
International Standard



6735

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Dried milk — Assessment of heat class — Heat-number reference method

Lait sec — Évaluation de la classe de traitement thermique — Méthode de référence de l'indice de traitement thermique

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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NOTE — The method specified in this International Standard has been developed jointly with the International Dairy Federation (IDF) and the Association of Official Analytical Chemists (AOAC) and will also be published by these organizations.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Dried milk — Assessment of heat class — Heat-number reference method

0 Introduction

The heat treatment applied in the manufacture of spray-dried milk, predominantly in the preheating of the liquid milk, can be varied to produce a product suitable for a particular use. It is therefore necessary, both for the manufacturer and for the buyer or user, to be able to assess the degree of overall heat treatment so that a dried milk can be classified as, for example, "low heat", "medium heat", etc. The basis of classification is that an increasing proportion of the milk-serum protein (whey protein) in milk is denatured (and becomes associated with the casein) as the degree of heat treatment increases. The methods involve either the direct measurement of residual undenatured milk-serum protein or the indirect measurement of denatured milk-serum protein, and the concentration found in the dried milk in relation to the range of possible concentrations indicates the heat class. Ideally, because of the small seasonal variations in the concentration and relative proportions of the proteins in raw bulk cows' milk, a sample of the original liquid milk should be available for comparison when assessing the heat class of a dried milk, but this is only possible for the manufacturer. In practice, heat class is usually assessed solely by examining the dried milk and this inevitably imposes some limitation on the accuracy of all protein-based heat-classification methods.

The most widely used heat-classification method is probably that published by the American Dry Milk Institute (ADMI) in 1971, in which the concentration in the dried milk of undenatured milk-serum protein nitrogen (UMSPN) is determined turbidimetrically so that the dried milk can be placed in one of the following heat classes :

- low heat (not less than 6,0 mg of UMSPN per gram);
- medium heat (1,51 to 5,99 mg of UMSPN per gram);
- high heat (not more than 1,5 mg of UMSPN per gram).

The procedure for determining the so-called "ADMI whey-protein index" of dried milk has several drawbacks, however, and improved or alternative procedures utilizing dye-binding have been developed [for example Sanderson (1970), McGann, O'Connell and McFeely (1975)].

The heat-classification of dried milk is possible by the indirect measurement of denatured milk-serum protein (DMSP), for example by isolating the complex of casein and DMSP and determining its content of cystine plus cysteine (predominantly

derived from the DMSP) by the method of de Koning, van Rooijen and Draaisma (1976) and Mrowetz and Klostermeyer (1977). However, it has been recognized for some time that another method of this general type would be to utilize the procedure of Rowland (1938a) for determining the casein number of raw liquid milk (Rowland, 1938b), which is obtained by multiplying the ratio of casein nitrogen content to total nitrogen content by 100 and is useful in diagnosing subclinical mastitis [Rowland and Zein-El-Dine (1938)]. When this procedure is applied to heated milk, or to reconstituted dried milk, the "casein number" obtained is, in fact, 100 times the ratio of casein nitrogen content plus DMSP nitrogen content [or, more accurately, acid-insoluble (pH 4,8) protein nitrogen content] to total nitrogen content, and thus increases with the degree of heat treatment sustained by the milk or dried milk.

Consideration of all the available heat-classification methods for dried milk and extensive trials of most of these, including examination by gel electrophoresis of the casein /DMSP complex and the UMSP isolated from dried milks, led to the conclusion that a method based on the determination of "casein number" — renamed "heat number" to avoid confusion — would be the best overall general-purpose method and that this should be regarded as the reference method. During these trials, it became evident that for the accurate and precise determination of the heat number of dried milk, the methods described in IDF Standard 20 and IDF Standard 29, for the determination, respectively, of the total nitrogen content and of the casein content of milk, were unsuitable and, accordingly, alternative methods were developed. An advantage of the heat-number method of heat classification is that it enables the total nitrogen content of the dried milk to be determined.

No single heat-classification method is likely to be suitable for all purposes and, therefore, it is recognized that additional methods may be required for detecting extra-low heat and extra-high heat dried milks; in addition, a rapid routine method (for example employing dye binding) would be useful for plant control purposes. It is also recognized that even when the heat class of a dried milk has been accurately assessed and is a relevant criterion of suitability for a particular use, complementary information about the dried milk may be necessary, for example its rennetability [Voss and Schmanke (1973)].

The macro-Kjeldahl method employed in the determination of heat number is described in annex A and the proposed heat-classification scheme is described in annex B. These annexes form integral parts of this International Standard.