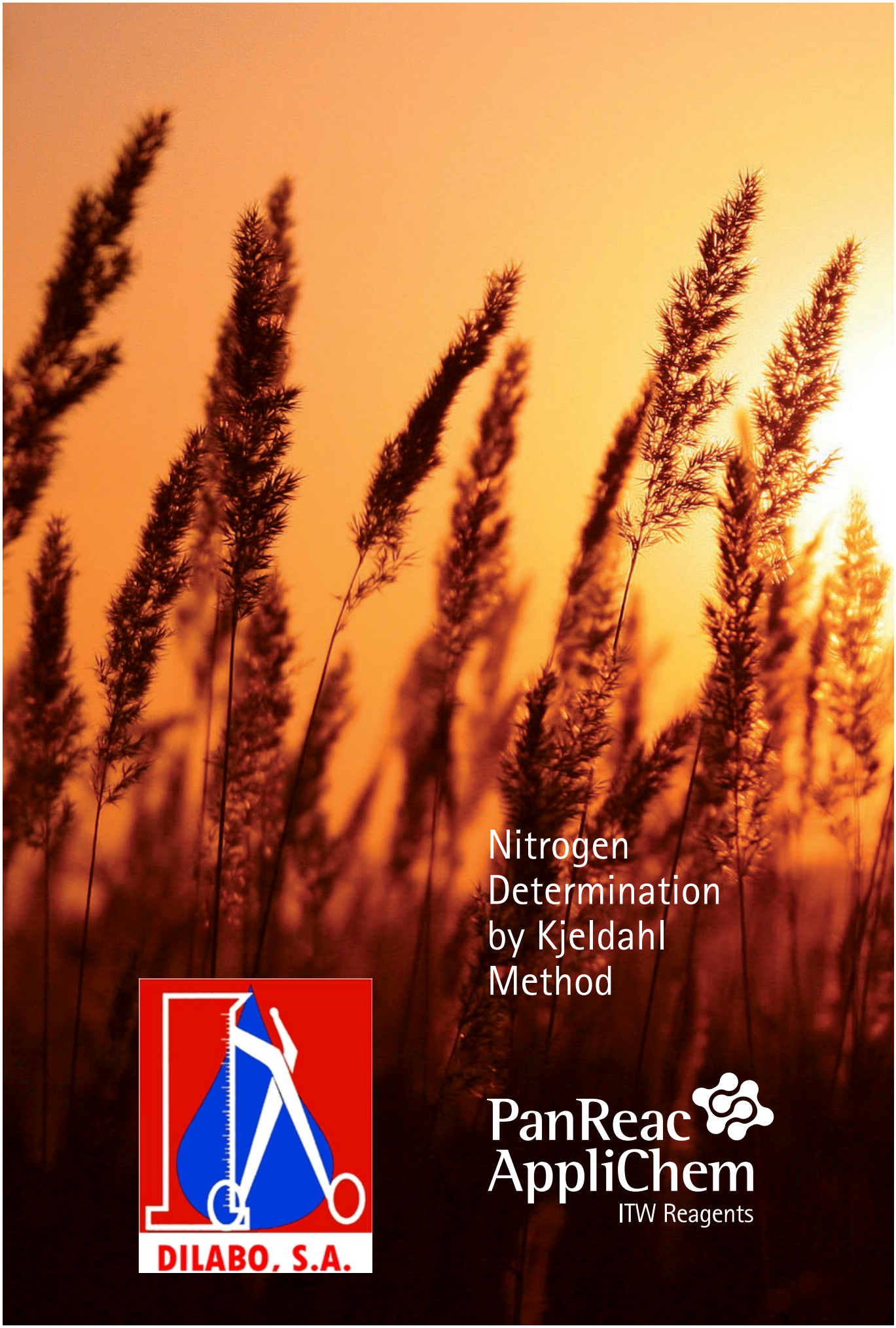
Nitrogen
Determination
by Kjeldahl
Method
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Determination of Nitrogen according to Kjeldahl

For longer than 100 years the Kjeldahl method has been used for the determination of nitrogen in a wide range of samples. The determination of Kjeldahl nitrogen is made in foods and drinks, meat, feeds, cereals and forages for the calculation of the protein content. Also the Kjeldahl method is used for the nitrogen determination in wastewaters, soils and other samples.

