

Guidelines for choosing the correct Velp Kjtabs in Kjeldahl Analysis

Kjeldahl Catalyst and Antifoam Tablets

Reference: Soya beans and lupins: **AOAC, method 920.87 (945.39 and 979.09)**; Animal feed; **AOAC 984.13**; Milk and derived products: **AOAC 991.20, IDF 20, 20-1, ISO 8968-1:2014**

Tested with

VELP Scientifica DKL 20 Automatic Digestion Unit (Code S30100210)

KS 1000 Scrubber (Code F307A0660)

UDK 169 Automatic Kjeldahl Nitrogen Protein Analyzer (Code F30200165)



Introduction

The Kjeldahl method consists of a procedure of catalytically supported mineralization of organic material in a boiling mixture of sulfuric acid and sulfate salt at digestion temperatures higher than 400 °C.

During the process, the organically bonded nitrogen is converted into ammonium sulfate. Alkalizing the digested solution liberates ammonia which is quantitatively steam distilled and determined by titration.

The digestion phase is the most time-consuming step of the Kjeldahl analysis. Speeding up the process and ensuring a proper outcome is of fundamental importance when it comes to efficiency in the laboratory.

In the digestion phase of the Kjeldahl analysis, the goal is to break down the bonds that hold the polypeptides together and convert them into simpler molecules (such as water, carbon dioxide and ammonium sulphate). These reactions can be speeded up by the temperature used during digestion and by the presence of acid, salt and **catalysts**.

In order to improve the performances of the digestion units in relation to a wide range of analytical applications, VELP designed seven different types of accurately pre-dosed **KjTabs™** tablets (details in the table below) to speed up the mineralization process and drastically reduce foam formation. Along with catalysts, VELP produces antifoaming **KjTabs™** to reduce foam formation during the initial phase of the mineralization process.

VELP KJTABS	COMPOSITION	TYPICAL APPLICATIONS
KjTabs™ VCM Catalyst A00000274	3,5 g K ₂ SO ₄ + 0,1 g CuSO ₄ x 5 H ₂ O	Protein determination: nut products, meat products, grains and cereals, flour (soya beans and lupins), yeast, sugar, syrup, molasses, pasta, egg. Nitrogen determination in urea, water, raw natural rubber and rubber latex
KjTabs™ VKPC Catalyst A00000275	4,5 g K ₂ SO ₄ + 0,5 g CuSO ₄ x 5 H ₂ O	Protein determination in bread and baked products
KjTabs™ VCT Catalyst A00000276	5 g K ₂ SO ₄ + 0,15 g CuSO ₄ x 5 H ₂ O + 0,15 g TiO ₂	Nitrogen determination in milk and dairy products
KjTabs™ VST Catalyst A00000277	3,5 g K ₂ SO ₄ + 3,5 mg Se	Protein determination in beer and malt. Nitrogen determination: soils, plants, forage, straw and fertilizers, engine oils, crude oil, lubricating oils and fuel oils
KjTabs™ VTCT Catalyst A00000281	3,5 g K ₂ SO ₄ + 0,105 g CuSO ₄ x 5 H ₂ O + 0,105 g TiO ₂	Nitrogen determination in milk and dairy products
KjTabs™ VW Catalyst A00000282	4,875 g K ₂ SO ₄ + 0,075 g CuSO ₄ x 5 H ₂ O + 0,050 g Se	Nitrogen and Protein determination in animal feed and pet food, forage and feedstuffs, grain, and oilseeds
KjTabs™ VS Antifoaming A00000283	0,97 g K ₂ SO ₄ + 0,03 g Silicone	Antifoam used for foam reduction

The use of VELP **KjTabs**[™] compared to the use of powders allows to:

- reduce operator time as the catalyst tablets are ready to use
- have a higher level of repeatability in each batch of reaction (reduced operator errors)
- guarantee a low risk for the operator's health (powders are volatile and metal catalysts are not always safe)

Sample preparation

Solid substances such as soybean and feed need to be homogenized and handled as described in the official methods. This step is aimed to allow an easier digestion and to improve sample homogeneity.

