

Kjeldahl Solutions



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Kjeldahl Solutions: A smart concept for maximum flexibility

Steam distillation is a key step in analytical processes in a broad range of laboratories. BUCHI Kjeldahl Solutions are a flexible concept which reflects this variety and supports analytical labs in solving their specific analytical problems. A comprehensive package of support and services rounds off the offering.

The basic elements of BUCHI Kjeldahl Solutions

- **Integrated workflow package**
 BUCHI offers Kjeldahl instrumentation for the entire analytical process, from sample preparation and digestion to distillation and analytical determination. Matching components can thus be combined to create a complete, highly efficient system.
- **Full range of products**
 Digestion and distillation are universal techniques that are used in a variety of applications. The BUCHI Kjeldahl product range is specially designed to match this versatility, also including instruments allowing for different degrees of automation.
- **Accessories for specific applications**
 BUCHI instruments are designed to work in accordance with methods such as AOAC, EPA, ISO, and DIN. Specific accessories, for example for the determination of COD, for the Devarda method, or for sulfuric acid digestion with hydrogen peroxide broaden the field of potential applications.
- **Support and technical competence**
 BUCHI customers can count on dependable, robust and safe instruments. BUCHI has been a reliable partner for Kjeldahl applications for more than 40 years. Highly trained support and service specialists assist customers wherever they are. During all this time, BUCHI has maintained a leading position in glassware technology – a core element of Kjeldahl and related lab procedures.

The Kjeldahl integrated workflow package

BUCHI provides Kjeldahl Solutions and support for the entire analytical workflow, from sample preparation to quantification. Depending on sample throughput, varying degrees of instrument integration and automation may be selected.

■ Sample preparation

Some applications require sample preparation prior to digestion and distillation. With a powerful mixer, non-homogeneous substances can be minced or crushed and homogenized to provide a representative sample.

■ IR Digestion/Block Digestion

Digestion systems are used to convert nitrogen containing substances (e.g. proteins) in a sample (e.g. milk) into the appropriate form of nitrogen. Beyond classical Kjeldahl digestions, additional applications such as the determination of COD (Chemical Oxygen Demand) can be carried out with the block digestion system.

During the digestion process, acid fumes and reaction gases may emerge. A scrubber is connected to the digestion system for neutralizing acid fumes and adsorbing unpleasant odors.



■ Mixer B-400

IR Digestion:

■ SpeedDigester K-425/436

■ SpeedDigester K-439

Block Digestion:

■ Digest System K-437

■ Digest Automat K-432/438



Scrubber B-414

Compatible rack for up to 20 samples

Connection and data transfer

■ **Distillation**

Digested samples can be processed directly in one of BUCHI's high-efficiency distillation units. The range of applications includes classical Kjeldahl tasks such as TKN (Total Kjeldahl Nitrogen) or Devarda as well as the direct distillation of other volatile components such as alcohol, sulfur dioxide, phenol, volatile acids, TVBN (Total Volatile Basic Nitrogen), formaldehyde and cyanide.

■ **Titration**

Reflecting different automation requirements, some distillation units actually combine the distillation step with the determination, for example by titration. The product range features an expandable distillation unit with the option of connecting it with a titrator of your choice as well as an automated unit with integrated titration.

■ **Integration and automation**

Depending on their sample throughput, users may require extra integration and a greater degree of automation. Automation and integration solutions from BUCHI are designed to meet the requirements of demanding customers in terms of convenience and time savings.



■ Distillation Unit K-350

■ Distillation Unit K-355

■ ■ KjelFlex K-360

■ ■ ■ AutoKjeldahl Unit K-370
(with integrated titration and data management)

■ ■ Digest Automat K-432/438
(for fully unattended operation)

■ ■ KjelFlex K-360
(option of connecting external titrator)

■ Autosampler K-371
(for automated sample changing)

Compatible rack for up to 20 samples

Versatility for a broad range of applications

The Kjeldahl method for the determination of organic nitrogen is the worldwide standard for calculating the protein content in food, beverages and animal feed. Additionally, Kjeldahl has been adapted to serve as the standard method of nitrogen analysis in environmental applications and the pharmaceutical, agricultural and chemical industries.