It is an official method and it is described in different normatives such as AOAC, USEPA, ISO, Pharmacopeias and different European Directives. The Kjeldahl method is used to determine the nitrogen content in organic and inorganic samples.

The procedure involves three major steps:

- **Digestion:** The sample is digested in boiling concentrated sulfuric acid, with the addition of a catalyst, until complete dissolution and oxidation. The nitrogen contained in the sample becomes Ammonium Sulfate.

  Sample — Catalyst

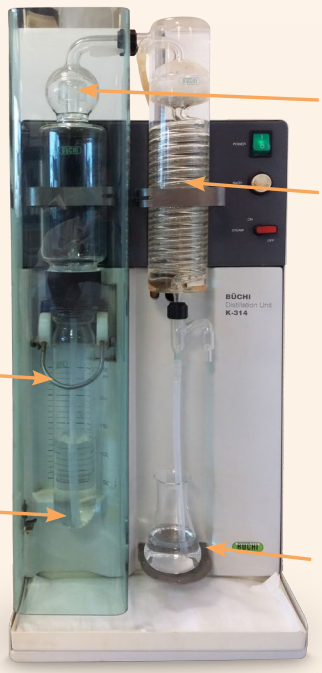
  $$\text{Protein (-N)} + H_2SO_4 \longrightarrow (NH_4)_2SO_4 + CO_2 + H_2O$$

- **Distillation:** Adding an excess of sodium hydroxide solution, the ammonium ion is released in ammonia form, distilled and received on a boric acid solution or a sulfuric or hydrochloric acid volumetric solution.

  $$(NH_4)_2SO_4 + 2NaOH \longrightarrow 2NH_3\,(gas) + Na_2SO_4 + 2H_2O$$

- **Titration:** The ammonia is determined with a volumetric acid solution or by back-titration with sodium hydroxide solution of a known concentration if it was received on hydrochloric or sulfuric acid. The results can be expressed in % N, % NH_3 or protein (%N x factor).

Kjeldahl equipment



2. Sodium hydroxide solution is added to neutralize the pH and to convert NH_4^+ into NH_3

4. NH_3 is condensed

3. NH_3 is dragged by bubbling steam

1. Sample already digested with sulfuric acid

5. NH_3 retained by an acid solution (boric acid, sulfuric acid or hydrochloric acid)

6. Finally NH_3 is titrated with sulfuric acid or sodium hydroxide volumetric solution

The following table shows our Kjeldahl program. If you wish to receive more information, don't hesitate to request our General Catalogue or visit our web in www.itwreagents.com.

