

Analysis of Protein



Protein

✿ Codex Guidelines on Nutrition Labelling

Protein = Total Kjeldahl Nitrogen x CF

CF = 6.25 for mixed food

Conversion factors

- ✿ **Conversion factor can vary from 5.18 (almonds) to 6.38 (milk and dairy products)**
- ✿ **Where to find the conversion factors?**

Codex standards

If not available in codex standards,

→ others, e.g. AOAC, GB, FAO publication

How to get Codex standards

✿ http://www.codexalimentarius.net/web/index_en.jsp

CODEX ALIMENTARIUS - Microsoft Internet Explorer

檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)

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FAO/WHO Food Standards ENGLISH | FRANÇAIS | ESPAÑOL

CODEX alimentarius

ABOUT CODEX MEETINGS AND EVENTS OFFICIAL STANDARDS

- Official Codex Standards
- Pesticide MRLs
- Veterinary Drugs MRLs
- GSFA Online (Food Additives)
- Special Publications
- Sales and Marketing

List

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Welcome

The Codex Alimentarius Commission was created in 1963 to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. The main purposes of this Programme are protecting health of the consumers and ensuring fair trade practices in the food trade, and promoting coordination of all food standards work undertaken by international governmental and non-governmental organizations.

NEWS

CAC32 Audio recordings

Audio recordings of the 32nd Session of the Commission of the Codex Alimentarius are available [here](#) in original language.

RELATED CODEX LINKS

- JECFA
- JMPR
- JEMRA
- Biotech assessment
- Expert consultations
- FAO/WHO trust fund for participation in Codex
- Codex E-Learning
- FAO Guide on Conduct of Plenary Meetings
- FAO: General Rules

EXTERNAL LINKS

Current Official Standards

Reference	Number	Year of adoption	Title	Revision	Year	Amendment	Year
<u>CODEX STAN</u>	298R	2009	Regional Standard for Fermented Soybean Paste				
<u>CODEX STAN</u>	295R	2009	Regional Standard for Ginseng Products				
<u>CODEX STAN</u>	294R	2009	Regional Standard for Gochujang				
<u>CODEX STAN</u>	1	1985	General Standard for the Labelling of Prepackaged Foods			6	2008
<u>CODEX STAN</u>	3	1981	Standard for Canned Salmon	2	1995		
<u>CODEX STAN</u>	12	1981	Standard for Honey	2	2001		
<u>CODEX STAN</u>	13	1981	Standard for Preserved Tomatoes	1	2007		
<u>CODEX STAN</u>	17	1981	Standard for Canned Applesauce	1	2001		
<u>CODEX STAN</u>	19	1981	Standard for Edible Fats and Oils not Covered by Individual Standards	2	1999		
<u>CODEX STAN</u>	33	1981	Standard for Olive Oils and Olive Pomace Oils	1	1989	2	2003
<u>CODEX STAN</u>	36	1981	Standard for Quick Frozen Finfish, Eviscerated or Uneviscerated	1	1995		

Codex standard (example)

CODEX STANDARD FOR DURUM WHEAT SEMOLINA AND DURUM WHEAT FLOUR ³

Codex Standard 178-1991

ANNEX

In those instances where more than one factor limit and/or method of analysis is given we strongly recommend that users specify the appropriate limit and method of analysis.

Factor/Description	Limit	Method of analysis
ASH		AOAC 923.03 (Type I Method); – or – ISO 2171 (1980) – Cereals, Pulses, and Derived Products – Determination of Ash Method B –550°C constant weight
■ durum wheat semolina	MAX: 1.3% on a dry basis	
■ whole durum wheat semolina	MAX: 2.1% on a dry basis	
■ durum wheat flour	MAX: 1.75% on a dry basis	
PROTEIN (N 5.7)		ICC 105/I – Method for the Determination of Crude Protein in Cereals and Cereal Products for Food and for Feed. Selenium/Copper catalyst (Type I Method) – or – ISO 1871 (1975)
■ durum wheat semolina	MIN: 10.5% on a dry basis	
■ whole durum wheat semolina	MIN: 11.5% on a dry basis	
■ durum wheat flour	MIN: 11.0% on a dry basis	
NUTRIENTS	Conform with Legislation of the Country in Which the Product is Sold	None Defined
■ vitamins		
■ minerals		
■ amino acids		

