Sugar Confectionery and Chocolate Manufacture

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Preface

The authors had five objectives in preparing this book: (i) to bring together relevant information on many raw materials used in the manufacture of sweets and chocolate; (ii) to describe the principles involved and to relate them to production with maximum economy but maintaining high quality; (iii) to describe both traditional and modern production processes, in particular those continuous methods which are finding increasing application; (iv) to give basic recipes and methods, set out in a form for easy reference, for producing a large variety of sweets, and capable of easy modification to suit the raw materials and plant available; (v) to explain the elementary calculations most likely to be required.

The various check lists and charts, showing the more likely faults and how to eliminate them, reflect the fact that art still plays no small part in this industry.

To help users all over the world, whatever units they employ, most formulations are given in *parts by weight*, but tables of conversion factors are provided at the end of the book.

There also will be found a collection of other general reference data in tabular form; while the Glossary explains a number of technical terms, many of them peculiar to the industry.

This is a time of world-wide change in the structure of the sugar confectionery and chocolate industry. It is experiencing consolidation with a general movement towards larger manufacturing units employing less labour with higher investment and capital costs in automatic and continuous high-output production lines.

Many old-established factories have been closed because of mergers or takeovers or changing market pressures. But new, small vigorous companies have been formed to manufacture lines which the larger firms are finding uneconomic to produce in batch quantities. Confectionery packs offered under the retailer's own label are accelerating the change to more efficient

production to cope with the lower profit margins generally associated with this trade. New firms entering the industry have high sales potential provided a good product is offered, effectively packaged and efficiently marketed. Sales of confectionery products in the United Kingdom are considerable, as the following figures for 1971 show.

	United Kingdom		
	Producers	*Imports*	*Exports*
	£	£	£
Chocolate and chocolate confectionery	182 169 000	4 197 000	16 984 000
Chocolate crumb, cocoa butter and other cocoa products	12 402 000	20 136 000	3 666 000
Chocolate couverture and similar products	12 163 000	63 000	472 000
Medicated confectionery	1 810 000	—	187 000
Sugar confectionery	108 248 000	3 208 000	14 610 000

(Source: *Business Monitor*, June 1972, HMSO.)

Sales by United States manufacturers during 1970 were 1925 million dollars of which 770 million dollars were direct sales to retailers (Source: US Industrial Outlook, US Department of Commerce).

Sales of sugar confectionery and chocolate in 1968 in the EEC (the original 6) were £244 million and £388 million respectively (Economist Intelligence Unit Reports 95, 98, 101, 113).

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1

Basic Technical Considerations

1.1 Introduction

Some understanding of the chemical and other scientific properties of sugar confectionery and chocolate is important for the technologist; notably in overcoming faults that may have developed in the product; in the preparation of matching recipes; for detecting wrong blending of ingredients or incorrect processing conditions; and in the maintenance of high standards of quality.

Throughout the book reference is made to such general scientific concepts as moisture content, pH, etc. This introductory chapter is intended to describe briefly the more important of these and their significance to the properties of confectionery.

1.2 Moisture and Total Solids Content

The amount of water left in a sugar confectionery product depends on the type of raw materials used and on the extent of the processing during manufacture. When water is heated under normal atmospheric conditions it will boil at 100° C (212° F); but this boiling temperature is increased when sugar is present in solution. For a fixed concentration of sugar, under standard conditions of atmospheric pressure, a solution will always boil at the same temperature. Conversely if a sugar solution is boiled to a fixed temperature under standard conditions the remaining liquor will always contain the same percentage concentration of sugar and water. The increase in boiling temperature for varying concentrations of sucrose is shown in Table 1.

The effect of other sugars (which are described in Chapter 2) in raising the boiling point is shown in Table 2 and the effect of boiling under vacuum in Table 3.

Before the general availability of thermometers, a number of crude tests were used to determine boiling level. To enable the reader to use older recipes, these are set out in Table 4.

TABLE 1. Boiling Point of Sucrose (Cane or Beet Sugar) Solutions

Sucrose Concentration %	*Boiling Point* °C	°F
40	101·4	214·5
50	102	215·5
60	103	217·5
70	105·5	222
75	108	227
80	111	232
85	116	241
90	122	252
95	130	266

The presence of other raw materials, such as fats, non-sugar milk solids, starch etc., does not significantly affect the boiling temperature. It is therefore possible to determine the boiling points used in the manufacture of a competitor's confection through a knowledge of the composition and, in particular, the water content (see also §17.10).

A knowledge of the water (moisture) content of a raw material is important in developing confectionery recipes. In the United Kingdom it is necessary to incorporate more than 4% butterfat in any sweet which contains in its title the word 'butter'. If the weight of butter added was divided by the batch weight after processing, an erroneous value for the percentage butter content would be calculated, for butter contains some water and this must be taken into account when developing recipes which contain this ingredient (see also §17.2).

The water left in a confection can also influence its storage behaviour in a number of ways: e.g. whether or not the product will dry out or pick up moisture in store, and the extent of crystallisation occurring during its expected shelf life. Boiled sweets which contain more than 4·0% moisture will normally crystallise (grain) while in store. Average moisture content for a range of sugar confectionery products and raw materials is shown in Table 5.

TABLE 3. Effect of Boiling under Vacuum

Approximate Total Solids Value %	*Open Boil Temp.* °C	°F	*Vacuum Cooking* *Boiling Temp.* °C	°F	*Vacuum* lb/in^2
96	143·4	290	129·5	265	25
97	150	302	135	275	27
98	160·1	320	140·6	285	28

TABLE 2. Boiling Temperatures of Glucose Syrup and Invert Sugar Syrups and Mixtures thereof

Temperature		*Glucose Syrup Concentration* %	*Ratio* *Glucose Syrup Solids* / *Invert Sugar*					*Invert Sugar Concentration* %
°C	°F		4:1	2:1	1:1	1:2	1:4	
105·5	222	81·0	79·2	78·0	76·5	75·0	73·8	72·0
111·1	232	85·6	83·8	82·7	81·2	79·7	77·6	76·8
116·1	241	89·3	87·8	86·7	85·5	84·2	83·1	81·6
122·2	252	92·7	91·6	90·9	90·0	89·1	88·4	87·3
130·0	266	97·8	96·9	96·2	95·5	94·7	94·0	93·1

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