■ **In food processing:**

protein, TVBN (Total Volatile Basic Nitrogen), sulfur dioxide, hydroxyproline

■ **In analysis of beverages:**

protein, alcohol, volatile acids, sulfur dioxide

■ **In the feed industry:**

protein

■ **For environmental applications:**

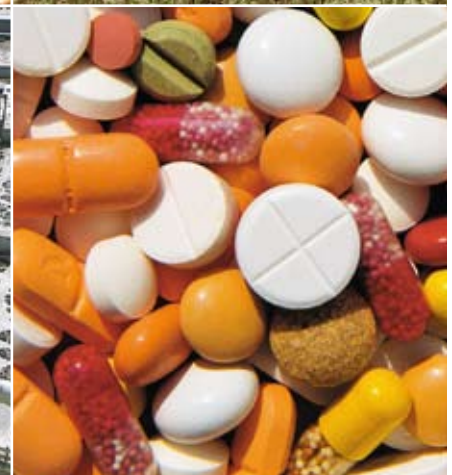
ammonia, TKN, phenol, COD, Devarda, heavy metals

■ **In agricultural laboratories:**

ammonia, nitrate, total nitrogen, Devarda

■ **In the pharmaceutical and chemical industry:**

organic nitrogen, ammonia, urea



■ Mixer B-400

Optimum sample preparation

- Crushes and homogenizes at the same time
- Reproducibility of the analysis improved
- Sample prepared in only a few seconds

The Mixer B-400 is suitable for samples with high water content such as vegetables, fruits or ready-to-serve meals, samples with high fat content such as meat, sausages or fish, and samples with high fiber content such as animal feed and green fodder.

■ SpeedDigester K-425/436

Cost-optimized flexibility

- Short warm-up time thanks to IR heater
- Flexibility thanks to use of 300 and 500 ml sample tubes

This practically proven digestion system provides space for 6 or 12 samples in 300 ml sample tubes or 5 or 10 samples in 500 ml sample tubes.

All samples are heated evenly, an aspect that guarantees optimal boiling characteristics and ensures that even samples with a tendency to foam can be digested without problems.

■ SpeedDigester K-439

Perfect reproducibility

- Short warm-up time thanks to IR heater
- Maximum reproducibility thanks to temperature control
- Increased ease of use thanks to LC display and method memory
- Use of 300 and 500 ml sample tubes

This digestion system provides space for 12 samples in 300 ml sample tubes or 10 samples in 500 ml tubes.

The SpeedDigester K-439 is the first IR digestion system on the market with integrated temperature control. For this reason it is possible to program temperature/time ramps. In addition, IQ/OQ documents are available for qualification.



■ ■ Digest System K-437

A complete device for the safe digestion of up to 20 samples simultaneously. The sample tubes are evenly heated and all the acid fumes collected with the aid of the optional Scrubber B-414. Digestion temperature and time can be entered and read on the display at all times.

- Undertake standard Kjeldahl digestions on 20 samples in 300 ml sample tubes simultaneously
- Simple operation
- Indication of the exact temperature during digestion
- Countdown time indicator
- Sample tubes made of high quality BUCHI glassware

■ ■ Digest Automat K-432 and K-438

The models K-432 and K-438 are additionally equipped with an automatically controllable lift for raising and lowering sample tubes, methods can also be programmed and saved. These features make possible fully automatic digestion processes. Temperature profiles can be entered for problematic samples (e.g. risk of foaming). By connecting to the AutoKjeldahl Unit K-370, the digestion process can be controlled via the K-370, the digestion data saved and printed out.

- Increased convenience on the digestion of up to 12 samples in 500 ml sample tubes (K-432) or 20 samples in 300 ml sample tubes (K-438)
- Practical lift for automatically raising and lowering the sample rack
- Temperature profile with 4 temperature steps
- Data transfer to K-370
- Working memory for 9 programs for different sample types
- Built-in clock to start the digestion at a previously defined time

**Digest System
K-437**



**Digest Automat
K-432**



**Digest Automat
K-438**



☒ Suction Module

Suction module for digestion with H₂O₂ for use with SpeedDigester

- Cuts digestion time by 50 %
- Environmentally friendly since a heavy metal catalyst is not necessary



☒ Reflux Digestion Set

The Reflux Digestion Set is used with the SpeedDigester for the recovery of heavy metals or determination of hydroxyproline

- Efficient reflux
- No loss of volatile compounds



☒ Scrubber B-414

Exhausts and neutralizes acid fumes and reaction gases in an environmentally friendly way

- High suction output thanks to the powerful pump (33 l/min.)
- 3 liter volume of scrubbing solution
- Flexible, allowing a wide range of applications
- High neutralization efficiency thanks to large gas/liquid contact area
- Neutralization possible with both alkalis and acids
- Modular construction

Using the Scrubber B-414, acid fumes and reaction gases generated during the Kjeldahl analysis or other processes can be neutralized safely without harming the environment. The device operates without a water jet pump and minimizes tap water consumption. There are different options enabling you to adjust the unit to your own requirements. The enclosed construction guarantees maximum safety at work.



