8     Emulsifiers in baking

B.S. KAMEL and J.G. PONTE JR

8.1 Introduction

The industrialization of the food processing industry, including baked goods, was
the result of consumers demanding high quality, convenience, longer shelf-life,
easier storage conditions and high appeal to sight, touch, taste and smell. Other
socioeconomic factors such as increased disposable income, need to save time and
effort, access to food stuff at any time and portionability have also been factors.
New trends such as more natural, healthier (saturated vs. unsaturated fats, animal
vs. vegetable fats, low cholesterol), more nutritious, environmentally friendly,
freshness, lower fat content, high fiber, reduced level of refined sugar, microwav-
able products, no bromate, clean label and low sodium are just examples of what
consumers are demanding. The healthy food market products in the US are worth
$30 billion and increasing by 6% annually; the reduced fat and caloric foods and
beverages represent 70% of this market (Osnabrugge, 1988). To meet the above
demands, the food product development and baking scientists and technologists
are forced to use functional food additives such as gums, modified starches, enzyme
and enzyme-treated protein, fat replacers, microglobular protein emulsifiers and
many others to achieve their goals. The consumption of food additives is forecast
to grow by 5.8% annually between 1988 and 1995; surfactants represent 16.6% of
the total food additive consumption in 1988. In the US the consumption of
surfactants was 103 million kg and expected to grow to 136 million kg (annual
growth rate of 4.9%).

The dollar value of food surfactants will be over $500 million between 1990
and 1995 for an annual increase of 2.3% (Anon, 1991).

Emulsifiers in foods can perform a variety of functions. The most important
involves the reduction of surface tension at oil – water interfaces, interactions with
starch and protein components and modification of the crystallization of fats and
oils (Table 8.1). Selection of a proper type of emulsifier for a given food product
is normally based on experience and experimental tests or by trial and error. In
baked product applications, surfactants exert a variety of specific functions. Other
effects can also be obtained; many of these may overlap in any given application.
It is essential that correct choice of surfactant type and dosage be made to ensure
optimum performance. The major functions of surfactants in food are listed below:

(a) Emulsifying and stabilization of a water in oil (w/o) such as margarine,
butter or cake, and oil in water (o/w) such as salad dressing and whipped toppings.

(b) Starch complexing (antistaling).

(c) Protein interaction.

(d) Viscosity modifiers.

(e) Foaming and aeration.

(f) Texture modification.

(g) Lubrication.

(h) Crystal modification.

(i) Wetting.

(j) Solubilizing.

(k) Demulsification.

(l) Palatability improvement.

(m) Suspensions.

(n) Dispersion.

Synthetic and natural surfactants have been increasingly used to improve the quality of yeast raised, chemically leavened and non-leavened baked goods. In these products emulsification is often of secondary importance but starch complexing, protein strengthening and aeration are of primary importance.

The precise definition for surfactants that impart softening or conditioning to the dough is not universally available in the baking industry but it is commonly implied that surfactants do aid in the development of less tacky, more extensible doughs which process through machinery without tearing or sticking, or which result in baked product of finer crumb structure and improved volume and symmetry.

The onset of firming of a loaf of bread, cake and other baked goods will occur several hours after baking and increase progressively with time. The effectiveness of a particular surfactant may not become apparent until the second or third day or even longer; these types of surfactants are referred to as softeners. The term softener has become generic for many surface active agents, although the term may be somewhat of a misnomer in that there exists a controversy as to whether the compounds actually soften bread or only retard the rate of crumb firming. Their function as crumb softening agents is closely related to their interaction or complex formation with starch, particularly the linear amylose fraction to retard bread staling. Surfactants may also slow the rate of bread firming by forming a complex with the amylopectin fraction within the starch granule.

Most baked products possessing a moist, spongy crumb are subject to a progressive deterioration in quality. As a general rule, the higher the practical moisture content of the fresh product, the more pronounced are the changes that occur upon staling. Products such as bread, yeast-raised sweet goods and cakes stale to a much greater extent than do products such as cookies and crackers. The losses attributable to bread staling are economically of great significance.

The term dough conditioner/strengtheners implies an action directly upon the