

Candles. Stearic and hydrogenated fatty acids are used with paraffin wax in candle manufacture to impart whiteness and rigidity.

Paper and Paper Products. The principal fatty acid used is stearic acid in coatings. In addition, oleic acid finds use as a defoamer in paper manufacture.

Inks and Crayons. An example of the use of a fatty acid as a solvent is the application of oleic acid with Victoria Blue B Base, a dye employed in inks for carbon paper, typewriter ribbons, and similar products. In crayons and lead pencils stearic acid functions as a wax and lubricant.

Ore Flotation. The principal products used in this industry are tall oil, fatty amine salts, and oleic acid. Among the many minerals treated with these reagents are phosphates, fluorspar, feldspar, and limestone.

Metallic Soaps. Manufacture of metallic soaps accounts for a substantial consumption of fatty acids. End-products in this group are used in a great many of the finished materials produced by other industries indicated in this discussion. Among the more common are aluminum, calcium, zinc, barium, and iron stearate, lithium 12-hydroxystearate, copper oleate and linoleate, and cobalt, calcium, and manganese linoleates. These products find use in lubricating greases, waterproofing compounds, cosmetics, flattening agents, paint driers, and mildew proofing compounds.

Napalm used by our Armed Forces as a gelling agent for gasoline contains the aluminum soaps of oleic and coconut fatty acid. A similar product developed during the past few years is used in the Hydrafac process, which takes advantage of the gel-forming properties of aluminum fatty acid soaps in reviving the flow of spent oil wells.

Food Products. Certainly one of the most interesting fields involving stearic, oleic, and palmitic acids is the use of monoglycerides and ethylene oxide condensates as bread fresheners, anti-spattering agents for cooking fats, and food emulsifiers. Much publicity has been given these products in recent years in connection with studies by many organizations on chemicals in foods so their composition and use are well known.

Earlier in this discussion I mentioned that there are few fields of manufacture or technology today which do not use fatty acids or their derivatives in some form or other. I trust now you can see the truth of this statement.

The multitude of new types of fatty acids and derivatives which research has developed for specific industrial uses during the past few years is phenomenal. This work still continues at such a rapid pace that the next decade will undoubtedly see many new products commercially available which at present have not even reached the test tube stage.

Evaluation at the Consumer Level

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CONSIDERATION of Consumers' Research should probably begin with a brief outline of its background and origins. It was the outgrowth of public response to a book entitled "Your Money's Worth" written by Stuart Chase and myself. Published in 1927, this book had the distinction of being the first of several best-sellers in the field of consumer problems that reflected the information and point of view of Consumers' Research. It was a pioneering book in the sense that it discussed by brand name a considerable number of well-known, widely-advertised products and freely mentioned their unfavorable as well as favorable aspects, a practice which had hitherto been taboo in books for the general reader. It still is taboo in proceedings of nearly all professional and technical societies.



F. J. Schlink

Perhaps I should qualify the term "pioneering" a bit because much information having to do with patent medicines came from a remarkable group of books and pamphlets issued by the American Medical Association for the information of physicians. These were the work of the director of the A.M.A.'s Bureau of Investigation, the late Dr. Arthur J. Cramp, who set

an example of courage, initiative, and public service which has never been equalled in American professional societies. (Others who in earlier years had made great contributions to exposure of frauds in misrepresented foods or patent medicine were Samuel Hopkins Adams with his series of "muckraking" articles in popular magazines, Mark Sullivan, and Dr. Harvey Wiley, physician, chemist, and first head of the Federal Food and Drug Administration. The pioneer in state activity in exposure of adulteration of foods, drugs, and other consumer products and in the protection of the consumer through specifications and standards was Prof. E. F. Ladd of North Dakota. His successors have been Culver S. Ladd and R. O. Baird.)

"Your Money's Worth" served to whet the appetite of its readers for more information on specific products, and the demands were so insistent that in a little more than a year's time Consumers' Research was set up to obtain information to handle these requests. In the beginning it had a small subsidy from a philanthropist and functioned largely as a clearing-house for information obtained from professional societies such as the A.M.A., American Dental Association, a few of the more active state departments of health, certain state experiment stations (such as North Dakota and Connecticut) and other governmental departments which carried out research or tests of one sort or another, college professors and graduate students carrying out research or investigations with a bearing on consumers' problems, and college and municipal purchasing departments.

Contacts were made with commercial laboratories and college teachers and research men to carry on test-

ing programs on a fee basis. As these sources became insufficient to meet the needs of our readers, a development which happened early in the history of Consumers' Research, we began to establish our own laboratory and testing and measuring devices. Brands for test are selected on the basis of wide distribution and popularity. They are rated as A. Recommended, B. Intermediate, and C. Not Recommended. The price rating is entirely separate from and independent of the quality rating.

