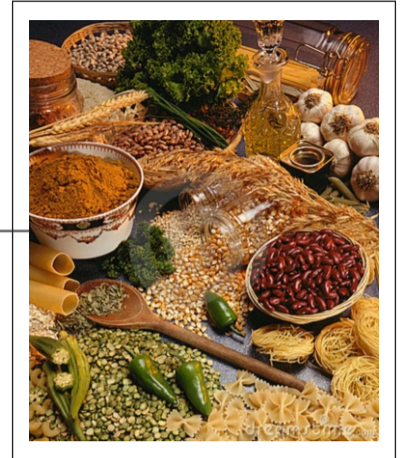


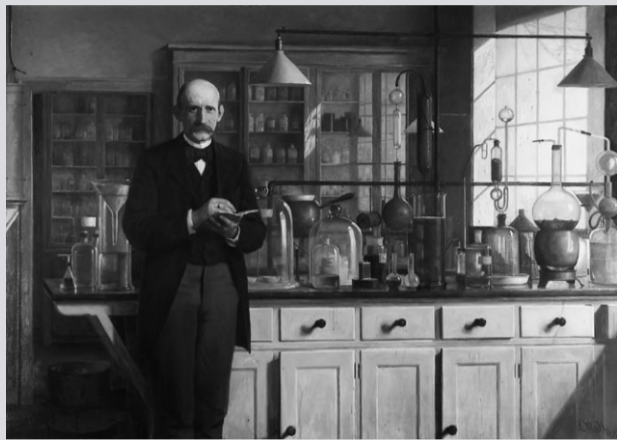
Kjeldahl

Digestion Units



Fully Automatic Digestion Units

Traditionally soils, sediments, sludge's, foods and other materials have been digested using Sulphuric acid in large round-bottomed flasks for Kjeldahl analysis. These were heated on heating mantles and notoriously took up a lot of room in the fume cupboard. In order to maximize the number of digestions in a given space, systems were designed to use tall straight Quartz digestion tubes in racks on a rectangular Aluminum heating block.



Johan Kjeldahl in his laboratory at Carlsberg Brewery in Copenhagen in the year 1880 (image by courtesy of Carlsberg Archives, Copenhagen)

The Kjeldahl method is the official method for determining nitrogen and protein contents in :

- Foods (Raw materials and finished products)
- Animal feeds
- Soils, Fertilizers, etc.
- Waste water, sludge, etc.
- Lubricants, fuel oils, etc

Kjeldahl Method:

Johan Kjeldahl a Danish Chemist in 1883 while studying the changes of protein content during the transformation of barley into malt process developed the method for determining Nitrogen which then took its name from him. Because of its high degree of precision, reproducibility and versatility, the Kjeldahl method is used today to determine content of Nitrogen and Proteins according to official methods. **(AOAC, EPA, DIN, ISO)** .

Seldom in human history has an invention remained basically unchanged for such a long time as Kjeldahl's method for Nitrogen determination.