AOAC official methods

✿ Total Kjeldahl Nitrogen

Method	Matrix	Conversion factor
920.53	Beer	6.25
945.23*	Brewing sugars and syrups	6.25
920.103	Tea	6.25
920.87	Flour	5.7
979.09**	Grains	5.7 for wheat and its products, 5.18 for almonds, 5.46 for peanuts and brazil nuts, 5.30 for tree nuts and coconut, 6.38 for dairy products.
950.36**	bread	5.7
991.20	Milk	6.38
930.33***	Ice-cream and frozen desserts	6.38
920.152	Fruit products	6.25
981.10	Meat	6.25
950.48	Nuts and nuts products	5.18 for almonds, 5.46 for peanuts and brazil nuts, 5.30 for other tree nuts and coconut

- * procedure similar to 920.53
- ** procedure similar to 920.87
- *** procedure similar to 991.20

National Standard of P.R.C. (國家標準)

✿ GB/T 5009.5-2003 食品中蛋白質測定

氮換算為蛋白質的系數 (conversion factor):

一般食物為6.25; 乳製品為6.38; 麵粉為5.70;

玉米,高粱為6.24; 花生為5.46; 米為5.95;

大豆及其製品為5.71; 肉與肉製品為6.25;

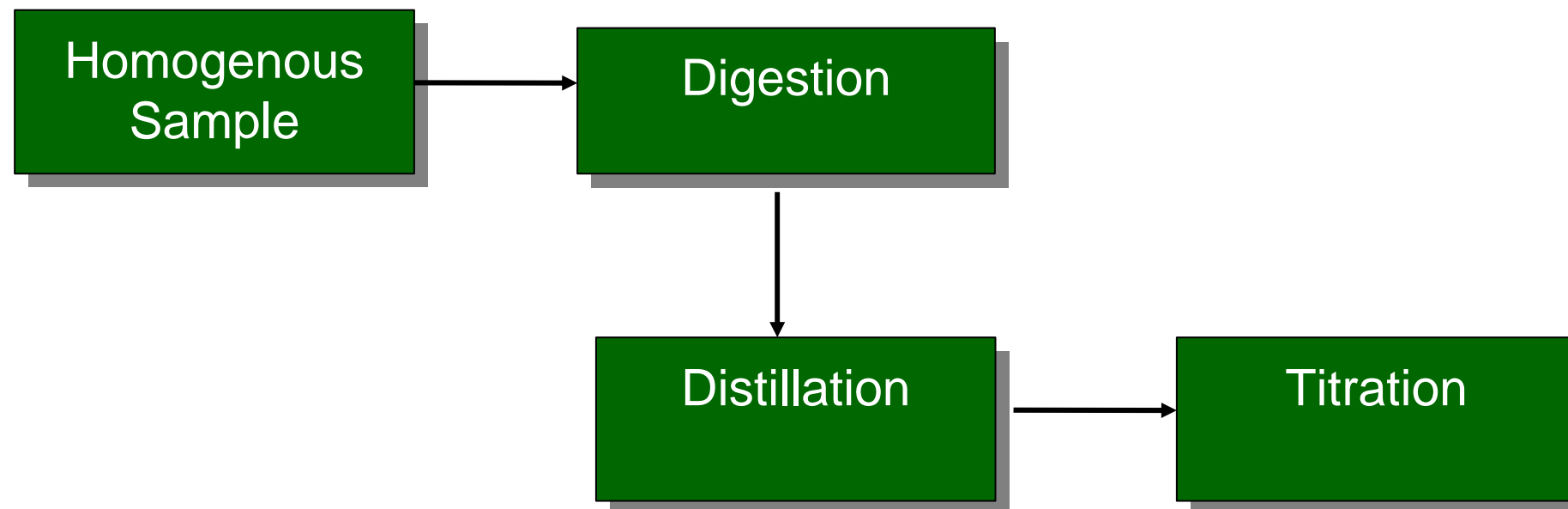
大麥,小麥,燕麥,裸麥為5.83; 芝麻,向日葵為5.30

FAO publication

✿ FAO Food and Nutrition Paper 14/7

Food	Factor	Food	Factor
<i>Cereals</i>		<i>Pulses, nuts and seeds</i>	
Wheat whole meal or flour	5.83	Groundnuts	5.46
Wheat flour (low or medium extraction)	5.70	Soya bean (all products)	5.71
