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Salt analysis - make sure you understand the results

Introduction

In 2003, 'Salt and Health' - a report by the Scientific Advisory Committee on Nutrition, which advises the UK Food Standards Agency (FSA) and UK health departments - recommended targets for reduced salt consumption by adults and children. This was on the basis that high salt intake may be linked with high blood pressure, which increases the risk of heart disease. As a result, the FSA initiated a series of targets for reducing the salt content of specific groups of products.

It is the sodium part of salt (sodium chloride) that is at issue here, and believed to be responsible for the adverse health effects. Many companies have been re-evaluating the sodium and salt content of their foods as a result of the FSA's activities, and many products are now labelled as containing less salt than previously.

Food labelling legislation requires that salt be declared in the list of ingredients where it is used. The new Food Information Regulation is tightening the requirement to label products with salt content. Irrespective of whether or not a claim concerning sodium or salt is made, the nutrition information will be required to include data on the salt content per hundred grams, or hundred millilitres, of the food.

Furthermore, there are certain restrictions on the use of sodium claims such as "low in sodium" and "reduced sodium".

Determining the salt content of foods

Salt analysis (via both sodium and chloride determination) is one of the many chemical analytical services available at Campden BRI.

Salt in food is generally determined analytically in one of two ways:

- Firstly, the salt content can be estimated from the sodium content. This is obviously the most accurate way to assess the sodium content of a food if specifically required. It is usually determined by ashing the food at say 500°C and, after dissolution of the ash, determining the sodium content by spectrophotometry, making use of its characteristic light emission or absorbance in a flame (AAS, ICP or flame photometer).

- However, sometimes the salt content is estimated from the analysis of the chloride content of the food. Again, this is often carried out by ashing the food and carrying out classical techniques such as the Volhard titration or the Mohr titration. These make use of the reaction of chloride with silver ions.

Alternative procedures and equipment are also available which use electrochemical techniques.

From these analyses the salt content is estimated by calculation making use of the atomic weights of sodium (22.99) and chloride (35.45). The molecular weight of sodium chloride is 58.44 (that is, 22.99 + 35.45), and 58.44 grams of pure sodium chloride will contain 22.99 g of sodium and 35.45 g of chloride. These figures can be used to inter-relate the levels of sodium, chloride and salt.

For example:

Sodium content (%) x 2.54 (i.e.58.44/22.99) = Equivalent salt content (%)

and

Chloride content (%) x 1.65 (i.e.58.44/35.45) = Equivalent salt content (%)

Presence of other compounds of sodium and chloride

The flaw in these calculations is that compounds of sodium and chloride, other than salt, may be present in the food. For example, in the case of sodium, sodium bicarbonate (raising agent), sodium nitrite (preservative) and sodium phosphate (stabiliser) can all be present at reasonable levels and would contribute significantly to the sodium content, while chloride might be present from potassium chloride. This is important for several reasons:

- If sodium levels are used as the basis for determining salt, then the presence of sodium from other sources (e.g. raising agent) would lead to an overestimate of the equivalent salt content.

- If analysis for chloride were carried out, this could be used to calculate the equivalent salt content. From this the sodium content could be calculated on the assumption that the only sodium present was derived from salt, but the sodium contribution from sources, other than NaCl would be missed - and the true sodium level underestimated.

- Similarly, but perhaps less important, if the chloride present were derived from, say, potassium chloride then the equivalent salt content and sodium content could again be overestimated if calculated from the chloride concentration.

It is not uncommon for companies receiving analytical results to query why the sodium and chloride concentrations do not equate, and this is often due to the presence of raising agents or similar additives in the food. It is therefore necessary for companies to consider the purpose of such data before requesting the analyses, and to request the most appropriate analyses.

Proficiency results

The results of rounds of external proficiency testing (FAPAS) involving the analytes sodium and chloride demonstrate that the determination of sodium is more accurate and precise than that for chloride. Many laboratories perform very poorly when asked to analyse a food for chloride - it is suspected that the chloride is lost during the analysis in the ashing step, where it is susceptible to volatilisation.

Changing from the use of one analyte to another

On a few occasions recently, laboratories have changed from using chloride analysis to sodium analysis in order to determine sodium and equivalent salt content. This has led to apparent levels of sodium that are higher than their expected and declared levels. In general this is due to sodium being present from sources other than salt, as indicated above.

Recommendations

1. Companies should be clear about what data they need - sodium, chloride, salt or some combination of these.

2. Companies should ensure that their contract laboratories are using sodium analyses to ascertain the salt and sodium levels, as this is likely to give more meaningful results than estimates of the sodium content from the chloride levels.

3. Companies should be aware that the sodium present may not all be contributed from salt and that other ingredients might contain sodium. Likewise for chloride.

4. Chloride may be the best means of estimating salt alone, if other sodium compounds are present, but chloride analysis is less precise than sodium analysis.

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Issued Nov 2011