

Determine protein content in high protein creams by the Kjeldahl method

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Introduction

Proteins are biological macromolecules composed of one or more amino acid chains. They have several carboxylic and amino groups. Protein content is worked out from the nitrogen amount measured with the Kjeldahl method. The aim of this experiment is to determine nitrogen quantity in high protein dairy creams for undernourished people.

Material and methods

This experiment was composed of three parts: mineralization, distillation and an assay.

During the first part of the method, a sample was decomposed with a concentrated sulfuric acid excess using a catalyst. This mineralization was realized by an automatic unit: a Gerhardt Kjeldatherm, programmed in three heating steps and one cooling step (figure 1). The nitrogen was changed to ammonium sulfate.

After mineralization, a sodium hydroxide excess was added to liberate ammoniac.

Then the ammoniac was distilled in a boric acid excess with the Gerhardt Vapodest 10. The ammoniac was transformed to ammonium borate.

The third part of this experiment was a colorimetric acido-basic assay. The quantity of ammoniac produced was assayed with hydrochloric acid. When the equivalent volume was reached, the blue color becomes pink.

The nitrogen content was :

$$w_N (\%) = \frac{1,4007(V_E - V_w) [HCl]}{m}$$

$w_N(\%)$: nitrogen content in mass percent

V_E : equivalent volume at assay

V_W : equivalent volume when a reference is realized

$[HCl]$: hydrochloric acid molar concentration

m : test sample value

Then, the protein content (or nitrogen total content) can be calculated by the relation:

$$w_P = w_N \times 6.38$$

Results and discussion

On the packaging the protein content stated is 9.57g/100g. There is a difference between the theory and the experiment (figure2). Maybe, the real content is different or the experiment is not precise enough for this sample type, it could also be an experimental error.

In any case, this difference is not significant and serious because there is no real legislation on the subject. ANIA (French National Association of Food Industries) recommends $\pm 2g$ if the content is less than 10g. But if the real content is higher, the manufacturer must justify why he wrote this value on the packaging.

Figure 1 : Kjeldatherm temperature program
Figure 2 : Results of eight samples taken in the same cream pot, the same day.

Step	Temperature (°C)	Duration
1	180	45'
2	250	60'
3	410	90'
4	ambient	-

Figure 1

	Sample Mass (g)	Equivalent Acid Volume (mL)	Protein content w_P (g/100g)
1	0.7584	7.90	9.31
2	0.7575	7.90	9.32
3	0.7570	7.85	9.27
4	0.7580	7.90	9.31
5	0.7540	7.80	9.24
6	0.7534	7.75	9.19
7	0.7504	7.70	9.17
8	0.7549	7.85	9.29
		Average	9.26
		SD	0.06
		% SD	0.62%

Figure 2

Conclusion

This is the official method for the analysis of milk and dairy products (international standard ISO 8968-1: 2001). This method appears reliable for dairy creams analysis as the measurement appears stable and the standard deviation is low.



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