	Nitrogen% expected value	Protein% expected value
Soybean	7.25	45.3% (protein factor 6.25)
Feed	2.22	13.9% (protein factor 6.25)
Liquid milk	0.53	3.4% (protein factor 6.38)

Kjeldahl Method: DKL 20 and UDK 169 Procedure Sample Digestion

Place the sample (0.5g for soybean, 1.0g for feed and 5ml for liquid milk) into a 250 ml test tube (Code A00000144). In each test tube add:

- 2 catalyst tablets **KjTabs**[™]
- 2 antifoam tablets **KjTabs**[™] VS (code A00000283)
- 20 ml concentrated sulphuric acid (96-98%)

The following **KjTabs**[™] were used for different types of digestions comparison:

- **KjTabs**[™] VCM (code A00000274)
- **KjTabs**[™] VST (code A00000277)
- **KjTabs**[™] VTCT (code A00000281)

Prepare some blanks with all chemicals and without samples.

Connect the Digestion Unit to a fumes neutralization system (**KS 1000 Scrubber** code F307A0660) to neutralize the acid fumes created during the digestion phase.

Digest the samples setting the following ramps depending of the sample as described in the official methods: "Soya beans and lupins", "Animal feed" and "Milk and derived products".

Distillation and Titration

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

Condition the **UDK 169** unit by performing the Automatic checkup in Menu-System and a Wash down.

Distil the samples by selecting the following method depending on the sample: "Soya beans and lupins", "Animal feed" and "Milk and derived products".

A 0.2N titrant solution was used for the soybean samples. 0.1 N for feed and liquid milk samples.

Results

The tables below show the results obtained by analyzing the different substrates using the different **KjTabs™**.

Soya bean	KjTabs™ VCM*	KjTabs™ VST*	KjTabs™ VTCT*	Expected average %P value
Average ± SD%	45.473 ± 0.168	44.799 ± 0.268	45.411 ± 0.249	45.3
RSD%**	0.369	0.598	0.548	

Feed	KjTabs™ VCM*	KjTabs™ VST*	KjTabs™ VTCT*	Expected average %P value
Average ± SD%	14.075 ± 0.129	13.956 ± 0.096	14.021 ± 0.108	13.9
RSD%**	0.918	0.689	0.767	

Liquid milk	KjTabs™ VCM*	KjTabs™ VST*	KjTabs™ VTCT*	Expected average %P value
Average ± SD%	3.421 ± 0.011	3.364 ± 0.025	3.405 ± 0.006	3.4
RSD%**	0.322	0.730	0.176	

(*) Average ± standard deviation (5 runs)

(**) RSD% = Relative Standard Deviation

Conclusion

The obtained results are reliable and reproducible in accordance with the expected values, with a low relative standard deviation (RSD < 1%), which means high repeatability of the results.

The main differences between the KjTabs™ catalytic tablets concern the analysis of samples with a high nitrogen and protein content, such as soybeans, and samples with a low nitrogen and protein content, such as the liquid milk [%P=45.3% and %P=3.4% respectively].

Using the correct **KjTabs™** it is possible to obtain values closer to those expected and with a smaller relative standard deviation (RSD%). In fact, for the milk sample, the values obtained with the **KjTabs™ VTCT (suggested for nitrogen determination in milk and dairy products)** are the best among the conditions tested. The same happens for the soya bean, where **KjTabs™ VCM (indicated for universal application including soya beans and lupins)** reports values with the best relative standard deviation (RSD%).

Therefore, choosing the right catalyst tablets is essential to obtain correct and highly accurate results. In particular, when the amount of protein inside the sample is high or very low, the use of the correct catalyst makes the difference in terms of result quality.

Contact the **VELP Analytical Team** to learn more and discover the most suitable **KjTabs™** for your application.