Use of Lecithin

in Sweet Goods: Cookies

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1. Benefits of using STERNPHIL E 60 K and PRECEPT 8160
Hydrolysed and Deoiled Lecithins based on natural renewable resources

If you have worked with standard refined lecithin – then you have not discovered all the possible benefits of deoiled and hydrolysed lecithin!

- **Hydrolysed or Deoiled Lecithins offer larger "spread" of cookie dough when baking.**
- **Hydrolysed or Deoiled Lecithins offer more tender cookie texture with "home made" crust appearance.**
- **Deoiled Lecithin offer improved machinability and reduced stickiness in fat reduced cookies.**
- **Deoiled Lecithin reduces stamping pressures, clean-up times and improves production yields.**

2. Lecithin, the Natural Choice of Emulsifier for Bakery Products!
The main functionality of lecithin in sweet bakery products is the unique effect on the flow properties of dough ("dough machinability") as well as the "release" properties on hot metal surfaces when producing wafers, cones and continuos layers of cake. These properties are related to the peculiar phosphorylated and ionic nature of lecithin that is generally not matched by any other emulsifiers. The dough machinability- and release properties are difficult to quantify and they only prove themselves in full industrial scale baking.

The other well known properties of lecithin are demonstrated in yeast raised bakery products. They are "shelf life extension" and "volume". These two properties are much easier to quantify.

3. Normal Full Fat Cookies
The following baking tests will demonstrate the benefits of using lecithin. Table 1 shows the lecithin types tested.

Lecithin Tested	Description
Control	No Emulsifier
STERNCITHIN F-10	Standard Lecithin
STERNPHIL E 60 K	Hydrolysed Lecithin Degree of Hydrolysis 60 %
PRECEPT 8160	Deoiled, Hydrolysed Lecithin

Table 1: Lecithin Types Tested

The standard baking method used at The Solae Company is the AACC method 10-50D (American Association of Cereals Chemists) shown in table 2 and 3.

Ingredients	Flour %			
	Control	STERNCITHIN F-10	STERNPHIL E-60 K	PRECEPT 8160
CENTRABEST shortening Melt point 44 – 48 °C	28.5	26.7	26.8	27.4
STERNCITHIN F-10		1.8		
STERNPHIL E 60 K			1.7	
PRECEPT 8160				1.1
Granulated sugar	57.8	57.8	57.8	57.8
Salt	1.1	1.1	1.1	1.1
Baking soda	1.1	1.1	1.1	1.1
Dextrose solution (8.9 g in 150 ml)	14.7	14.7	14.7	14.7
Water (ambient, tap)	7.1	7.1	7.1	7.1
Pastry flour, soft red wheat 8 % protein, ash 0.43 max.	100	100	100	100
Total	210.3	210.3	210.3	210.3

Table 2: Cookie Formula

Apparatus: Hobart N-50 mixer with a paddle attachment

1. Blend shortening, sugar, lecithin, salt and baking soda for 3 minutes on speed 1. Stop the mixer after each minute to scrape the bowl and paddle.
2. Add water and dextrose solution and mix for 1 minute on speed 1.
3. Scrap the mixing bowl, and mix the cream phase for another minute on speed 1.
4. Add flour. Mix for 2 minutes on speed 1, stopping every 30 seconds to scrape.
5. Divide two-thirds of the dough into 6 equal portions.
6. Space out the dough pieces on a cookie sheet with roll guides. Flatten partially by hand.
7. Roll approximately 3 times until even thickness. Cut cookies with a 65 mm diameter round cutter.
8. Remove excess dough from the sheet and bake cookies for 10 minutes at 200 °C.
9. Cool 1 minute and remove the cookies to cookie sheets. Store cooled cookies in plastic bags until evaluation within 24 hours.

Table 3: Cookie Baking Procedure

Measurement of Cookie Spread

Place cookies in a straight row and measure the width of the entire row at the largest point. Then rotate each cookie 90 ° and measure the width again. The spreads values can be compared by ANOVA, using SAS statistical software package with Duncan's multiple range test for the comparison of means.

Scoring of Surface Cracking

Compare the cookies using a 10 point scale, with 10 being the best and 1 the worst. Deeper and more extensive cracking is considered desirable.

Flavour and Texture

Conduct an informal taste panel to evaluate the flavour of the cookies. The Solae Company uses at least five panellists.

