Functional Lecithin Powder
for Wafers

Introduction

In the automatic production of wafers quality depends to a large extent on the smoothness of the process. Even the most minor faults, especially soiling of the baking surfaces, can severely jeopardize economical production. Besides the proper choice of flour, starch, processing etc. then the right lecithin grade is particularly important. Lecithin is the only emulsifier that allows a positive interaction in the entire wafer making process.

Description of Wafer Making

Dough Formation
↓
Dispersion & Emulsification

Holding Pumping & Depositing
↓
Emulsification & Viscosity Control

Baking & Shaping
↓
Release form Irons

Cooling & Packing
↓
Breakage & Appearance

Benefits of Dry Lecithins

Compared to fluid lecithin it is generally recognized that spray dried lecithin offer the optimal performances:

- Free-flowing & simple to use
- High Emulsifying potential
- Rapid Solubility & Dispersibility
- Controls Flow properties of batter
- Reliable Release effect
- Reduces Soiling of baking line
- Improved "Runability"
- Even, golden browning
- Greater resistance to Breaking
- Compatible with all wafer types

Dry Lecithin	Type of Lecithin
LECIFLOW 60	Soya lecithin
STERNMULS M545	Soya lecithin
CENTROSOFT SM545	Sunflower lecithin
CENTROSOFT RM545	Rape seed lecithin

Is CENTROSOFT different to soya bean lecithin?

Research in our Application Centre has shown that CENTROSOFT is applicable in wafers previously using soya bean origin lecithin. Comparing oven runability, texture and taste during typical shelf life, CENTROSOFT performs completely equivalently to soya based lecithin.

Solae Europe, S.A. 2, Cheomin du Pavillon CH-1218 Le Grand SaconneX Switzerland	Solae, LLC P.O. BoX 88940 St. Louis, MO 63102 USA Tel +1 800 325 7108	www.solae.com

The Effects of Lecithins

The surfaces of wafer irons have hydrophilic rather than lipophilic properties (see figure 1). When the wafer batter comes into contact with the iron, the fat in the batter tends to withdraw into the centre of the dough layer. This means that fat alone would be unevenly dispersed and thus useless as a release agent. The hydrophilic head group of lecithin orientates towards the batter/air and batter/iron inter-phase. The lipophilic part of the bipolar lecithin molecule causes the fat to rise to the surface and stay there. Together with the lecithin it then acts as an effective release agent. The effect of lecithin is proportional to the content of phospholipids expressed as Acetone Insoluble AI. A fluid lecithin contains the legal minimum of 60 % AI. The spray dried LECIFLOW 60 contains 60 % fluid soya bean lecithin and thus 36 % AI (regarding labeling please see our Product Specification).

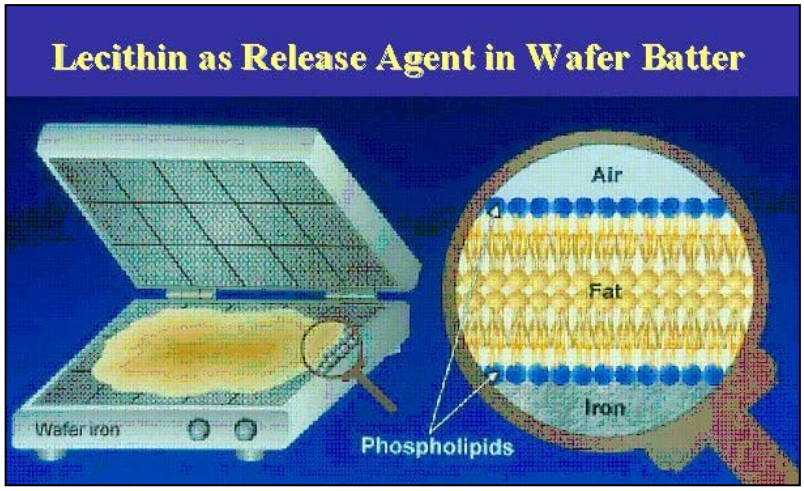

Figure 1 Lecithin as release agent in wafer batter

Lecithin ensures homogeneous and stable dispersion of the fat and other batter ingredients. The result is even browning without the typical spots (see figure 2).

Figure 2 Appearance of wafer cones

Continuous High Speed Wafer Production

There are different methods of forming the batter in the industry. Generally all dry ingredients are mixed into the water by the use of high speed mixers and then finally the melted fat or oil is mixed into the batter. Preferably the mixing time should be short in order not to change protein components of the wheat flour.

Figure 3 shows a simple case example of an industrial ice cream cone test and the dynamic interaction between oil-lecithin and processing.

Ingredients	**Quantity Kg**			
	Control	Test 1	Test 2	Test 3
Wheat flour (cake flour)	36	36	36	36
Coconut oil	2	1,6	1,6	2
Sugar	17	17	17	17
Salt	0,24	0,24	0,24	0,24
Water	42	42	42	42
STERNCITHIN F-10	1,1			
LECIFLOW 60		1,5	2	2
Appearance of cones	0	0	+	++
Structure of cones	0	-	0	+

Figure 3 Haas TRO-1220 approx. 10.000 cones/hr

Figure 4 and 5 shows a microscopic picture of the very same area of a typical batter. By far the majority of particles are starch granules that display their characteristic centre crosses in the polarised light. However, the “particle” of the size 30,18 micron to the left show up again as a “black whole” to the right measuring 31,38 micron in this exposure. Logically, this is an emulsified oil droplet which should preferable be kept small and evenly distributed in order to safeguard release and homogeneity of wafer surface and structure. Lecithins help to control the size of the oil droplets.

