Utilization of Lecithin

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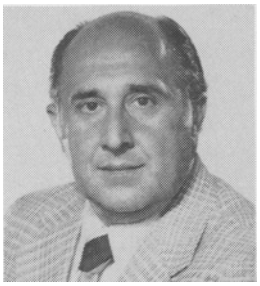

ABSTRACT

Lecithins are used in small amounts in many industrial, food, and cosmetic products. Various lecithin products and applications are discussed.

The paper by W. van Nieuwenhuyzen on the production and properties of lecithin serves as an excellent basis for this paper, in which we will discuss the use of lecithin and the proper selection of a lecithin to meet specific requirements for flavor, color, and performance. In addition to the normally accepted uses, there are some special applications for this unique and versatile product. Lecithin has synergistic properties and therefore, in some formulations where lecithins had not been considered to be completely functional, one can obtain excellent results by using a mixture of lecithin and other ingredients. The term "lecithin" as used in the trade refers to the ordinary commercial lecithin which is a mixture of phospholipids with a carrier of about 1/3 vegetable oil. The phospholipids are roughly equal amounts of phosphatidyl choline (which is usually referred to as pure lecithin), phosphatidyl ethanolamine (which among chemists is more commonly known as cephalin), and also inositol phosphatides plus minor amounts of plant sugars and sterol glycosides.

In most formulations, the amount of lecithin actually used is 0.1–0.3%. This is low in relation to other components. While normal fluid grade soybean lecithin does have a definite flavor which can vary according to the care taken in the lecithin production process, the amount used is so low that one would not normally detect its presence. Some researchers believe the original or normal flavor of the fluid lecithin will carry over into their product and, therefore, they do not think it is worthwhile to test or try lecithin in some formulations. It is difficult to establish a standard method for measuring taste acceptability since this will be a matter of personnel preference. For very bland products, the lecithin should be selected with care, as, for example, a specially refined or fractionated grade.

If the finished product is to be subjected to high temperatures for a prolonged time, one would normally investigate the heat stability of all the ingredients. Carbohydrate material in the lecithin may tend to caramelize, resulting in an increase in flavor and an effect on color; however, we must again consider the quantity of lecithin in the formulation and the total effect of the other ingredients which have been subjected to the same conditions. In this regard, standard unbleached fluid lecithin, as well as special grades, is still being used in packaged pan release agents for consumer use as well as industrial release agents where the surface temperatures are relatively high and the lecithin film is extremely thin.

Lecithin is regularly used in bakery products including doughnuts which are normally fried in hot oil, and there is no development of an objectionable taste. Actually, lecithin will enhance the quality of baked goods by improving water absorption and the handling of the doughs, increasing volume, increasing shelf life, and improving uniformity of the product. These are only a few of the overall advantages that can be obtained by using lecithin in baked goods. In some formulations it is possible to reduce the quantity of fat or shortening without affecting product quality. When lecithin prices are low, one would naturally consider replacing some of the higher priced ingredients with lecithin. In many cases an additional amount of lecithin would have no adverse effects—actually, it will probably help—but there will be occasions when the additional lecithin can contribute to taste and even odor problems.

Unbleached fluid lecithin is perhaps the most widely used commercial grade and, therefore, researchers and those developing formulas have a tendency to make general statements about the flavor or taste and odor of lecithin. Furthermore, standard unbleached fluid grades have a dark brown color which does not permit high use levels in white or very light colored products; however, even in some of these formulations, brown unbleached fluid lecithin can be used effectively at low concentrations.

This brings us to another phase of lecithin selection, namely color. In some countries, bleached lecithin is not permitted; that is to say, the residue chemicals used in the bleaching process are prohibited. As these bleaching processes become more sophisticated and new bleaching methods are discovered, it is reasonable to assume that there will be available a light colored lecithin capable of meeting existing regulations. One bleaching procedure uses hydrogen peroxide in the presence of water; benezoyl peroxide has also been used for bleaching lecithin. The long chain fatty acid groups in the lecithin molecule which provide the hydrophobic properties of lecithin, as well as the phosphoric acid–choline complex which provides the hydrophilic property of lecithin, are not adversely affected by the bleaching process. Lecithin reduces the surface tension of an oil in contact with water, and the bleached lecithin can provide specific benefits in products requiring special emulsifying action. One example of this is either the dry or wet type whipped topping, such as a non-dairy whipped cream. In this application, a dark brown unbleached fluid lecithin would probably result in a slight color in the finished product, but the bleached lecithins would have no effect on the color. The degree of color stability required should also be considered, since it is possible to obtain both single and double bleached lecithin. For the present, single bleached lecithin may offer the best solution to the problems of maintaining good color while using a natural emulsifier and staying within the regulations regarding the use of bleached lecithin. Most lecithin suppliers have a color specification range for the various grades of lecithin and, with careful reselection, one can obtain exactly the right lecithin for the desired application. Purchases could be made on color specifications from selected lots. The difference in the cost of an unbleached versus a bleached lecithin would not normally be significant when considering overall formulation cost. Naturally, more of the lighter colored lecithin can be used and still remain within product color specification. If the emulsifying properties required are greater than can be obtained with reasonable lecithin levels, it may be possible to use any one of a number of special lecithin compounds which contain lecithin and a small quantity of synthetic emulsifer. In these cases, not only the economics but also the raw material supply must be considered.