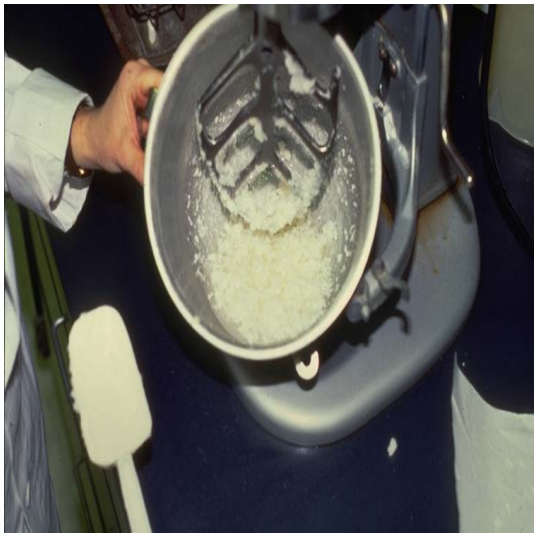
3.1 Results of Baking Trials in Full Fat Cookies

Results of baking trials appear form Table 4. There is a statistical difference between cookies made with hydrolysed or deoiled lecithin in terms of the spread of cookies compared to the control. The STERNCITHIN F-10 standard lecithin reference is in reality transferred from another similar baking test and can not be compared statistically, but it is clear that different types of lecithin offer different properties, and that hydrolysed or hydrolysed-deoiled lecithin are preferable for this application in terms of spread and surface cracking. The phenomenon of surface cracking may not always be desirable but in some countries it is associated with a "home made" appearance.

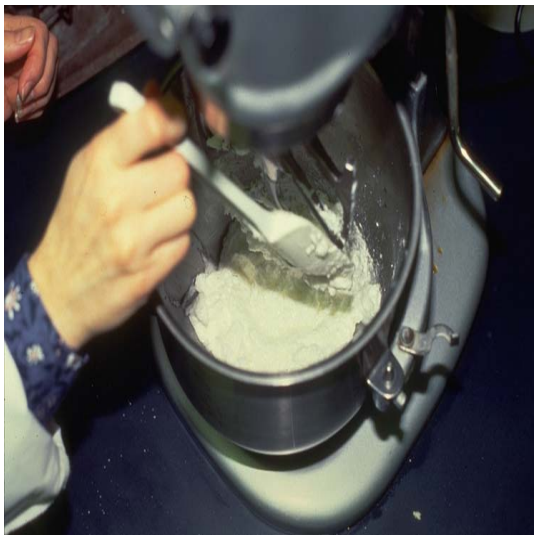
Lecithin Tested	Cookie Spread mm	Surface Cracking	Flavour/Texture
Control	543 a	7	Dough is sticky, lacks smoothness Cookie is slightly chewy
STERNCITHIN F-10	557	7.5	Dough is almost homogeneous, not smooth, sticky
STERNPHIL E 60 K	561 b	9	Dough is homogeneous, cookie has good texture
PRECEPT 8160	561 b	9.8	Dough is homogeneous, cookie has good texture

Table 4: Results of Baking Tests with Lecithins

The following photographs illustrate the dough properties. Picture 1 show the sugar cookie dough when no emulsifier is added (control) and picture 2 shows the typical homogeneous appearance when using a commercial emulsified shortening (Crisco household shortening).

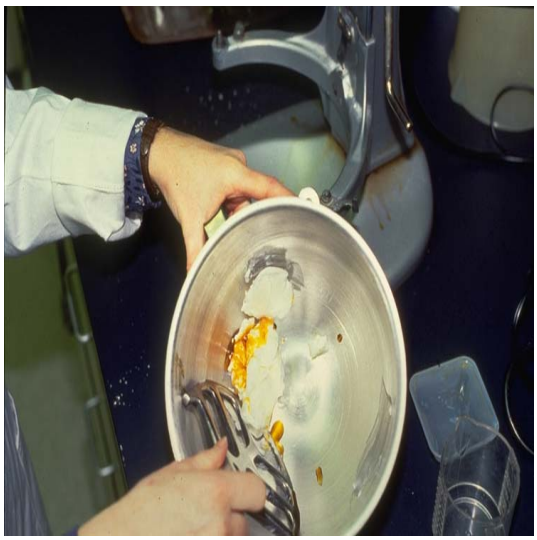


Picture 1: Sugar Cookie Dough with Non Emulsified Shortening



Picture 2: Sugar Cookie Dough with Emulsified Shortening

Pictures 3 and 4 exhibit the inhomogeneous dough appearance when standard grade lecithin is added.



Picture 3: Preparation with STERNCITHIN F-10

Picture 4: Cookie Dough with STERNCITHIN F-10

Finally picture 5 shows a characteristic dough appearance when using hydrolysed STERNPHIL E 60 K (hydroxylated lecithin in the US).

Picture 5: Sugar Cookie Dough with Emulsified Shortening

4. Fat Reduction in Cookies

Fat reduction in bakery products may be desirable for dietary- or for cost reduction purposes. It is well known that reducing the fat content of cookie dough cause very sticky dough. The next baking test will show how this can be overcome by the lubricating properties of deoiled lecithin.

