

## The Analysis of Marzipan

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Published methods of analysis for the determination of the almond content of marzipan are reviewed. The estimation of almond content, by difference, after the determination of the moisture and sugar contents of the marzipan, is proposed as an alternative method and compositional data are listed.

The nut content of marzipan can be obtained by three different methods:

- (1) From the oil content of the marzipan using a conversion factor based on the average oil content of almonds<sup>1,2,3,4</sup>. It has been found that the oil content of all types of blanched sweet almonds varies from 55.11 to 64.06 per cent. with a mean of 60.76 per cent. calculated on a dry basis.
- (2) From the protein content of the marzipan, using a conversion factor based on the average protein content of almonds<sup>1,2,3,4</sup>. This laboratory has found the protein content of all types of blanched, sweet almonds to vary from 21.34 to 28.21 per cent. with a mean of 24.4 per cent. calculated on a dry basis (Protein = Nitrogen  $\times$  6.25).
- (3) By difference after determining the moisture and sugar contents of the marzipan, subtracting the total of these from 100 per cent. to give the dry sugar-free nut residue. This figure is then adjusted to allow for the sucrose present in sweet almonds. The sucrose content of all types of sweet almonds varies from 3.12 to 6.05 per cent. with a mean of 4.0 per cent. calculated on a dry basis. The normal components of marzipan other than nut are moisture, sucrose, invert sugar and, sometimes, glucose syrup solids.

The use of neither Method (1) nor Method (2) is favoured because both are capable of wide variation, depending on the exact factor employed. In addition, the determination of the oil content of marzipan is considered to be long and difficult. Satisfactory results have never been obtained from the various modifications of the Werner-Schmidt method and difficulty was experienced in drying out the extracted oil completely. Even when heated under vacuum it can take up to 72 hours to reach constant weight. Method (3) has been used for several years and has been found to give consistently accurate results on samples of known composition.

Moisture is determined in marzipan by drying it on sand at 103° C under

vacuum. The sucrose, invert sugar and glucose syrup solids (if any) can be found by either of two procedures:

- (a) Polarimetry, before and after inversion, of a solution cleared with zinc acetate and potassium ferrocyanide reagents<sup>5</sup>, coupled with a volumetric determination of total reducing sugars (calculated as dextrose) in the cleared solution.

It is found convenient to prepare two solutions of different strengths (say 5 and 10 per cent.) and to treat these in parallel to arrive at a correction for the volume of the precipitate.

- (b) Volumetric determination of total reducing sugars in the cleared solution before and after inversion: and determination of laevulose in the cleared solution after oxidation with alkaline hypo-iodite<sup>6,7</sup>.

In either case three equations are obtained for the three unknown components. In Method (a) glucose syrup solids are assumed to have a specific rotation of  $+140.5^\circ$  unaffected by inversion and to contain 45 per cent. of total reducing sugars calculated as dextrose. In Method (b), it is assumed that invert sugar = (laevulose  $\times 2.1$ ) and that glucose syrup solids = (total reducing sugars - invert sugar)  $\times 2.2$ . The factor of 2.1 for converting laevulose to invert sugar has been derived experimentally from the examination of commercial invert sugars. Table I gives typical results for two types of marzipan.

TABLE I

|                                       | A<br>per cent. | B<br>per cent. |
|---------------------------------------|----------------|----------------|
| Moisture .. .. .                      | 13.4           | 8.0            |
| Total Dry Sugars .. .. .              | 33.9           | 69.2           |
| Dry Sugar-free Nut (by difference) .. | 52.7           | 22.8           |
|                                       | 100.0          | 100.0          |
| Equivalent Dry Almond Substance ..    | 54.9           | 23.8           |

The percentage of Dry Almond Substance (containing 4 per cent. of sucrose) is obtained by multiplying the amount of Dry Sugar-free Nut by the factor 100/96.

Analysis of five samples taken from the same batch of finished paste made to a recipe formulated to give 23.7 per cent. of Dry Almond Substance gave results ranging from 22.6 to 24.1 per cent., with a mean of 23.5 per cent. and a standard deviation of 0.59 per cent. Occasionally samples of marzipan may be encountered which contain other ingredients such as glycerine and sorbitol. These must be determined, and the results used in conjunction with those for sugar and moisture when deriving dry sugar-free nut content.

#### References

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