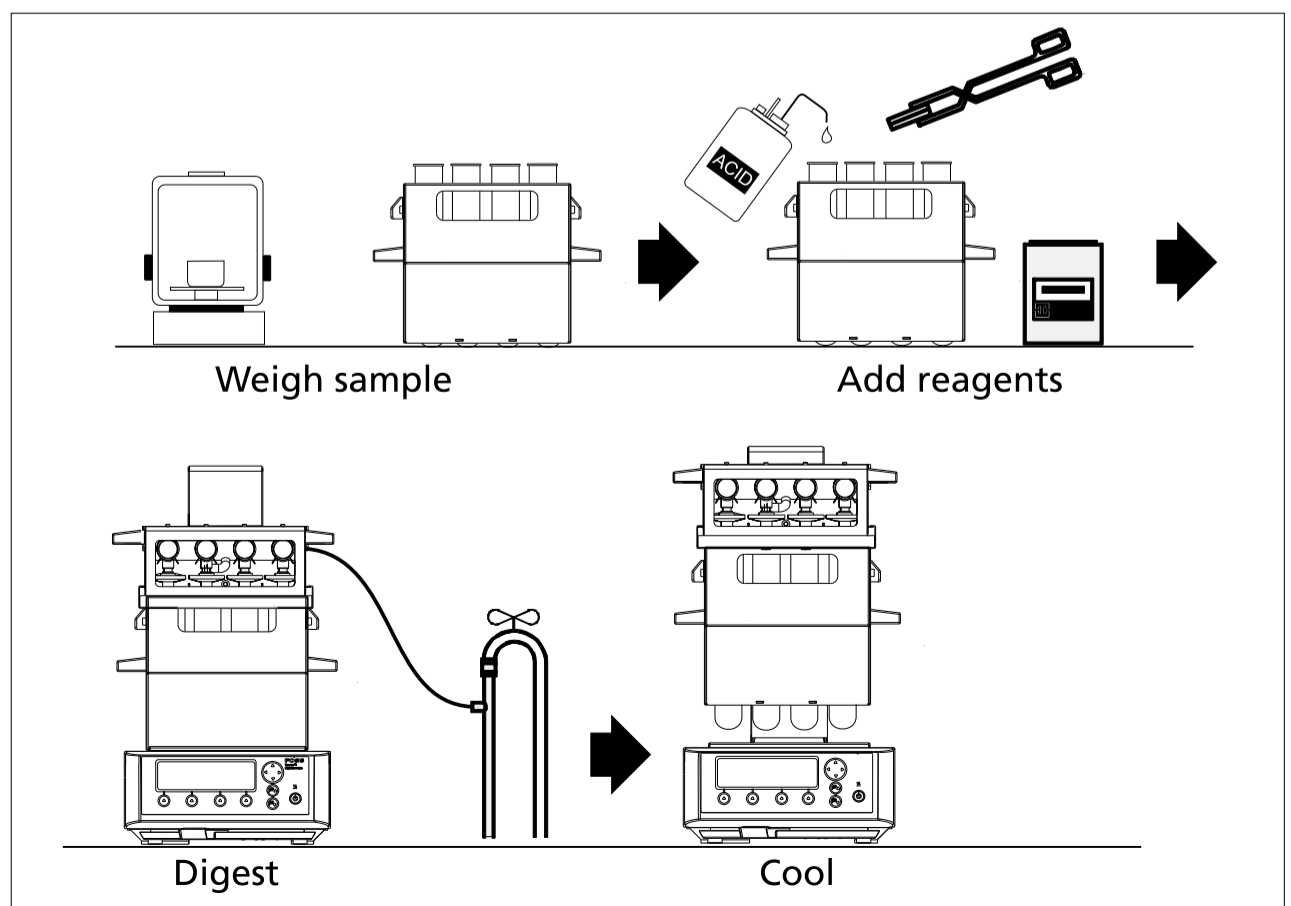
More than 90% of Protein containing samples and over 60% of all Nitrogen containing samples can be analyzed by using this basic procedure.

The food industry processes raw material in numerous ways and into many different products, from cheese and bakery products or ice cream production through to uses in meat processing or in the production of ready meals. Hence the overall protein content plays an important role both for the payment of raw material delivered and for determining the value of the product.

The Digestion Units are compact and well insulated to minimize heat transfer to the surroundings and allow fast, even heating thus giving good working conditions as well as saving energy.

The Digestion block consists of

- ▶ Aluminum block with holes for digestion of tubes. Energy efficient heater and ceramic insulation to retain heat inside the tube.
- ▶ Insert rack with handle for easy loading and removal of digestion tubes.
- ▶ Exhaust system with glass Manifold and water jet pump (glass filter pump).
- ▶ A console to hold the insert rack and exhaust manifold during cooling. This saves time and bench space.
- ▶ Digestion tubes 250 ml capacity (Quartz).
- ▶ Digestion PID Controller with auto tuning to obtain precise temperature.



The Kjeldahl digestion procedure

A comparison of acid consumption between a classical Kjeldahl system and block digester system.