☒ COD Accessory

The COD Accessory is used in conjunction with the K-437 or K-438 block digestion system for the determination of chemical oxygen demand.

- Thermal stability +/- 2 °C up to 200 °C
- Countdown time indicator
- COD determination in accordance with official methods, e.g. DIN or ISO
- Simple operation
- Easily observable process



▣ Recirculating Chiller F-100

Efficient cooling in the lab – as easy to use as tap water

- Environmentally friendly and economical, saving up to 300 liters of water a day when used in conjunction with a distillation unit
- Higher process safety and lower emissions thanks to the constant, low cooling temperature
- Robust design with stainless steel housing, for use in harsh lab environments

The most common coolant used in laboratories is tap water. However, water is a valuable resource. The Recirculating Chiller F-100 is a cost-efficient device which is the basic unit in the BUCHI Chiller line. It cools to a fixed temperature of 10 °C, and is ideal for use with one distillation unit. The compact design and the integrated wheels enable it to be moved around very easily.



■ Distillation Unit K-350

Easy-to-use distillation unit for classic Kjeldahl applications

- Compact stand-alone unit taking up minimal space
- Alkali resistant plastic housing
- Integrated timer
- High performance steam generator
- Protective door, sample tube and service door sensor
- Service door (front access)

The K-350 is the cost-effective solution for fast and reliable nitrogen determination in accordance with standard methods.

Applications

- Organic nitrogen and protein determination according to Kjeldahl
- Devarda nitrogen determination
- TKN determination



■ Distillation Unit K-355

Versatile Kjeldahl distillation unit for a wide range of applications

- Compact stand-alone unit taking up minimal space
- Alkali-resistant plastic housing
- Integrated timer
- Acid-resistant pump
- High performance steam generator
- Electronic steam regulation
- Protective door, sample tube and service door sensor
- Service door (front access)

In addition to classic applications, the K-355 enables all kinds of steam distillation options, including methods which require reduced steam output. A reliable and acid-resistant pump even allows applications where the dosage of strong acids is required.

Applications

- The same applications as for the K-350

In addition:

- Alcohol distillation
- Determination of sulfur dioxide
- Phenol distillation
- Determination of volatile acids
- Cyanide determination
- Formaldehyde determination
- TVBN (Total Volatile Basic Nitrogen) in fish



■ ■ ■ KjeldFlex K-360

Modular and flexible

- Automatic emptying of sample tube and receiving vessel after distillation/determination
- Integrated boric acid, sodium hydroxide, and water pump (optional: acid resistant pump)
- Electronic steam regulation
- Password protection
- Memory function for 500 results

The device can be expanded

- by connecting an external titrator to an automated system.
- by connecting an acid resistant pump for Non-Kjeldahl applications.

Applications

- Determination of organic nitrogen and protein according to Kjeldahl
- Devarda nitrogen determination
- Determination of other steam-volatile components (e.g. SO₂, phenol, formaldehyde)
- TKN determination

Options

- Level sensors for monitoring the different tanks
- Titration set
- Acid resistant pump
- External dosage device for back titration



■ ■ ■ Kjeldahl Sampler System K-370/K-371

K-370 – The total solution with integrated titration

- Compact stand-alone unit, state-of-the-art design
- Accurate and highly reproducible results
- Rapid installation on standard lab benches
- Electronic steam regulation
- Easy-to-read control panel with integrated keyboard
- Multitasking software
- Straightforward data transfer to PC
- High levels of safety
- Memory for up to 10,000 results

The K-370 is the most convenient solution available for labs with a large sample throughput. The K-370's multitasking software enables you to simultaneously carry out measurements, prepare new measurements or print out results.

