

## THE INFLUENCE OF RAW MATERIALS ON CHEMURGY OF FATS

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According to the definition which we can find in the chemical encyclopedia the Chemurgy is the linking of agricultural, scientific, and industrial efforts to improve active cooperation between these branches of a nation's economy for their mutual benefit. The chief objectives of Farm Chemurgy can be listed under four heads: 1) new, nonfood uses for farm crops, their residues and byproducts; 2) new and profitable uses for previously unused plant materials; 3) new crops that farmers may grow profitably; 4) more valuable uses for presently used crops through chemurgic upgrading.

Oilseeds are good new chemurgic crops for several reasons. Local production of oils having the various desired characteristics would make the country self sufficient in times of emergency. The meal left after removal of the oils is usually rich in proteins. Such meals, except a few such as castor and tung which contain toxic substances, are good protein supplements for animal feed. The proteins are also used in the making of plastics and adhesive and in some cases vegetable protein fibers.

The introduction of the soybean into U.S. and its development into a major crop is one of the triumphs of chemurgy.

The technology of fats comprises unit operations and chemical, physicochemical and biochemical processes. These processes and operations occur in various combinations in the subsequent stages of extraction and fat refining. Some of these stages have the distinct character of chemical technology, they are employed either in the refining of fats or as a form of further transformations.

The chemurgy of fats to which the present Symposium is devoted will include the following variants:

- a) utilization of oil and extracted meals for chemical processing,

b) chemical processing of the oils in order to improve their quality or to extend their utility value,

c) utilization of crops which though not raw-materials for edible oil, they still fitted for use as animal feed after the extraction of oils,

c) development of cultivation of crops which as yet have not been widespread but which may bring economic benefits.

The characteristic feature of the chemurgy is, above all, the chemical processing of oils that are used in the technology in a fairly wide range. So, the most conspicuous are the following process: hardening of fats, then interesterification, later utilization of fatty acids, oxidation and ozonolysis as technological process.

This rather uncommon name "chemurgy", defining concisely and confining it to the field of interest of oil technologists comprises the chemical processes employed for the refining of oils of natural origin with the objective to utilize them as food and for technical purposes.

The chemurgy of fats with a chemical composition which allows for their use as food, can arouse some doubts if world economy is taken as a whole. Since, neglecting the branches of chemurgy which are concerned with the adaptation of raw-materials from the oil industry for consumption, its other forms leading to products of chemical processing. Though, considering the processes of chemurgy leading to non-food products on the scale, of an individual country and, above all, concentrating on its economy, the chemurgy allows for development of the chemical industry and a reduction of imports, or for the export of highly processed products demanded on a given market or foreign currency gained or saved on these operations. Therefore, as long as all the countries are guided by the individual interest of their population and as long as there is no common world economy, chemurgy has a marked significance as it allows for the employment of our own workers and brings considerable economical advantages.

But even from the purely nutritional point of view, chemurgy affords the possibilities of approaching the desired standard based on the physiological requirements. Rapeseed oil may be taken as a typical example. The countries where this crop is widespread may have an excess of this oil over their needs imposed by the normal nutrition of the population. However, by the processing of this oil for nonedible uses, e.g. the production of fatty acids with middle-length chains or their derivatives by the ozonolysis of erucic and eicosenic acids and then the export of these products allows for the importation from abroad of other edible oils demanded by the population, such as soybean, peanut and sunflower oils. In these cases chemurgy virtually contradictory to

the utilization of agricultural crops as food, might be a very useful solution in a confined area.

Another property of products obtained by means of chemurgy is the increase of the lifetime of final products which for various reasons, is a very favourable economical phenomenon. For example, the hydrogenation as well as the oxidation or the production of derivatives of fatty acids, give products with a considerably prolonged lifetime which do not undergo changes due to external influences under the normal conditions of storage.

Having in mind the significance of the chemurgy of fats and a fact that a symposium of this type has not been held as yet, we have attempted to formulate, in this way, the subject matter of the present meeting. We feel, that this first attempt will not bring some general results, as the insight into the papers submitted on three last congresses of International Society for Fat Research held in Chicago, Göteborg and Milano indicates that contrary to purely chemical, biochemical and physiological subject matter — the problems connected with chemurgy were represented by a very inconspicuous number of papers. This phenomenon is easy to account for as the information on the subject of technological methods leading to improved fat refining or to the production of new non-edible products is, in general not published for the reason of industrial secrecy. Besides, these subjects are being worked out mainly in the industrial institutes of private ownership, while the problems of the sphere of basic researches are being studied at universities or state laboratories. However, it seems that not all has to be kept secret as some technological methods already employed on a large scale are known in many countries, and only due to the lack of books and even papers in scientific periodicals, they are not suitably systematized. The hydrogenation of fats and some methods of interesterification are typical examples of this situation. The organization of this Symposium, perhaps would allow for the development of an information pool on an international scale which can effect the modernization of technology in individual countries.

The classical technology of oils is based on raw-materials of natural origin which must have properties depending on atmospheric conditions prevailing during growth, on soil conditions, on agrotechnics, on the method of harvesting, transport and storage. All these factors cannot be strictly standardized and as a result they lead to raw-materials of differing chemical compositions. This is the reason for the necessity for wide-range regulation of process parameters in the continuous systems of technological methods. The situation is still more complicated if, apart from the variation of equality, there are changes in a type of raw-ma-

terial which may be caused by political problems or by price fluctuations on the world market. It may be due also the bad crops of these oilseeds in a given country or to a change in the pattern of own crops brought about by economic considerations. This variation in raw materials results in the necessity for a still wider range of parameter regulation in technological processes.

A selection of conditions during the hydrogenation of oils is the typical example of difficulties caused by such a variation. Therefore, a definition of the correlation between parameters of technological processes and the type of raw-material used and its purity has a grave industrial significance.

The chemical processes which are characteristic for chemiurgy demand the defined purity of substrates contrary to their less distinct influence in the unit processes such as extraction or deodorization where chemical reactions do not play such a fundamental role.

The latest studies have shown that the contamination by phosphorus of phospholipids or by sulphur of sulphur glycosides present in the rapeseed oil, may cause profound changes during the hydrogenation even at the level of 0,001 per cent. So, the correlation between the purity of oil and the progress of a chemical reaction is considerably greater in this case, than during the stages based on the unit processes.

In the programme of the present symposium we have planned to divide the papers into four major subject groups: hydrogenation, interesterification, oxidation and ozonolysis, derivatives of fatty acids. Perhaps, this division, not based on any previous experiences would demand some correction. It is indicated by the ratio of the submitted papers:

- hydrogenation,
- interesterification,
- oxidation and ozonolysis,
- derivatives of fatty acids.

This ratio indicates the main trends of scientific interests, of course only those, that have been revealed. Still we would hope that this Symposium will stimulate research centres to develop their studies in the directions which till now have not aroused greater interest, and on the other hand I hope that it will be a stimulus towards an increase in the number of publications.

A detailed introduction to the debates of every subject group, is included in the plenary lectures delivered by the invited outstanding representatives of European Science in this respective fields. Hereby, I would like to express my sincere thanks to professor Naudet of France, to professor. Reinheckel of GDR, to dr Gander of (GFR) and doc.

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Drozdowski of Poland, for taking it upon themselves to elaborate these reports which are not easy and so valuable for us.

All the plenary reports and papers will be published in extenso in a special volume in the English language which will appear in the editions of Polish Academy of Science. I hope that the high of lectures, papers and discussions will be a stimulus to organize further meetings on the same subject matter in other countries in future.