	Block Digester	Classical Kjeldahl
Acid volume used	12 ml	25 ml
Loss by evaporation	1.2 ml	7.2 ml
Consumption by 1 g sample	3.6 – 7 ml	3.6 – 7 ml
Consumption by reagents	2.1 ml	4.2 ml
Remaining in digestion tube	1.7 – 5.1 ml	6.6 – 10.0 ml
Alkali volume used	40 ml	100 ml

The table shows 3 major advantages:

- Acid loss by evaporation is minimized.
- Volume of NaOH that needs to be added during distillation is reduced
- Exact temperature controller can be achieved.

Quartz Digestion tubes : Quartz Digestion tubes are excellent for use in Kjeldahl analysis. Unlike borosilicate glass, Quartz can withstand sudden heating and cooling. Quartz tubes can withstand temperatures up to 1000°C and hence boiling of Sulfuric acid at 420°C can be easily done without the fear of breakage.

Quartz is better resistant to sulfuric acid attack at elevated temperature than borosilicate glass.

Model number	BKL 4	BKL 6	BKL 8	BKL 12
Number of positions	4 x 250 ml	6 x 250 ml	8 x 250 ml	12 x 250 ml
Temperature range	Ambient to 450° C	Ambient to 450° C	Ambient to 450° C	Ambient to 450° C
Stability and precision of heating block temperature	+/- 1° C	+/- 1° C	+/- 1° C	+/- 1° C
Exhaust Mani fold	Yes	Yes	Yes	Yes
Sample rack	Yes	Yes	Yes	Yes
Test tubes	Yes	Yes	Yes	Yes
Electrical Requirements	230v 50Hz 1kw	230v 50Gz 1.5kw	230v 50Gz 2kw	230v 50Gz 3.5kw

Temperature indicator/ Controller



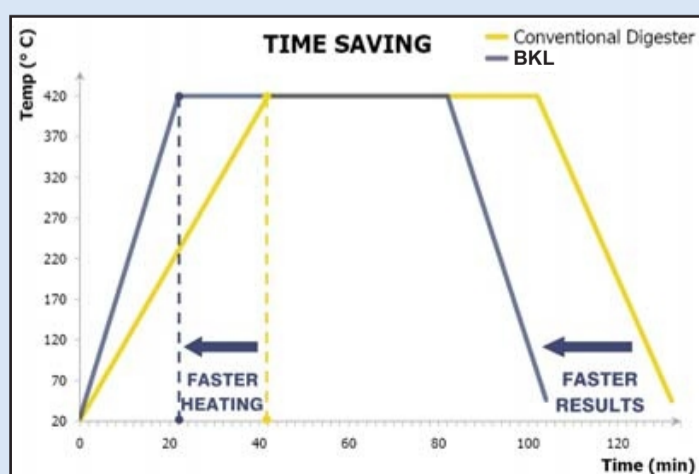
There are two types of PID Controllers used in Kjeldahl digestion systems.

One is the profile controller 10 programs each of 16 steps with Auto-tuning, memory retention, auto start etc. These are mainly used with Borosilicate glass vessels as these digestion tubes cannot be suddenly heated or cooled. These controllers can ramp the temperature in two or more temperature / time sequences.

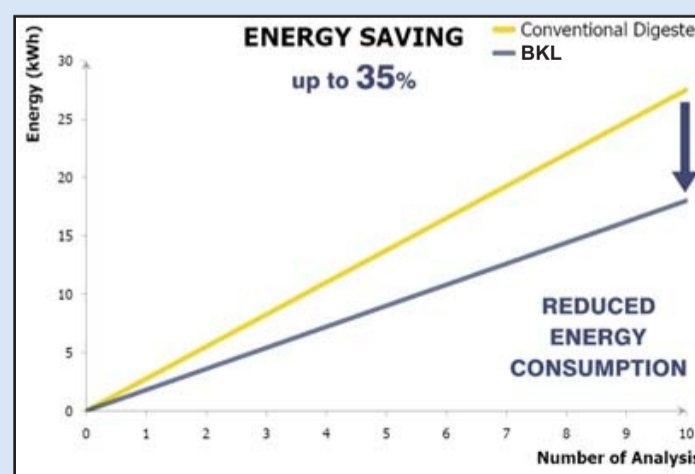
However most digestions require only the control of a single temperature and time for example 420°C for 60 minutes. In such case PID controller with auto tuning is used.