THE work of Consumers' Research of particular interest to oil chemists is that dealing with soaps and other detergents. On food materials, including cooking fats and oils, we have done little work in recent years, chiefly because knowledge of the products from nutritional research, the aspect in which the consumer is chiefly interested, has not yet developed to a point where it can give really dependable answers about the relative values of a great many manufactured food products and their countless variations and combinations. Besides, nutritional studies are time-consuming and costly, and the information from animal experiments, for example, is small in comparison to the time, personnel, and funds expended. Unfortunately in too many cases the information developed is of an inconclusive character or points the way to further work rather than to a decision about the immediate subject under investigation.

Consumers' customs, habits, and preferences play the predominant role in food choice for most people, and they are less interested in the laboratory findings or their interpretation on mayonnaise, brands of cake-mix, or pie filling than in the flavor. Few consumers have become aware of the fact that modern developments in the food industry have made flavor a relatively unreliable criterion of the quality and wholesomeness of the ingredients. Recent illustrations of this have been reflected in the decisions of the Food and Drug Administration, after a long period of controversy, to bar the use of flour which has been treated with nitrogen trichloride as a bleach or "improver" on the basis of reports from English sources as to its toxicity and to prohibit further use of a family of chemical compounds (certain esters of fatty acids) which have been used as "bread softeners" to make bread seem fresh longer.

THERE is a lively interest in soaps and household detergents on the part of consumers, and in this field we have a substantial amount of work done for us by consultants. Detergents such as toilet soaps, laundry soaps, shaving creams, and bar soaps are, as a rule, evaluated on the basis of applicable Federal and A.S.T.M. Specifications. Synthetic detergents have been reported to our readers on the basis of chemical analyses, and washing tests made on a number of different kinds of artificially soiled cloth in both soft and hard water. In evaluating synthetic detergents used for laundering, we take into consideration not only soil removal but redeposition of soil on clean white cotton cloth. This method for detergency evaluation is one developed and used by Foster D. Snell Inc.

Detergents used in dishwashing have been rated by the use of a wicking material of glass fibers soiled with grease and protein-carbohydrate mixtures; the wicking was subjected to standard agitation in a laundry detergency testing device in accordance with the

method developed by the York Research Corporation in Stamford, Conn. Some detergents used in dishwashing by machine have been compared in a laboratory model dishwasher in which the detergent solution was sprayed on the dishes soiled in a standard manner through the spray head of a clothes washing machine, the design of which happened to be especially adapted for the purpose. Detergents for use in hand dishwashing were tested by a method using soiled glass slides, which were thereafter examined through use of a Hunter Reflectometer. These last two types of test methods were used by the Foster D. Snell laboratories.

I should perhaps mention that on matters affecting soaps and detergents Consumers' Research supplies its readers with information which is often well-known to the industry and to a few investigators but is beyond the knowledge of even well-informed ultimate consumers. In the case of toilet soaps, for example, we mention the disadvantage of a high content of coconut oil. We tell our readers about certain disadvantages of laundry soaps that contain a high percentage of rosin. The possible effects of synthetic detergents on the biological processes in septic tanks is a problem which has troubled a good many people living in rural and suburban areas. We have been able to inform our readers that the likelihood of harm is a relatively small one when the septic tank is of adequate size.

Sometimes questions involving detergents come up in connection with the testing of appliances in which detergents are used. For instance, some years ago after a brief investigation of this problem we mentioned the corrosive damage occasioned by some synthetic detergents on the metal surfaces of home washing machines. In connection with domestic dishwashing machines, information has come to Consumers' Research which indicates that detergents may be to some extent responsible for the brown stain that has been noticed on silverware cleaned in dishwashers. One interesting development from our work on washers is a method which, it appears, will permit critical comparison of different washing machines by distinguishing the effectiveness of a washing machine as a clothes-and-water agitating device from the cleansing effect of any particular detergent that may be used in the washing process.

Sometimes consumers are interested in knowing what is in a particular product used in cleaning operations in the home. We regularly publish brief statements of analyses of a wide range of household cleansers containing soaps, synthetic detergents, and alkaline salts. Scouring powders, on the other hand, are studied rather from the standpoint of physical characteristics. They are examined by a well-qualified petrologist especially to determine the nature and characteristics of the abrasive present and its likelihood of harming the finish of sinks, bathtubs, stoves, and refrigerators. Other products which use detergent materials which are analyzed or tested are polishes for silver and other metals, and rug cleaners.

