

Food Microscopy **(An Annotated Bibliography)**

PART IIIC. CHOCOLATE AND SUGAR CONFECTIONERY

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Confectionery comprises an almost infinite variety of products, but these can be broadly classified into a number of groups, such as boiled sweets, caramels and toffees, chocolate, fillings, fondants, fudge, gums and jellies, icings, liquorice products, marshmallows and Turkish delight, marzipan, nougat, etc.

A bibliography⁶ on candy (1466 references) covering the years 1944 to 1954 has been published by Robinson and Skau (1955), and 20 years of confectionery and chocolate progress from 1947 to 1966 have been reviewed by Pratt *et al.*⁴⁵ Published books of historic significance to the British sweet and chocolate industry have been listed^{33,37} by Lees (1968, 1969).

Turning to microscopical work, both light and electron microscopy (including SEM) have been used to determine the microstructure of many of the raw materials and finished products of the confectionery industry. The cocoa bean has been well studied histologically, and this has helped in the study of the milling of cocoa bean kernels. Many particle size studies on cacao pastes and powders have been reported. The shell content in cocoa products can be quantitatively determined by microscopical counts of stone cells or spiral vessels, and polarised light microscopy has been used in this connection.

The light and electron microscopes have been much employed in the investigation of the various types of bloom in chocolate, and the effects of tempering. Considerable research has also gone into the study of the polymorphic behaviour of cocoa butter, partly in connection with fat bloom. The light microscope is still often used to determine the smoothness or fineness of grinding of sugar crystals in chocolate and chocolate-type coatings. Thin (10 μm) sections of chocolate have also been cut and studied to elucidate its microstructure. Aerated chocolate has come under microscopical scrutiny in studies aimed at linking organoleptic evaluation with structural characteristics. More recently the effects of emulsifiers on the microstructure of chocolate, coatings and toffees have been investigated.

Sugar crystal sizes in sucrose and dextrose-type fondants, and also air cavities in badly-creamed fondants have been measured under the microscope.

To avoid grittiness, sugar crystals should be below 25 μm . The sizes of crystals in other grained confectionery have also been studied microscopically.

Unwanted crystallisation, or graining, in and on boiled sweets, and crystallisation in table jellies have all been investigated with the help of the microscope. Both light and electron microscopy have been used in elucidation of the microstructure of caramels, toffees, fudge, and marshmallow. The microscope has also been used for the examination of raw marzipan produced by various grinding techniques.

The following references provide an introduction to the study of the microstructure of these types of confectionery.

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