9
Recipes for wafers

9.1 Introduction

Wafers are unlike any other types of biscuits both in their form and their manufacture. They may be thin sheets, deep relief sheets for making hollow wafers, cones made in formed cavities, cones made by rolling baked discs, discrete discs or tubes made by winding continuously baked strips. In all cases they are made from a batter and baked rapidly between two hot metal surfaces.

The majority of wafers are made by baking between flat heavy plates. These plates are commonly either 370 × 240 mm, 470 × 290 mm, 470 × 350 mm or 700 × 350 mm and produce wafer sheets of this size. The sheets commonly have flat surfaces with only moderate patterning (reeding) which is there principally for greater strength. The internal structure of wafers is very open so a wafer sheet of 3 mm overall thickness and size 470 × 290 mm will weigh only 50–56 g.

Wafer sheets are rarely eaten plain and most commonly are sandwiched with fat based creams. The sandwiches, made from the large flat sheets, are commonly called books and are composed of 3, 4 or 5 wafer sheets with 2, 3 or 4 layers of cream. The percentage of cream in the book is quite high. These books are then cut with wires or saws into squares or rectangles for packaging or chocolate coating.

There are very many variations on the above theme which gives rise to different forms of finished wafers. For the purposes of this account it is the flat sheets of wafer which will receive most attention.

9.2 Recipes for wafer batters for flat sheets

Water and wheat flour are by far the major ingredients of all wafer batters but there are many others that may be included. In a paper by Carey[1] of Nestlé it was stated that typical commercial wafers would consist of a combination of some, but not all, of the following ingredients in their batter recipes. For the benefit of those wishing to make the basic wafer sheet he also gave a recipe to start from.

		Starting point
flour	100	100.00
dough fat or oil	0.8–3.4	2.25
lecithin (liquid)	0.05–0.06	
lecithin (powder)	0.75–1.00	0.95
sugar (any crystal size)	1.05–3.5	
whole egg powder	up to 1.0	
whole liquid egg	0.75–4.0	
salt	0.16–0.25	0.25
soda	0.3–0.6	0.32
amm. bic.	0.75–1.0	
SMP/soya flour	1.4–3.0	
yeast (for 1 hr fermentation)	0.35–0.63	
water	128–147	137

This list of ingredients can be compared with selected commercial recipes given below. It can be seen that Carey's list, although long, is by no means complete!

Recipe no. Type product	126 wafer batter	127 wafer batter	128 wafer batter	129 wafer batter	130 wafer batter
flour, weak	100.00	100.00	100.00	98.04	96.15
cornflour				1.96	
tapioca starch					3.85
powdered sugar	1.67	3.54			
malt extract 80%				2.94	
oil	3.75	2.71	3.25	2.35	2.50
lecithin			1.25	0.59	0.38
soya flour			2.50		
SMP	1.67	3.12		1.96	
dried egg	2.92	0.35			
amm. bic.		0.83			
soda	0.26	0.26	0.15	0.29	0.31
ACP					0.04
salt	0.17	0.17	0.15	0.20	0.38
SMS			0.025	0.050	
P. enzyme					0.077
magnesium carbonate				0.25	0.50
cocoa			0.75		
added water	133	145	172	141	142

Critical ingredients The water absorption of the flour will significantly affect the amount of water needed to give a suitable batter consistency. It is best to use a flour of weak to medium strength.

The wafer has a very bland taste so the quality of the oil or fat used should be good in terms of flavour and absence of rancidity. Some say that inclusion of a small amount of cocoa powder or sugar helps to stabilise the wafer flavour and gives a longer shelf life.

The use of milk powder or reducing sugars (as in malt extract) will cause the sheet to colour during baking so should be avoided if very white sheets are required. Wafers of various colours may be obtained by adding colouring to the batter.

Magnesium carbonate is occasionally used to aid wafer sheet release from the plates. The mechanism is not understood.

Mixing This is done as a batch system with a high shear mixer. Apart from dispersing all the ingredients in the water the aim is to prevent the formation of gluten strands following the hydration and mixing of the flour. If such strands form they will block screens and nozzles at the point of batter deposition. It is not clear which particular qualities of flour are more likely to give the gluten strands but generally their formation can be avoided if cold water is used and the flour is not left in static contact with the water before mixing starts.

Mixing provides the opportunity to get the optimum solids content and consistency of the batter which is critical for a desired quality of wafer sheet.

The mixing process entrains some air and this slowly rises out of the batter after the mixing has stopped. This makes it difficult to critically measure the consistency and viscosity of the batter and to adjust the water level as necessary.

