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The L.J. Minor Foodservice Standards Series

Standards for Fats & Oils

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Standards for Fats & Oils

To all who are involved or plan to be involved in the vast and complex foodservice industry, and who strive to achieve high quality foodservice standards

Preface

This book was written as a basic reference textbook for students in the schools of hotel, restaurant, and institutional management. It is also designed to be a reference and further study guide for cooks, chefs, dietitians, and foodservice management personnel who are already employed in this important industry.

There are many texts available that thoroughly cover, in great depth, the chemistry and technical aspects of fats and oils. However, the author is not aware of any text devoted exclusively to fats and oils for foodservice. Therefore, this book is designed to provide just enough technical background to allow an understanding of how and why certain types of fats and oils work for specific uses in foodservice. This leads to practical applications and standards for the various types of products available for such uses as deep frying, griddling, pan frying, salad dressing, and baking. Tested quantity recipes are included as a further guide to product usage and menu expansion.

This book is divided into three parts. The first part deals with the chemistry and general technical background for fats and oils. Part II covers the major practical applications in foodservice, along with recipes. In Part III, nutrition, dietary considerations, product and recipe development techniques, and sanitary and quality control procedures are considered.

Fats and oils play a very important role in all foodservice operations. This book will provide the information necessary for a good understanding of these products and how they should be used.

I gratefully acknowledge my many friends at Procter & Gamble who provided material; Marge Bomkamp who typed the original manuscript; my devoted wife Betty who provided artwork, proofread copy, and especially provided moral support; and to the others in my family: Ralph, Janie, Robyn, Jan, Sally, and Ken.

Harry W. Lawson

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Part One

FAT AND OIL TECHNOLOGY

1 Definitions and Overview

This book is a study of fats and oils, with special emphasis on their use in the foodservice industry. In order to set meaningful standards for these products, it is necessary to have a good understanding of fats and oils and how they should be used.

Fats and oils constitute one of the three major categories of food products. The other two are proteins and carbohydrates. Fats and oils are essential nutrients of the human diet and are concentrated sources of energy. They supply about 9 kcal/g, as compared with about 4 kcal/g from protein and carbohydrates.

In any study of human nutritional requirements, the contribution of each of these major food categories must be understood in order to set up dietary standards for individuals. Knowledge of vitamins and minerals as well as the function of oxygen, water, fiber, and trace elements is also essential.

Fats and oils occur naturally in many of our foods, such as dairy products, meats, poultry, nuts, fish, and vegetable seeds. In the foodservice industry, fats are very important in the processing of many of the "eating out" favorites. Examples include french fried potatoes, grilled and pan-fried eggs, salad dressings, an infinite variety of breads and rolls, and dessert items.

Manufactured foods such as dairy products, margarine, snacks, prefried poultry, fish and meat, peanut butter, and crackers contain significant quantities of fats and oils. Many of these and other foods are important to various segments of the foodservice industry.

All fats and oils are predominantly tri–fatty acid esters of glycerol, commonly

referred to as triglycerides. The term "lipids" is more all-inclusive and includes triglycerides, sterols (including cholesterol), phosphatides, mono- and diglycerides, free fatty acids, fatty alcohols, waxes, terpenes, fat-soluble vitamins, and others.

This book is confined to the study of food fats and oils. Inedible products include some types of waxes, tallows used in soapmaking, drying oils for paints, and lubricating oils.

Fats and oils are basically insoluble in water but soluble in most organic solvents, such as carbon tetrachloride, petroleum ether, and ethyl ether.

The term "fat" generally refers to substances appearing to be solid or semisolid at normal room temperature (70°–75°F; 21.1°–23.9°C). "Oils" are liquid at or below these temperatures. However, these terms are used interchangeably. Examples of fats include vegetable shortenings, butter, margarine, and lard. An example of an oil is cottonseed, soybean, sunflower, or corn oil.

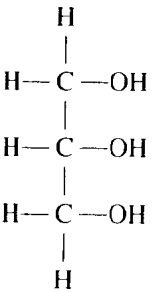
Food fats can also be divided by their origin, either plant or animal. Typical examples of plant derivatives include soybean, cottonseed, sunflower, and safflower oils, whereas fats of animal origin include lard and butterfat.

Fats and oils provide about 43% of the caloric needs of people in the United States. This is another important reason to have a good understanding of these products as they relate to the foodservice industry.

The Basic Chemical Structure of Fats and Oils

The carbon atom is the basic element in food chemistry, including fats and oils. Carbon atoms, with a valence of four, tend to bond together with other carbon atoms to form molecules with long chains. Furthermore, carbon's ability to form bonds or react with other elements such as hydrogen, oxygen, iodine, nitrogen, and phosphorus is fundamental to understanding the chemistry of fats and oils.