While lecithin is generally accepted as a possible component in many prepared food products, the following information may provide additional areas for using lecithin:

1. Animal feed products such as calf milk replacers, as well as pet foods and many other types of feeds, require high

fat and oil contents. Assimilation of these fats and oils into the digestive system can be a problem and, in these cases, relatively high concentrations of lecithin can be used. In addition to providing excellent emulsifying properties at high fat concentrations, lecithin will increase the digestibility of fats, help to stabilize the finished product, and also provide antioxidant properties.

2. The use of lecithin in chocolate is well known and accepted, but there are other areas of confectionery products which effectively utilize lecithin with excellent benefits—these are the ice cream and chewing gum type products as well as the various pastes and fondants.
3. In hard candy, high sugar confection type products, lecithin in combination with other oils can serve as an excellent release agent on cold surfaces. Many producers of confections have felt that occasional sticking of these high sugar products to the cold surface could only be prevented by using frequent and heavy applications of standard release agents. They sometimes overlook the fact that lecithin will provide an effective thin layer surface with excellent releasing properties resulting in higher production and less cleaning time.
4. In the standard high salt content margarines, lecithin has excellent properties for reducing spatter, providing good emulsification, easier spreading, etc. A similar effect is obtained when lecithin is used in commercial shortenings. We will briefly comment later on a special lecithin for use in diet and low salt type margarines.
5. Lecithin can be used in the instant type products, including beverage powders, to improve their solubilization or dispersion.
6. Finally, we have flour treatments, where lecithin can serve as a means to condition the dough, increase water absorption, etc.

In these cases, normal unbleached fluid lecithin can be used but, actually, there are conditions where special grades or treated lecithins may be more effective at lower concentrations.

We would like to refer to those items in product lines which did not specify lecithin in the original formualtions. There have been many advances in lecithin technology and, if formulas include synthetic emulsifiers, it may be possible to use either a normal lecithin or one of the special grades which have been developed. If a flavor or color problem in an edible product can be definitely traced to the presence of lecithin, we suggest reexamining the various available lecithins before considering replacement of that lecithin with a synthetic emulsifier. The cost of using a higher quality or special lecithin mixture is insignificant in terms of total costs. In some cases it is simply a matter of using a lighter color lecithin which also has less flavor. Lecithin mixtures can provide exactly the same results and in many cases could also improve the overall product quality.

In today's health-oriented society, there is much emphasis placed on the dangers of high cholesterol diets. In this regard, it is interesting to know that lecithin can serve as a functional ingredient in cholesterol-free egg products. Similarly, in those commercial foods where active phosphatides or phospholipids are desired, it is possible to obtain special purified lecithin compounds to meet those requirements. For example, there is a special lecithin compound which can be used in conjunction with salad oils to supply increased levels of purified phosphatides in a convenient and acceptable form. In diet and low salt margarine formulations, there may be problems in maintaining good emulsion stability when using ordinary or regular grade lecithin; with a special purified grade, it is possible to produce not only a smooth and easily spreadable margarine but one which has a higher than normal phosphatide content. In the meat industry, lecithin can be used in the curing and treatment of bacon which is intended to be sliced and packaged for direct sale to the consumer. Lecithin can provide a better and easier separation of the refrigerated bacon slices while not affecting the taste or appearance of the bacon.

We have been discussing emulsification, dispersion, and other physical benefits from the use of lecithin. This naturally leads into the cosmetic area, where lecithin has a unique functional performance. Lecithin is an important part of all living cells. Some researchers have found that phospholipids are very important to the normal functioning of skin and therefore recommend that, in view of the excellent compatibility with the skin plus excellent penetration properties, there should be greater use of lecithin in cosmetic creams and lotions. Modified or special grades, as well as the natural lecithins, will provide excellent emulsifying, wetting, and dispersing action and also improve stability. In the case of modified grades, increased water solubility is obtained. Modifications such as hydrogenation, sulphonation, and ethoxylation can further improve the special properties of lecithin. Hydrated forms disperse readily in water, and special grades are available which will produce stable emulsions with water in acidic and also in alkaline media. In addition to lecithin's excellent emollient action which will soften the skin, lecithin improves the wetting properties of oils to help them spread more evenly on both skin and hair.

Lecithin's versatility provides for use of this special material in widely different applications, such as improving plasticity of industrial sealing compounds, in textile processing and dyeing operations, in the manufacture of paints and pigmented coatings, as well as in the production of plastic and rubber compounds, not the least of the special applications for lecithin is in the pharmaceutical product line, where highly purified grades are used in the manufacture of intravenous fat infusions.

This substance we call lecithin which is accepted for general applications is in reality a complex and useful ingredient. In the health food industry, lecithin is supplied as a finished product and is available in various forms. There are many ways to use this uniquely versatile material, and we trust that it may help solve some of the problems or challenges in current product lines or planning new products.