We should be happy to work with a set of specifications and standards that might be evolved for evaluating these products from the consumers' point of view. In fields where standards and specifications do not exist, we use such criteria as we are able to set up ourselves. In many fields Consumers' Research has been the first to lay down guiding principles respecting the properties which goods and appliances should have to serve consumers efficiently. There are many items for

which no specifications or standards exist that have been developed by a public or unbiased body. This does not mean that governmental specifications are necessarily the ones which should be used to protect the consumers' interest for in many cases the government specifications are as unsuitable as those developed by industry or a trade association in which industrial groups exercise control.

It is to be hoped that manufacturers may shortly come to conclusions about nomenclature and labelling of detergent products so that consumers can tell whether the particular material is a soap or soap substitute, whether it is designed to be used on dishes, floors, and clothes, or for all household purposes. If, for example, a detergent is safe for use on painted walls, its label should so indicate in unequivocal terms, and the essential caution or special directions should be included. If it is not safe for fine fabrics or for silk or wool, the label should supply that information too and state clearly to what types of washing it may be applied safely and economically.

The label should also describe in reasonable detail the chemical nature of the product so that if the housewife finds a particular kind unsatisfactory for her purpose—harsh, say, on her hands or nails—she will not have to go through the process of discovering by trial and error that another product with a different name has the same undesirable property. Medical men in particular complain about the difficulty of getting information on the composition of various household materials for they often have the problem of dealing quickly with ill health or a skin lesion caused by a substance, the composition of which may be wholly unknown to them.

THROUGH careful study of the data available from scores of chemical laboratories we have succeeded in arranging connections with perhaps seven or eight analytical laboratories whose work is careful and responsible. Some of these laboratories specialize in detergents and cosmetics; others in solvents or petroleum products; still others in determination of contaminating substances in foods in micro amounts. One laboratory chiefly active in food and drug analysis and

assays was recently engaged for a series of food analyses and for a literature search in a highly specialized field connected with food chemistry.

One of the most important aspects of the work of Consumers' Research is its broad use in educational fields, such as high schools and colleges. Its bulletins and other published material are used for various courses, such as economics of consumption, general economics, consumer education, marketing, and the like. There are now in existence at least a hundred theses, books, and articles written on problems of testing and rating of products from the consumers' standpoint. Consumers' Research has prepared a special bulletin of 38 pages entitled "Consumers' Test Manual," which includes a wide range of chemical tests that can be carried out by teachers and students to detect contaminating and preservative substances in foods, and metals and other contaminants in drinking water. There are also a few simple chemical test methods applying to soap and certain other cleaning agents.

The effect of Consumers' Research upon the goods available in the market is significant. Most of the distinctly fraudulent products—and there are a good many of these—have a much shorter run than in previous years because there are now many persons who are aware of the fields in which falsification or misleading use of scientific tests as a sales technique will commonly occur. A surprising number of manufacturers have written to Consumers' Research and conceded that the defects which we had reported in their products were actually present and that the findings had been valuable to them in pointing out deficiencies of which they had not been conscious.

There are few fields of manufacture which fully protect the consumers, but the need for modification of practices is much less in industries where there has been an extensive development of technical and scientific studies and of standard tests and specifications. In a very real way the engineer, chemist, and scientist are the defenders of the public interest, even at times when they are not aware of the relationship of what they are doing to the protection of consumers, for the effects of scientific and technical activity spread wide like the ripples cast in the water of a pond by a stone.

Soap by Saponification

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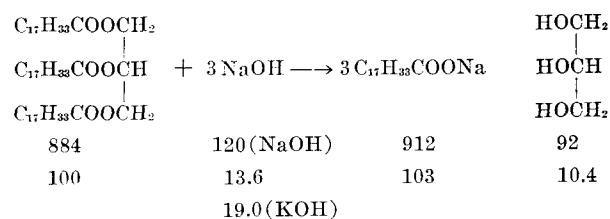
SOAP raw materials and their processing have already been treated. It remains to show how these materials are converted into finished soaps in various forms and, in particular, how fats and oils are converted into soaps. In brief, we will deal first with some fundamentals of the reaction; secondly with a typical kettle saponification, and thirdly with other methods of saponification.

Fundamentals

Natural oils and fats are triglycerides which react with an alkali to yield glycerine and salts of the fatty acids which may contain similar or different long chain alkyl groups.

Considering the case where the three alkyl groups are similar and equal to $C_{17}H_{33}$, the fat molecule be-

comes triolein and three molecules of sodium oleate soap are formed.



Mathematically 884 pounds of such triolein will react with 120 pounds of anhydrous caustic soda to yield 912 pounds of anhydrous soap and 92 pounds of glycerine. For each 100 pounds of fat there is used 13.6 pounds of alkali to produce 103 pounds of soap and