Batter handling After mixing, the batter is transferred to a holding tank via a screen to remove lumps and gluten strands. From this tank either the batter is pumped to a small reservoir near the wafer oven or it is pumped around a ring main to the wafer oven(s) and back to the tank. The batter consistency will slacken with time so the holding time should not be long. There is also a tendency for sedimentation so the tank should be continuously agitated in a gentle manner.

In a few cases the batter is fermented with yeast and here the batter is stood in the tank for about one hour. The yeast probably acts by producing a supply of minute gas bubbles that form the nuclei for aeration in baking. It is not clear how this works better than chemicals such as sodium or ammonium bicarbonate.

Wafer sheet forming The wafer oven consists of a set of plate pairs which are carried continuously through a heated oven. The plates open at the front of the oven where the baked wafer falls out and almost immediately batter is spread onto the freed hot plate to form a new sheet. The batter is spread across each plate in a series of streams from a sparge pipe with nozzles. The plates are then locked closed and an explosive baking process starts. This spreads the batter evenly across the plate and a small amount is driven out through steam vents around the edges of the plate pair. The baking causes gelatinisation of the starch and protein in the flour, some colouring of the surfaces and of course great moisture reduction. At the point where the plates open the wafer is at about 2% moisture content and the opening of the plates allows a slight shrinkage of the sheet so that it falls away or is easily released from the plates with the aid of an air jet.

Baking usually takes about 2 minutes. The faster the baking, and thus the higher the plate temperatures, the lighter in weight will be the wafer sheets from a given batter. This is because the explosive expansion of the batter is greater and therefore the movement towards and through the vents is faster. Faster bakes tend to give less even moisture levels across the sheet.

Critical features of this wafer sheet formation and baking are:

- The batter should spread completely across the plate but not be so great in volume that a lot is expressed through the steam vents.
- The consistency of the batter will determine how readily the batter spreads across the plate.

- When baked, the moisture content of the sheet must be low and even otherwise there will be a release problem (the sheet may stick to the plate surface) or the sheet will warp badly as it cools. Conversely, over-baked and burnt sheets will also not release readily.
- The weight of the sheets determines the eating quality. A heavy sheet, made from a batter with low water and high solids will be harder and tougher than one made from a low solids batter.
- The balance between the spreadability of the batter and the desired wafer sheet weight can be adjusted with the level of ammonium bicarbonate in the batter. More ammonia will cause much greater spreading of the batter at the commencement of baking.
- The greater the levels of sugar and milk powder in the recipe the greater will be the tendency for wafer sheets to stick to the plates.

Critical aspects of the condition and maintenance of the wafer plates which affect the quality of the wafer sheets and the efficiency of the wafer-making operation are:

- Release of baked wafers from the plates is affected if the plates are not clean.
- Release of the wafers is also impaired if the gaps between the plates in a pair are not even or the settings of all the plate pairs are not the same.

9.3 Other types of wafer

As stated above, the main consideration here is with flat wafer sheets because these represent by far the main section of this market. There is a growing interest in rolled wafer sticks and a small specialised market for round wafer sheets that have been rolled (into cones) or folded to form wafers for desserts.

In order to make any wafer that can be rolled or folded the recipe has to have a significant level of sugar. The rolling or folding takes place immediately after the oven exit while the sugar is still molten. The wafers are thin and the internal structure is much less open than for typical flat wafers.

For rolled wafer sticks the ratio of sugar to flour is about 60 to 100 whereas for rolled wafer cones the ratio is about 35 to 40 parts of sugar to 100 of flour.

Recipe no. Type product	131 rolled wafer cones	132 wafer sticks
flour, weak	95.24	100.00
cornflour	4.76	
powdered sugar	40.00	75.00
oil/butter oil	2.86	2.00
lecithin	0.95	0.50
soya flour	2.38	4.00
whey powder		2.00
dried egg		2.00
salt	0.50	0.50
vanilla/in*	0.10	
added water	125	120

* This ingredient is not represented by an accurate quantity.

The rolled wafer cones are usually sold for filling with ice cream. The wafer sticks, which are formed by winding a continuous narrow strip of baked wafer to form a tube, are usually filled at the time of winding, with chocolate or some sort of sugar and fat cream mixture. They may also be partially coated with chocolate.

9.4 Secondary processing

As mentioned above, most flat wafers are sandwiched with cream. The composition of this cream is described in section 10.2.2.

The wafers may be sandwiched with toffee or caramel instead of, or in addition to, cream. See section 10.4.2.

Sandwiched wafers which have been cut into small pieces are commonly enrobed with chocolate or form the centres of moulded chocolate bars.

Reference

[1] CAREY, M (1993) *Processing of wafer biscuits*. Biscuit Development Seminar, Cambridge Biscuit Seminars, Selwyn College, Cambridge, unpublished.