Macaroni, spaghetti, wheat pastes	5.70	Almonds	5.18
Wheat bran	6.31	Brazil nuts	5.46
Rice (all products)	5.95	Coconut	5.30
Rye (all products)	5.83	Chestnuts	5.30
Barley (all products)	5.83	Seeds (sesame, safflower, sunflower)	5.30
Oats (all products)	5.83	Other seeds	5.30
<i>Milk and Dairy Products</i>		<i>Other Foods</i>	6.25
Milk (all-fresh or dry)	6.38		
Cheese (all)	6.38		
Butter (and margarines)	6.38		

Flow Chart for Total Kjeldahl Nitrogen



Sample

✿ Sample size

=> Definition of “0” \leq 0.5 g/100g

e.g. if sample contains 0.5% protein and the conversion factor = 6.25, 1 g sample contains $(1 \times 0.5\%)/6.25 = 0.0008$ g of N (~0.06 mMole) (0.6 ml x 0.1M HCl)

Digestion (1)

✿ Reagents:

i) conc. H_2SO_4

ii) Na_2SO_4 or K_2SO_4

iii) catalyst (e.g. $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, TiO_2)

Digestion (2)

- ✿ ratio of H_2SO_4 : Na_2SO_4 or K_2SO_4
2.5:1 (initial) → 1:1 (final)
- ✿ proportion of acid to salt affect temperature
 - Too much acid → incomplete digestion
 - Too little acid → loss N

Digestion (3)

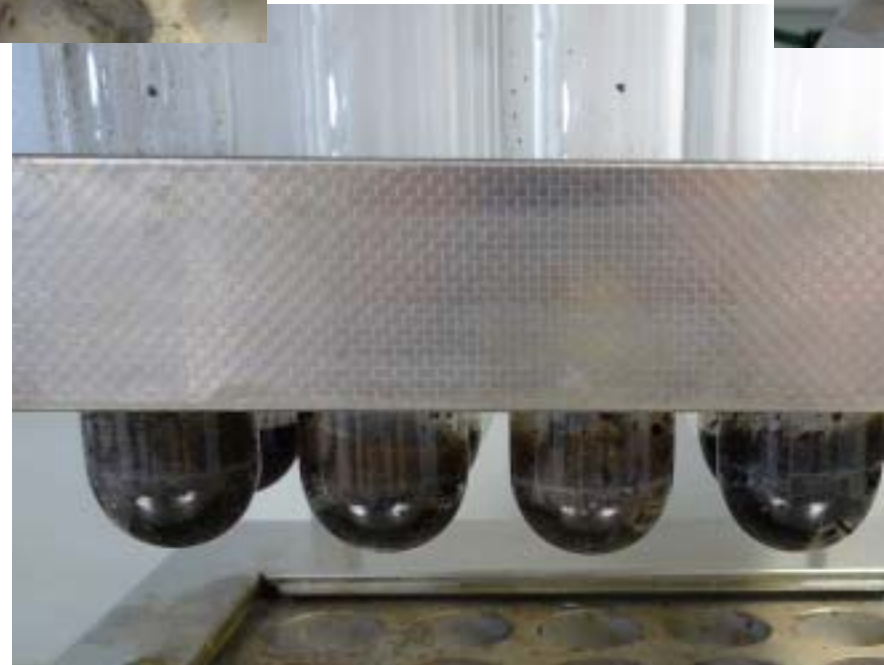
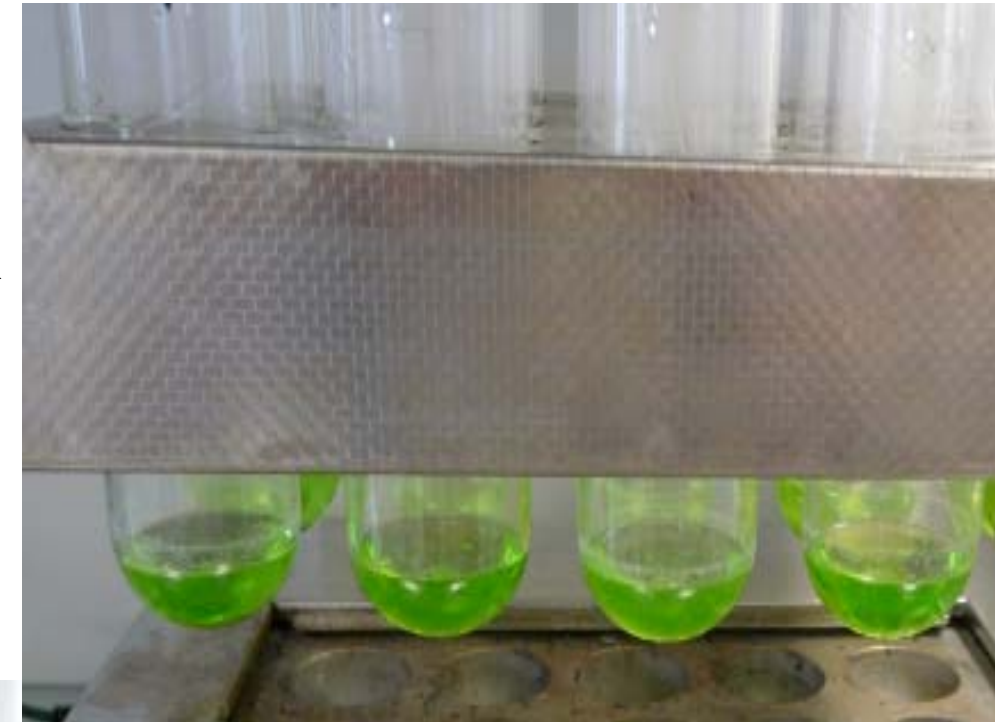
✿ Conditions