Product Tested	Type of Lecithin
Control	No Emulsifier
CENTROLEX F	Deoiled Lecithin

Table 5: Lecithin Types Tested

Ingredient	Full Fat Cookie	Low Fat Cookie
Margarine	27	20
CENTROLEX F	0	1
Sugar	59	59
Dextrose	7	8
Salt	1	1
Sodium bicarbonate	1	1
Water	30	30
Flour	100	100

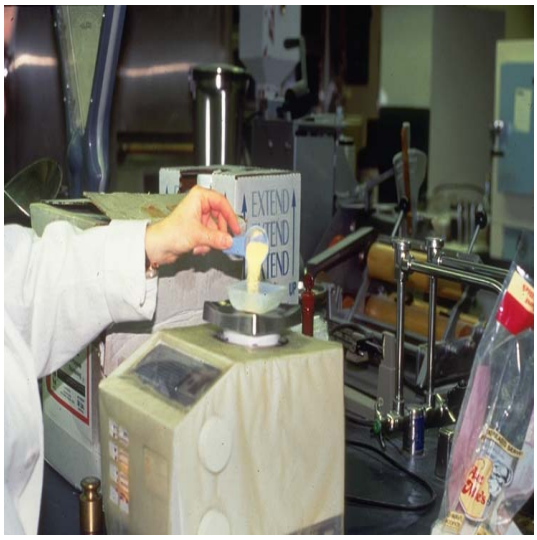
Table 6: Fat Reduced Cookies

Picture 6 illustrate the sticky fat reduced cookie dough and picture 7 attempts to monitor the stickiness when rolling these types of dough.

Picture 6: Fat Reduced Cookie Dough

Picture 7: Rolling Fat Reduced Dough

Picture 8 shows the weighing of the deoiled lecithin, picture 9 the homogeneous appearance of the dough and picture 10 the improved easy dough handling.



Picture 8: Adding CENTROLEX F

Picture 9: Sugar Cookie Dough with Emulsified Shortening

Picture 10: Easy Rolling of Cookie Dough with CENTROLEX F

Finally Figure 1 shows the Instron profile of the 2 dough, Y-axis represents the Instron Force in grams. The area under the curves is the "power area" representing the amount of energy needed to form and shape the dough. Reduced stickiness correlate with smaller "power areas". It is evident that the dough with deoiled CENTROLEX F has quite different rheological properties requiring less work for dough handling.

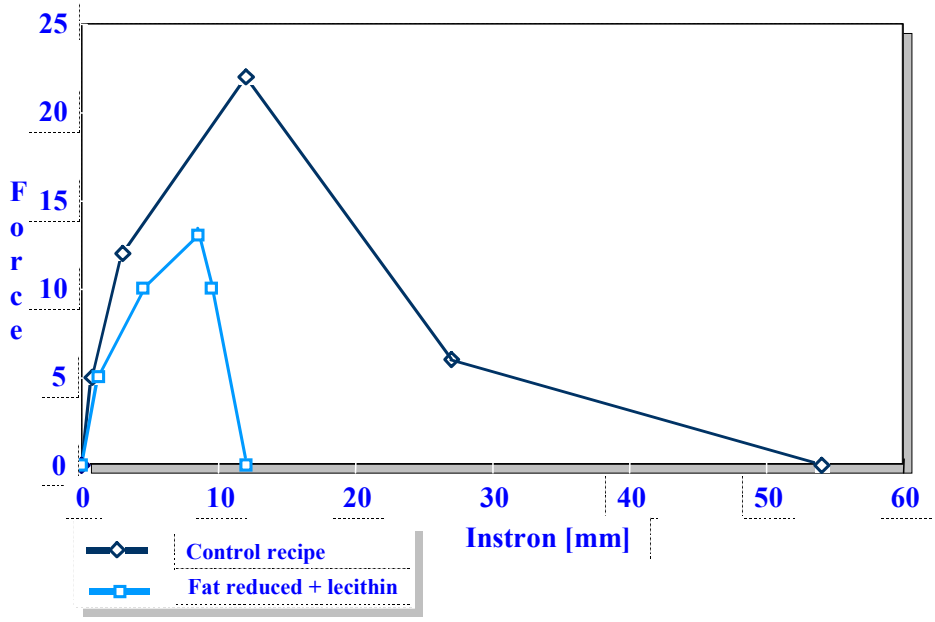


Figure 1: Measurement of Stickiness of Fat Reduced Dough

5. Formulating Cookies with higher levels of Phosphatidylcholine for Health Claims

Formulating for increased levels of choline or phosphatidyl choline is a special art. Reaching 10 or 20 % of the recommended daily intake of Choline requires 10 times higher levels of lecithin addition than normally required for ordinary emulsification purposes. Table 6 show 2 examples from the cookie area.

Ingredients	**Peanut Butter Cookies %**	**Oatmeal Raisin Cookies %**
Contribution to Daily Adequate Intake of Choline per Serving	10 % 55 mg Choline/30 g cookie	10 % 55 mg Choline/30 g cookie
Butter	11.24	
Margarine		14.55
CENTROLEX FP 30 Based on Flour/Oat	3.95 (15 %)	3.94 (12 %)
Brown sugar	16.96	15.89
Sugar	2.39	8.96
Egg whites	13.05	
Egg whole		8.15
Flour, all purpose	25.87	14.67
Vanilla	0.43	0.41
Baking soda	0.63	0.39
Baking powder	0.57	
Salt	0.26	0.24
Peanut butter	22.26	
Honey	2.39	
Cinnamon		0.21
Rolled oats		19.55
Raisins		13.04
TOTAL WEIGHT	100.00	100.00

Table 7: Choline Enriched Cookies