Measuring the moisture content of foods

PETER FELLOWS

Measurement of the moisture content of foods is important for both control over drying foods such as spices, fruits, and grains and for safe storage of dried foods. Knowing the moisture content of oilseeds or nuts is also useful for ensuring that they are within the correct range for extracting the maximum yield of oil. In honey processing and the manufacture of preserves such as jam and marmalade, the converse measurement of solids content (100 – percentage moisture) is important to ensure the shelf life of these products.

There are a large number of different methods to measure moisture or solids contents that can be used at a small scale. Simple methods to assess the moisture content of grains and nuts that do not require equipment but need some experience are: 1) place food pieces on a hard surface and tap them with a metal or stone weight – the hardness (or softness) of the grain indicates the approximate moisture content; 2) shake seed pods or shake a sample of grain inside a metal can and listen to the sound made by the seeds or grain – those with a high moisture content give a dull sound whereas dry grain gives a sharp sound; 3) push a hand with extended fingers into a heap of grain – wet grain offers more resistance than dry grain; and 4) shake a sample of grain with dry salt in a clean dry glass jar for several minutes – if the salt sticks to the sides of the jar the grain is too damp; if the jar surface is clear of salt the grain is dry. Moisture content can be measured accurately using an electronic moisture meter, based on the conductance of electricity through a sample of grain. However, the instrument is relatively expensive and therefore likely to be affordable only by larger-scale processors.

A more time-consuming method to measure the moisture content of any food is to dry a weighed sample in an oven at 103°C until the weight does not change (however, care is needed when interpreting the results for herbs and spices because volatile oils are lost as well as moisture). This method requires small metal dishes, an accurate weighing scale, a laboratory desiccator and a thermostatically controlled oven that has close control over the temperature. The procedure is as follows: 1) if

Peter Fellows is a freelance food technologist

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necessary, finely grind or finely chop the food to be tested; 2) weigh three small samples of food accurately (2 g ± 0.001 g) in the small dishes; 3) place them in the oven for 1 hour and then put them in a desiccator to cool; 4) weigh the samples; 5) replace the dishes in the oven for 30 minutes and repeat the procedure until their weight does not change. The moisture content is found using the formula: percentage moisture = [(initial weight – final weight)/ initial weight] × 100, for an average of the three results.

Sugar is the main solids component of honey, jams, sugar confectionery, etc. and it can be checked using a number of methods. The simplest methods, used to check that products have been boiled to the correct consistency, are low cost and do not require special equipment but are less accurate: A) place a small sample of food between two wetted fingers and open them; B) dip a spatula in water and then in the food, return it to cold water; C) place a sample on a cool ceramic plate and note the texture after it has cooled. The expected results are shown in Table 1.

A jam thermometer or an electronic thermometer that reads up to 110°C can also be used to measure the temperature of boiling: as the sugar content increases the temperature of boiling also increases (Table 2).

Note: the boiling temperature depends on height above sea level and this should be checked if a producer is operating in a mountainous region. It also changes according to the amount of glucose syrup in the boiling mixture and processors should have experience of making the product before using this method.

A refractometer is a more accurate method to directly measure the sugar content. Hand-held refractometers (Figure 1) are cheaper than the bench (or 'Abbe') type. Optical hand-held refractometers have a range of 0–50° Brix for juices,

Table 1. Results of simple tests for sugar boiling

Test	*Result*	*Approx. temperature (°C)*
A	Thin strands	103
B	Forms small droplets	105
C	Forms a strong gel	105
B	Forms large droplets	106
B	Forms hard feathery strands	111
B	Forms soft ball	116
B	Forms hard ball	120
B	Forms thin sheet	129
B	Sheet forms, slightly brittle	133
B	Sheet forms rapidly	143
B	Brown brittle sheet forms	180

Table 2. Boiling temperatures of different sugar concentrations

Boiling point (°C)	*Sugar concentration (%)*	*Moisture content (%)*
101.4	40	60
102	50	50
103	60	40
105.5	70	30

sauces, syrups, etc. and 40–90° Brix for honey, jams, and other preserves, with some single-range instruments covering 0–80° or 0–90° Brix. A sample of food is placed on the glass prism, the cover is closed and the reading is made through the eyepiece by pointing the instrument at a bright light. The scale in degrees Brix, which corresponds to percentage sucrose, is read against a clearly defined division between black and orange colours. More recent digital refractometers have a prism cell for the food sample and the sugar concentration is displayed as a digital readout on an LCD screen.

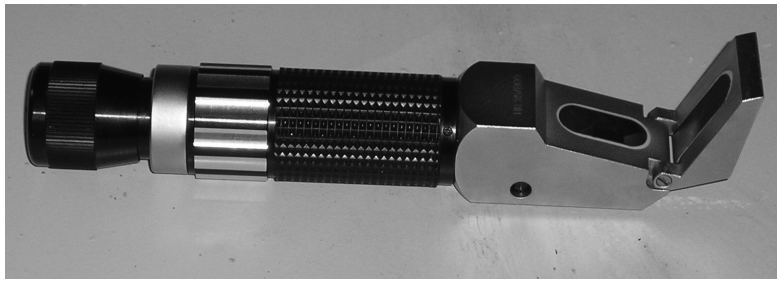

Figure 1. A hand-held refractometer