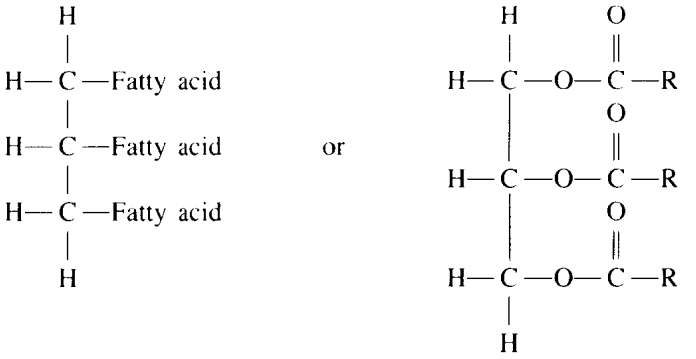
Basically, fats and oils may be considered as mixtures of triglycerides. This is the manner in which they are composed naturally.



Glycerol

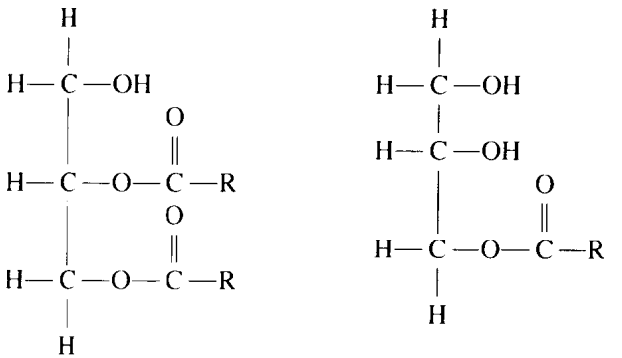
The glycerol molecule has three carbon atoms, together with five hydrogen atoms and three OH^- or hydroxyl groups. It should be noted that there are four

bonds or linkages to each of the three carbon atoms. When three fatty acids are combined with one glycerin molecule, we have a triglyceride.



Triglyceride

"R" is the chemist's method of abbreviating portions of long-chain molecules such as those of fatty acids. If only two fatty acids are attached to a specific glycerin molecule, we have a diglyceride; if only one fatty acid is attached, the molecule is a monoglyceride. Each carbon atom continues to have four linkages.



Diglyceride Monoglyceride

Any fatty acid not linked to a glycerol molecule in a fat or oil is referred to as a "free fatty acid." The major component of all fats is made up of triglycerides, which represent over 95% of the weight of most food fats in the form in which they are consumed.

Some unrefined oils contain high levels of free fatty acids. A typical level for crude soybean oil is from ½ to 1½%. Crude palm oil may contain 3–5% free

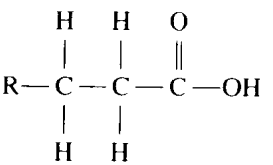
fatty acids. Refined fats and oils that are ready for use in foods usually have a free fatty acid level of less than 0.05%.

Some of the more common fatty acids found in naturally occurring fats and oils are butyric, lauric, palmitic, oleic, stearic, and linoleic. A 1-lb can of shortening, for example, contains millions of fat molecules consisting of mixtures of the various fatty acids attached to the glycerol molecules. The relative number of these various fatty acids and their particular placement on the glycerol molecules determine the various characteristics of the fat product. The processing techniques employed also affect a product's physical and performance characteristics. All fats and oils are built from a relatively small number of fatty acids.

Some fats are solid at room temperature, while others are liquid. Those that are liquid at room temperature are called oils or fluid fats. These liquid oils/shortenings are sometimes referred to as "unsaturated" fats. This does not mean that all of the fatty acids in that particular product are unsaturated, but merely that there is generally a high proportion of unsaturated fatty acids, which render this specific product liquid. For example, soybean oil has a preponderance of unsaturated fatty acids, making it a liquid, whereas lard has a greater proportion of saturated fatty acids, making lard a solid fat at room temperature. Coconut oil is a somewhat special case in that it is liquid to just about 78°F (28°C) in spite of the fact that it contains 85–95% saturated fatty acids.

Chain length, or the number of carbon atoms in a fatty acid, also has a great influence on whether a fat is solid or liquid. Most fatty acids have from 4 to 22 carbon atoms, primarily in even numbers. The products containing high proportions of the longer-chain fatty acids (14–22 carbon atoms) are more likely to be solid at room temperature, whereas those containing more of the shorter-chain fatty acids (4–12 carbon atoms) are more likely to be liquid. Coconut oil is very high in lauric acid, which contains 12 carbon atoms, and about 60–65% of the fatty acids are of 14 carbon atoms or less. This is the reason for its liquidity at relatively low temperatures. Therefore, the most important factors that render a product solid or liquid are the average fatty acid chain length and the amount of saturated in relation to unsaturated fatty acids.

The processing techniques employed and the ultimate crystal structure of the product also have an effect on the product's final form. This will be discussed in Chapter 6.



Saturated Fatty Acid