Applications

- Kjeldahl nitrogen and protein determination
- Devarda nitrogen determination
- TKN determination

Options for K-370

- Level sensors for monitoring chemical and waste tanks
- External dosage device for back titration
- External keyboard
- Automated sample changing in combination with the Autosampler K-371

The innovative Autosampler K-371

- Rack with space for 20 sample tubes, compatible with Digest System K-437 and Digest Automat K-438
- Express rack with space for 4 sample tubes
- Unique sample transfer technique

The K-371, controlled via the AutoKjeldahl Unit K-370, enables you to work efficiently and save precious time. The sampler features an innovative, robust sample changing mechanism that uses steam to transfer samples to the distillation unit. Carefully selected, chemical-resistant materials and numerous safety features (e.g. safety shield and a collision detection system) ensure optimum protection for users.



System preconfigurations

The choice of the optimum Kjeldahl system depends on the specific application, your workflow and your sample throughput. Kjeldahl Solutions offer a variety of configurations reflecting these different needs. The following are examples of possible combinations:

Option 1



Basic Kjeldahl Distillation Unit

for rapid determination of single samples

- Distillation Unit K-350
- SpeedDigester K-425 for up to 6 samples

Option 3



Flexible Distillation System

for routine determination

- KjelFlex K-360 (titrator connection)
- SpeedDigester K-436 for up to 12 samples
- Scrubber B-414

Option 4



Semi-automatic Distillation System

with programmable digestion:
for daily routine determination

- KjelFlex K-360 (titrator connection)
- SpeedDigester K-439 for up to 12 samples
- Scrubber B-414

Option 2



Distillation Unit

for universal use (Kjeldahl and Non-Kjeldahl).

- Distillation Unit K-355



Alternative:

- Digest System K-437 for up to 20 samples (instead of K-436)



Alternative:

- Digest Automat K-438 for up to 20 samples and lifting module (instead of K-439)

Option 5



Most convenient Distillation System

with integrated titration and data management:
for daily routine determination with high sample throughput

- *AutoKjeldahl Unit K-370 with integrated titration and data management*
- *Digest Automat K-438 for up to 20 samples and lifting module*
- *Scrubber B-414*

Option 6



Kjeldahl Sampler System

Fully automated distillation system for maximum productivity

- *AutoKjeldahl Unit K-370 with integrated titration and data management*
- *Autosampler K-371 for automated sample changing*

Option 7



Scrubber

for neutralization of acid fumes and adsorption of reaction gases and bad odors

- *Scrubber B-414*

BUCHI Services

At BUCHI, customer service does not stop with a sale - our top priority is to maintain solid, long-term customer relationships. Our global competence centers all over the world are therefore an integral part of our after-sales support service. Our experienced application chemists will gladly assist you wherever you might need help.

Competent service is an integral part of Kjeldahl Solutions – anywhere in the world and at a consistently high level. Wherever your company may be located, our specialists will always gladly help you solve your problems, answer your questions or assist you in compliance issues.

From the initial feasibility study to applications and service support, you will be backed up by a team of highly qualified specialists who will give you expert assistance with the evaluation and operation of your BUCHI Kjeldahl product. Our specialists will help you whenever

necessary, either locally at your laboratory or in our applications test laboratories. Whether your laboratory is involved in quality control or other types of analytical work, you will be able to fulfill your role in line with all the relevant norms – efficiently and reliably.



Support from the IQ/OQ process: qualification made easy

Laboratory instruments are now qualified to an increasing degree, as only then can it be ensured that applicable directives or standards (GLP/GMP) are met. To ease the qualification procedure and to avoid the need for every user to become involved in the detailed preparation of the necessary documentation, BUCHI offers complete qualification packages.



Complete, comprehensive IQ/OQ documentation

With the Installation Qualification (IQ), you can be assured that your instrument has been correctly installed and supported by thorough documentation. The Operational Qualification (OQ) is performed and documented, so that you can be confident that your instrument operates according to a pre-defined operational quality check procedure.

Qualified specialists are available

The training of the BUCHI Kjeldahl experts who work in competence centers around the world is a continuous process. This ensures that your specialist is an expert in the execution of the qualification procedure.



BUCHI provides laboratory equipment for research and discovery labs and analytical instruments for quality control – worldwide. All our products embody our philosophy of “Quality in your hands”. We strive to meet the needs of our customers to the highest degree by developing products and solutions that are robust, cleverly designed, convenient and easy to use.



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Quality in your hands