When Quartz digestion tubes are used PID controllers with auto tuning serves the purpose.

Programmable controller will be supplied at extra cost.



Time Saving with faster heating



Energy Saving as much as 35%

Ordering Information for Spare Parts

Digestion Units are delivered complete with one tube rack, exhaust Manifold, one set of Quartz tubes, rubber tubing, filter pump and electronic control unit.



Spares for Digestion Units

1)	Cat. No BKL / QT	Quartz Digestion Tubes 250 ml capacity	1 pc/pkt
2)	Cat. No BKL4/TR	Tube rack for 4 digestion tubes of 250 ml capacity	1 pc/pkt
3)	Cat. No BKL6/TR	Tube rack for 6 digestion tubes of 250 ml capacity	1 pc/pkt
4)	Cat. No BKL8/TR	Tube rack for 8 digestion tubes of 250 ml capacity	1 pc/pkt
5)	Cat. No BKL12/TR	Tube rack for 12 digestion tubes of 250 ml capacity	1 pc/pkt
6)	Cat. No BKL4/GM	Glass Manifold for 4 tubes with Teflon coupler	1 pc/pkt
7)	Cat. No BKL6/GM	Glass Manifold for 6 tubes with Teflon coupler	1 pc/pkt
8)	Cat. No BKL8/GM	Glass Manifold for 8 tubes with Teflon coupler	1 pc/pkt
9)	Cat. No BKL12/GM	Glass Manifold for 12 tubes with Teflon coupler	1 pc/pkt
10)	Cat. No BKL4/MR	Metal Rack for 4 tubes to hold glass manifold	1 pc/pkt
11)	Cat. No BKL6/MR	Metal Rack for 6 tubes to hold glass manifold	1 pc/pkt
12)	Cat. No BKL8/MR	Metal Rack for 8 tubes to hold glass manifold	1 pc/pkt
15)	Cat. No BKL12/MR	Metal Rack for 12 tubes to hold glass manifold	1 pc/ pkt
16)	Cat. No.BKL4/Stand	Stand to keep digestion tube rack	1 pc/pkt
17)	Cat. No.BKL6/Stand	Stand to keep digestion tube rack	1 pc/pkt
18)	Cat. No.BKL8/Stand	Stand to keep digestion tube rack	1 pc/pkt
19)	Cat. No.BKL12/Stand	Stand to keep digestion tube rack	1 pc/pkt
20)	Cat. No.BKL4/Stand (Manifold)	Stand to keep manifold rack	1 pc/pkt
21)	Cat. No.BKL6/Stand (Manifold)	Stand to keep manifold rack	1 pc/pkt
22)	Cat. No.BKL8/Stand (Manifold)	Stand to keep manifold rack	1 pc/pkt
23)	Cat. No.BKL12/Stand (Manifold)	Stand to keep manifold rack	1 pc/pkt

• Glass filter pump – 1 pc/pkt • Rubber tubing - 1 pc/pkt

COD Module for COD Digestion

- 1)BKL 4/ COD – Consisting of 4 test tubes of Borosilicate glass with air condenser of 750 mm long with ground glass joint and holding rack.
- 2)BKL 6/ COD – Consisting of 6 test tubes of Borosilicate glass with air condenser of 750 mm long with ground glass joint and holding rack.
- 3)BKL 8/COD – Consisting of 8 test tubes of Borosilicate glass with air condenser of 750 mm long with ground glass joint and holding rack.
- 4)BKL 12/ COD– Consisting of 12 test tubes of Borosilicate glass with air condenser of 750 mm long with ground glass joint and holding rack.

Sparers : • Borosilicate test tube - 1 pc/pkt • Air Condenser - 1 pc/pkt

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