Code	Description	Package
Digestion		
Catalyst		
173350	Kjeldahl Catalyst (Cu) (0.3% in $CuSO_4.5H_2O$) tablets (Potassium Sulfate + Copper(II) Sulfate). Missouri Catalyst.	1.25 kg (250 tablets of 5.0 g); 3.5 kg (1000 tablets of 3.5 g); 5 kg (1000 tablets of 5.0 g)
174428	Kjeldahl Catalyst (Cu) (6.25% in $CuSO_4.5H_2O$) tablets according to Directive 93/28/EEC (Potassium Sulfate + Copper(II) Sulfate)	4 kg (1000 tablets of 4.0 g)
175639	Kjeldahl Catalyst (Cu) (9% in $CuSO_4.5H_2O$) tablets (Potassium Sulfate + Copper(II) Sulfate)	1650 g (1000 tablets of 1.65 g); 5 kg (1000 tablets of 5.0 g)
172429	Kjeldahl Catalyst (Cu-Se) powder (Potassium Sulfate + Copper(II) Sulfate + Selenium). For N determination according to Wieninger.	1000 g (1000 tablets of 1.0 g); 5 kg (1000 tablets of 5.0 g)
172926	Kjeldahl Catalyst (Cu-Se) (1.5% $CuSO_4.5H_2O$ + 2% Se) tablets Potassium Sulfate + Copper(II) Sulfate + Selenium). For N determination according to Wieninger.	1000 g (1000 tablets of 1.0 g); 3.5 kg (1000 tablets of 3.5 g); 5 kg (1000 tablets of 5.0 g)
175570	Kjeldahl Catalyst (Cu-Se) (9% $CuSO_4.5H_2O$ + 0.9% Se) tablets (Potassium Sulfate + Selenium metal + Copper(II) Sulfate 5-hydrate). For soil analysis.	4 kg (1000 tablets of 4.0 g)
173349	Kjeldahl Catalyst (Cu-TiO_2) tablets (Potassium Sulfate + Sodium Sulfate + Copper(II) Sulfate 5-hydrate + Titanium(IV) Oxide)	875 g (250 tablets of 3.5 g); 1.25 kg (250 tablets of 5.0 g); 3.71 kg (1000 tablets of 3.71 g); 5 kg (1000 tablets of 5.0 g)
173348	Kjeldahl Catalyst (Se) tablets (Potassium Sulfate + Selenium)	3.5 kg (1000 tablets of 3.5 g); 5 kg (1000 tablets of 5.0 g)
177033	Kjeldahl Catalyst (Cu) (1.96% in $CuSO_4.5H_2O$) tablets (Potassium Sulfate + Copper(II) Sulfate 5-hydrate)	5 kg (1000 tablets of 5.0 g)
177040	Kjeldahl Catalyst (Cu) (10.26% in $CuSO_4.5H_2O$) tablets (Potassium Sulfate + Copper(II) Sulfate).	4 kg (1000 tablets of 4.0 g)
Acids and oxidants		
173163	Sulfuric Acid 98%	1000 mL; 2.5 L; 25 L
121076	Hydrogen Peroxide 30% w/v (100 vol.) for analysis	1000 mL; 5 L
Antifoaming		
211628	Silicone antifoaming liquid	100 mL; 250 mL; 500 mL
Distillation		
Alkalis for liberation of ammonia		
131687	Sodium Hydroxide pellets for analysis, ACS, ISO	500 g; 1 kg; 5 kg; 25 kg
141571	Sodium Hydroxide solution 50% w/v pure	5 L; 10 L
171220	Sodium Hydroxide solution 40% w/w	1000 mL; 5 L; 10 L; 25 L
122666	Sodium Hydroxide solution 32% w/v for analysis	1000 mL; 2.5 L; 5 L; 10 L; 25 L
Solutions for capture of ammonia		
282972	Boric Acid solution 1% for volumetric analysis	5 L
287096	Boric Acid solution 2% for volumetric analysis	5 L; 25 L
282928	Boric Acid solution 3% for volumetric analysis	1000 mL
282222	Boric Acid solution 4% for volumetric analysis	1000 mL; 5 L; 25 L
283334	Ammonia Fixative solution 1% for volumetric analysis	5 L; 25 L
181023	Hydrochloric Acid 0.1 mol/l (0.1N) volumetric solution	1000 mL; 2.5 L; 5 L; 10 L
181022	Hydrochloric Acid 0.5 mol/l (0.5N) volumetric solution	1000 mL; 5 L; 10 L
181061	Sulfuric Acid 0.05 mol/l (0.1N) volumetric solution	1000 mL; 5 L; 10 L
181060	Sulfuric Acid 0.25 mol/l (0.5N) volumetric solution	1000 mL; 2.5 L; 10 L
Titration		
Volumetric solutions		
181693	Sodium Hydroxide 0.1 mol/l (0.1N) volumetric solution	1000 mL; 2.5 L; 5 L; 10 L
181023	Hydrochloric Acid 0.1 mol/l (0.1N) volumetric solution	1000 mL; 2.5 L; 5 L; 10 L
181061	Sulfuric Acid 0.05 mol/l (0.1N) volumetric solution	1000 mL; 5 L; 10 L
Indicators		
283303	Indicator 4.8, Mixed (Methyl Red-Bromocresol Green) for volumetric analysis	250 mL
282430	Indicator 4.4, Mixed (Methyl Red-Methylene Blue) for volumetric analysis	250 mL
281618	Methyl Red solution 0.1% for volumetric analysis	250 mL

Packaging Symbols: Polyethylene bottle; Polyethylene container (cubitainer) with tap; Polypropylene bucket with handle; Polyethylene canister; Glass bottle

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