
N/Protein Determination in Pasta according to the Kjeldahl method

Reference: AOAC 930.25 Protein in Macaroni Products

Tested with VELP Scientifica DKL 20 Automatic Kjeldahl Digestion Unit (Code S30100210) and UDK 169 Automatic Kjeldahl Analyzer with AutoKjel Autosampler (Code S30200160)



Introduction

Pasta is a staple food of traditional Italian cuisine, with the first reference dating to 1154 in Sicily. Typically, it is made from an unleavened dough of a durum wheat flour mixed with water and formed into sheets or various shapes, then cooked and served in any number of dishes. Pastas may be divided into two broad categories, dried (pasta secca) and fresh (pasta fresca).

The amount of protein in pasta depends on the type of flour used to manufacture it. If it is made from durum wheat, the pasta contains protein and gluten. Pasta is considered a good source of nutrition for vegetarians because it contains protein comprising six of the nine essential amino acids.

Protein Determination in Pasta according to the Kjeldahl Method

Thanks to the high level of precision and reproducibility and to its simple application, Kjeldahl is nowadays the most used method for determining nitrogen and protein contents in the food and feed industry. It also has several other applications in environmental control (phenols and nitrogen in water, sludge, soil and lubricants) and in the chemical and pharmaceutical industry according to official AOAC, EPA, DIN e ISO procedures.

The modern Kjeldahl method consists in a procedure of catalytically supported mineralization of organic material in a boiling mixture of sulfuric acid and sulfate salt at digestion temperature higher than 400 °C. During the process, the organically bonded nitrogen is converted into ammonium sulfate. Alkalinizing the digested solution liberates ammonia, which is quantitatively steam distilled and determined by titration.

Sample

Dry Pasta "Anellini" Expected Protein Value: 11 %

Sample Digestion

Weigh about 1 g of grinded sample into a nitrogen-free weighing boat (code CM0486000) and place it into a 250 ml test tube. For each sample, add in the test tube:

- 2 catalyst tablet VCM (code A00000274; 3.5 g K₂SO₄, 0.1 g CuSO₄ x 5H₂O)
- 12 ml concentrate sulphuric acid (96-98%)

Prepare some blanks with all chemicals and without the sample.

Connect the Digestion Unit to a proper Aspiration Pump (JP code F30620198) and a Fume Neutralization System (SMS Scrubber code F307C0199) to neutralize the acid fumes created during the digestion phase.

Digest the samples for 60 minutes at 420 °C, according to the method "wheat spaghetti and macaroni, egg pasta" (n° 19 on DKL 20).

Distillation and Titration

Let the test tubes cool down to 50-60 °C.

Condition the **UDK 169 with AutoKjel Autosampler** unit by performing the Automatic Check-up and Wash-down in the Menu-System.

Distill the samples according to the following parameters (pre-defined method n° 19):

- H₂O (dilution water): 50 ml
- NaOH (32 %): 50 ml
- H₃BO₃ (4 % with indicators): 30 ml
- H₂SO₄ (0.1 N) as titrant solution
- Protein factor: 5.70

Distillation & Titration analysis time: from 4 minutes for one test.

Typical Results on Pasta

The results are automatically calculated by UDK 169 as percentage of nitrogen and percentage of protein.

Sample	Sample quantity (g)	Nitrogen %	Protein %
Dry Pasta "Anellini"	1.002	1.954	11.140
	0.993	1.929	10.994
	1.005	1.952	11.124
	1.002	1.961	11.179
	1.002	1.976	11.264
	0.996	1.97	11.231
	Average ± SD%	1.957 ± 0.017	11.155 ± 0.095
RSD% *	0.844	0.853	

Protein Factor: 5.70

* RSD% = (Standard Deviation * 100) / Average

The complete procedure was verified by using 5 ml of glycine standard solution (3%) containing 28 mg of nitrogen as reference substance. The obtained recovery falls into the expected range: between 98 % and 102 %.

Conclusions

The obtained results are reliable and reproducible in accordance with the expected values: all data fulfill the expected range.

Benefits of Kjeldahl method by using DKL 20 and UDK 169 with AutoKjel Autosampler are:

- High level of precision and reproducibility
- Maximum productivity and full automation
- Worldwide official method
- Reliable and easy method
- Time saving
- Moderate running costs