

SpeedDigester K-425, KjelMaster K-375:  
Nitrogen Determination in Tobacco according to the Kjeldahl Method

It is considered that flavour and taste of smoke is correlated with the nitrogenous constituents. According to Indian Central Tobacco Research Institute (CTRI) flue-cured tobacco containing 1.6 to 2.3 % total nitrogen gives the most satisfying smoke, whereas the acceptable limit of total nitrogen is 1.0-3.0 %.

High level of nitrogen in tobacco is associated with a high level of nicotine. A low nitrogen content would result in 'washed out', pale coloured leaf, lacking in rich colour characteristic of good tobacco. Therefore, the determination of total nitrogen is an important quality control measure in the tobacco industry [1].

Here, the determination of nitrogen in tobacco is performed using the SpeedDigester K-425 and KjelMaster K-375.

### 1. Introduction

It is generally considered that flavour and taste of smoke is correlated with the nitrogenous constituents. Flue-cured tobacco containing 1.6 to 2.3 % total nitrogen gives the most satisfying smoke. The acceptable limit of total nitrogen is 1.0-3.0 %. Apart from curing difficulty, tobacco with a nitrogen content higher than 3.0 % would result in deep brown coloured trashy leaf which shatters readily and has flat, insipid tasting smoke.

To determine the nitrogen content, the samples require digestion with sulfuric acid to convert nitrogen into ammonium sulfate. After conversion to ammonia through the alkalization with sodium hydroxide, the sample is distilled into a boric acid receiver by steam distillation, followed by a titration with sulfuric acid solution.

### 2. Experimental

**Equipment:** SpeedDigester K-425, KjelMaster K-375 Scrubber K-415 TripleScub.

**Sample:** Tobacco from Indian local market.

**Determination:** Experiment was carried out on different days to check the reproducibility. The samples were added directly into a sample tube as described in Table 1. Two Titanium Tablets and a tip of a spatula of stearic acid to each sample were added. Then 20 mL of sulfuric acid (conc. 98 %) were added. The digestion was performed using the K-425, applied by the parameters specified in Table 2.

Table 1: Weight of Tobacco sample.

Tobacco	mSample [g]	Tobacco	mSample [g]
Sample 1	0.6113	Sample 4	0.6339
Sample 2	0.6077	Sample 5	0.6287
Sample 3	0.6122	Sample 6	0.6331

Table 2: Temperature profile for digestion with the K-425.

Step	Heating Level	Time [min]
Preheating	4	10
1	4	10
2	7	110
Cooling	-	30

After digestion the ammonia of the sample was distilled into a boric acid solution by steam distillation and titrated with sulfuric acid (Table 3) performed by the KjelMaster K-375.

Table 3: Parameters for distillation and titration with the KjelMaster K-375.

H <sub>2</sub> O volume	50 mL	Receiving solution vol.	60 mL
NaOH volume	110 mL	Titration solution	H <sub>2</sub> SO <sub>4</sub> 0.5 mol/L
Reaction time	5 s	Titration mode	Standard
Distillation mode	Fixed time	Titration start time	0 s
Distillation time	240 s	End point pH	4.65
Stirrer speed distillation	5	Stirrer speed titration	7
Steam output	100 %	Titration algorithm	Optimal

### 3. Results

The results of nitrogen determination are presented in Table 3.

Table 3: Results of the nitrogen content in tobacco.

Tobacco	mSample [g]	VSsample [mL]	%N
Sample 1	0.6113	1.316	2.84
Sample 2	0.6077	1.337	2.91
Sample 3	0.6122	1.340	2.89
Average [%]	-	-	2.88
Rsd [%]	-	-	1.2

The mean blank volume (VBlank) was 0.075 mL (n = 3)

Reproducibility of results checked by performing same experiment with same sample on another day.

Table 4: Results of the nitrogen content in tobacco

Tobacco	mSample [g]	VSsample [mL]	%N
Sample 4	0.6339	1.418	2.82
Sample 5	0.6287	1.427	2.86
Sample 6	0.6331	1.408	2.80
Average [%]	-	-	2.82
Rsd [%]	-	-	1.1

The mean blank volume (VBlank) was 0.144 mL.

### 4. Conclusion

The determination of nitrogen in tobacco using the SpeedDigester K-425 and KjelMaster K-375 provides reliable and reproducible results with low relative standard deviations (Rsd).

### 5. References

- [1] Central Tobacco Research Institute;  
[http://www.ctri.org.in/for\\_quality.php](http://www.ctri.org.in/for_quality.php).