may make animals consuming the leaf protein products photosensitive. (Studies on this by New Zealand workers were cited.)
5. Functional properties are diappointing from an industry point of view. Under current processing technology, it is not yet possible to produce a leaf protein product with predictable functional properties over the range of conditions required in food systems.

On the encouraging side, Dr. Kinsella said the Proxan process developed at USDA's Western Regional Research Center (WRRC) does overcome many of the above difficulties and gives a product of good nutritional quality (but in overall yields of only about 2%). He also called attention to promising characteristics of tobacco leaf protein established by work of Wildman at the University of California (Berkeley). Fifty percent of tobacco leaf protein is soluble and easily extractable by simply macerating the leaves in phosphate buffer. Heating the extract for 10 minutes coagulates chlorophastic proteins. Chromatography of the remaining solution on Sephadex G-25 gives a high M.W. (~ 500,000 daltons) fraction that readily crystallizes. Amounting to about half of the total protein in the original extract, this turns out to be the enzyme ribulose diphosphate carboxylase. It is homogeneous, free of prosthetic groups and lipids, and has a good amino acid balance.

In further discussion from the floor, attention was called to the availability of processing cost estimates for leaf protein products in publications from WRRC and the University of Reading. Also, industrial quantities of leaf proteins are being produced using the Alfa-Laval process and several others.