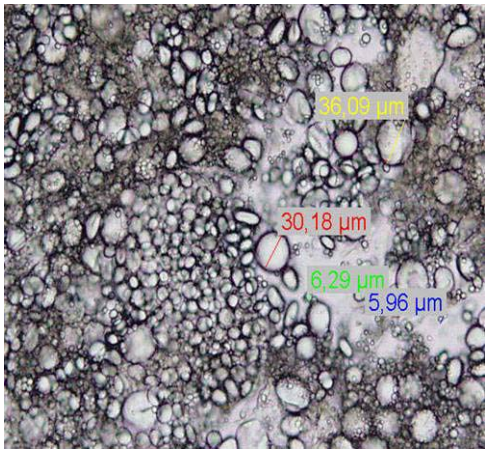

Figure 4 Dough batter in normal light

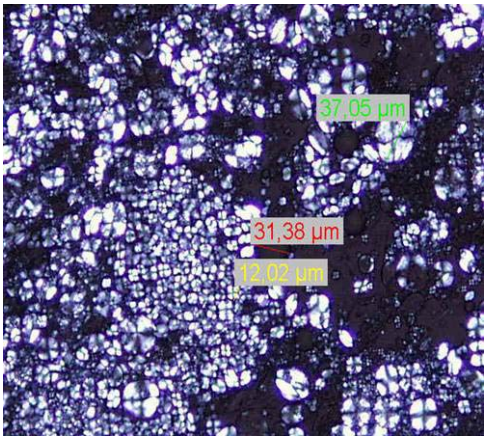

Figure 5 Same Dough batter area in polarized light

Production lines for ice cream cones are generally producing from 1500 cones pr. hour to as many as 10.000 per. hour. The lower capacity ovens typically run at 180-205 ° C and the higher speed ovens at 245-250 ° C.

Usage Levels of Lecithin

Generally the dosage of lecithin is proportional to the sugar content since sugars tend to increase soiling and burnt residue on the baking line. As a guideline the dosage of dry lecithin should be 1-2 % for a sugar content of 14 % and just 0.5-1 % for formulations with less sugar.
It is advisable to follow flow-time or viscosity of batters. This can be done by measuring the time a fixed volume of batter passes through a simple funnel. Generally the type of lecithin has minimal influence on the batter viscosity, but additional fat and of cause flour and water has a large influence. The application of fluid lecithin types tends to require addition of more oil for dispersion whereas dry lecithin gives batters with nicer glaze, smoothness and more optimal depositing on the irons. Wafers tend to expand more when using dry lecithin and shifting between dry and fluid lecithin may require adjusting machines or formulations. The overall net effect of applying the dry premium cost lecithin is better production stability, a better end-quality and uniformity – a better runability.

Experience shows that the taste of lecithin from different sources, such as soya, sunflower and rape seed lecithin, may appear to differ in the fresh warm wafers, but this is seldom the case when evaluated cold in blind taste panels. It is not recommended to taste on warm wafers direct from the line. This is very tempting for plant personnel when comparing the different lecithin.

Quantifying Wafer Texture

It is possible to make objective evaluations of wafer texture by the use of a Texture Analyzer. The principle of the method is to apply pressure from the top of the cone; a pressure evenly distributed inside the cone by an appropriate probe (simulating putting in ice cream balls) and registering the gram force used at the point of time, where the cone breaks apart.

Figure 6 illustrate the performance of 7 different lecithin all dosed at the same Acetone Insoluble (the same dosage of fluid lecithin) – but produced simultaneously at two different production lines. The CENTROSOFT SF-10, RF-10 and STERNCITHIN F-10 are fluid lecithin and all other products are spray dried lecithin. It is evident from the graphic representation that differences in Hardness can be expected for different lecithins and for different production lines. Furthermore it is interesting to note that the faster and higher temperature line produces more brittle cones that break with significantly less force.

Product	Production line 3000 – 3250 pcs/hr. Multiple range test 95,0 percent LSD		Production line 4700 – 5300 pcs/hr. Multiple range test 95,0 percent LSD	
	Means of 10 counts Force (g)	Statistical Group Homogeneity	Means of 10 counts Force (g)	Statistical Group Homogeneity
CENTROSOFT SM545	2928	X	1974	X
CENTROSOFT SF-10	3220	X	2625	X
CENTROSOFT RF-10	3326	XX	2598	X
STERNMULS M 545 soya	3413	XX	2066	XX
CENTROSOFT RM 545	3414	XX	2438	XX
STERNCITHIN F-10 soya	3433	XX	2368	XX
LECIFLOW 60 soya	3593	X	2445	XX

Figure 6 Comparison of Cone Hardness between 2 Production Lines for same batter