Temperature: ~420 °C

Time: ~2 hr

Appearance of final solution: **clear solution**

Digestion (4)



Distillation and Titration (1)

✿ Distillation

Add NaOH → strongly alkaline

Distill NH_3 into 1) standardized HCl or 2) boric acid

✿ Titration

1) with NaOH

2) with HCl

Distillation and Titration (2)

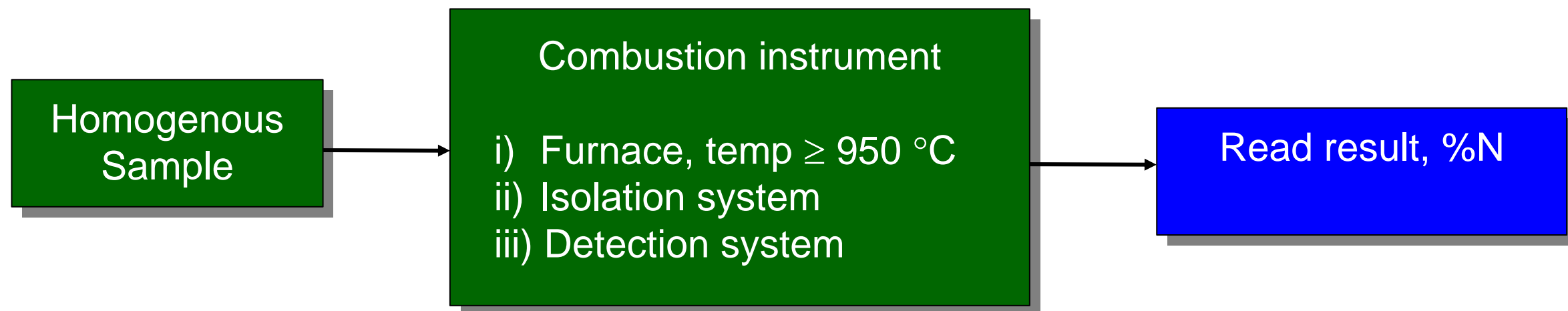


AOAC official methods

✿ Combustion

Method	Matrix
992.15	Meat and meat products
992.23	Cereal grains and oilseeds
997.09	Beer and brewing grains

Flow Chart for Combustion



Instrument requirement

- ✿ **Sample size : ≥ 200 mg**

- ✿ **Working range**

 - e.g. 0.5% to 60% protein \Rightarrow 0.08% to 10% N**

Combustion Instrument



Available proficiency test

✿ **FAPAS**

✿ **AOAC**

✿ **LGC**

CRM

✿ **NIST**

✿ **BCR**

✿ **LGC/ERM**

Thank You

