Application News

No. O66

Quality Control of Vinegar by TN Measurement

Measurement of the TN (total nitrogen) concentration in a food can make available information on the concentrations of nitrogen compounds within that food, such as proteins and amino acids. Vinegar is a cooking ingredient which is made from materials such as grains or fruit, and the amount of proteins and amino acids that originate from such materials greatly affect the taste of the vinegar. It is therefore possible to check the quality of vinegar with the concentration of proteins and amino acids by TN measurement.

The Kjeldahl method, which is widely used to measure the amount of proteins in food, requires multiple reagents to treat each sample as well as processes such as digestion and distillation.

Measurements therefore require work by operators for over several hours. The TNM-L total nitrogen unit for Shimadzu total organic carbon analyzer utilizes the thermal decomposition-chemiluminescence method, enabling rapid measurement taking only about 5 minutes per measurement without reagents. If an autosampler is used, automatic measurement of multiple samples is possible as well.

This application news introduces example TN measurements of various vinegar types using Shimadzu TOC-L$_{CPH}$ total organic carbon analyzer and TNM-L total nitrogen unit.

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■ Analysis Method

Five types of vinegar made from different materials (rice vinegar, brown rice vinegar, grain vinegar, apple cider vinegar, and balsamic vinegar) were targeted for TN measurement. Rice vinegar, brown rice vinegar, grain vinegar, and apple cider vinegar were diluted by a factor of 100 with pure water, and balsamic vinegar was diluted by a factor of 500. The obtained measurement results are corrected by the respective dilution factor.

A calibration curve was made using 20 mgN/L aqueous solution of potassium nitrate.

Table 1 Measurement Samples

Sample	Main Materials
Rice vinegar	Rice
Brown rice vinegar	Brown rice
Grain vinegar	Wheat, corn
Apple cider vinegar	Apple cider
Balsamic vinegar	Grape juice

Table 2 Measurement Conditions

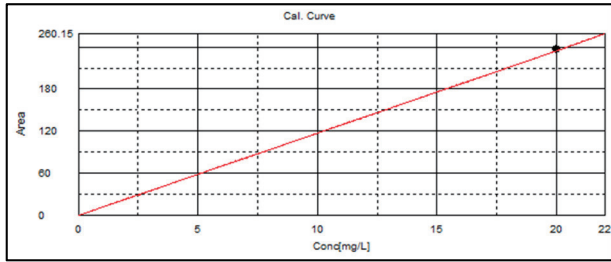|		
Analyzer	:	TOC-L$_{CPH}$ + TNM-L total nitrogen unit
Catalyst	:	TOC/TN catalyst
Measurement item	:	TN (total nitrogen)
Calibration curve	:	Single point calibration curve using 20 mgN/L aqueous solution of potassium nitrate
Sample	:	Commercially available rice vinegar, brown rice vinegar, grain vinegar, apple cider vinegar, and balsamic vinegar
Dilution factor	:	Diluted by 100: rice vinegar, brown rice vinegar, grain vinegar, apple cider vinegar Diluted by 500: balsamic vinegar

■ Analysis Results

The TN measurement results of the five vinegar types are shown in Table 3 and Fig. 1. We can see that the TN of all samples is measured with good accuracy.

These results show that since the amount of proteins and amino acids contained in the materials differ by each vinegar type together with the production method, the TN concentration differs with each vinegar type.
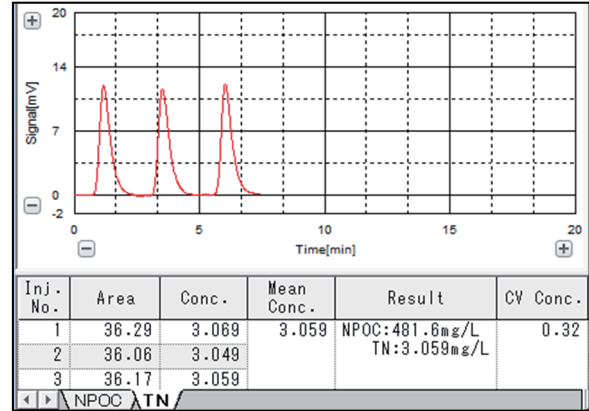
Table 3 Measurement Results

Sample	TN Measurement (mgN/L)
Rice vinegar	306
Brown rice vinegar	1650
Grain vinegar	357
Apple cider vinegar	24 .4
Balsamic vinegar	912

■ **Analysis Data**

TN calibration curve

Inj. No.	Area	Conc.	Mean Conc.	Result	CV Conc.
1	36.29	3.069	3.059	NPOC:481.6mg/L TN:3.059mg/L	0.32
2	36.06	3.049			
3	36.17	3.059			

NPOC ⟩TN

Sample: Rice vinegar diluted by 100

Inj. No.	Area	Conc.	Mean Conc.	Result	CV Conc.
1	193.9	16.40	16.49	NPOC:577.9mg/L TN:16.49mg/L	0.49
2	195.6	16.54			
3	195.5	16.53			

NPOC ⟩TN
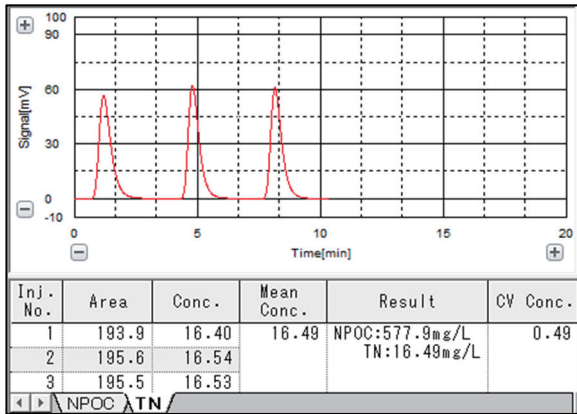
Sample: Brown rice vinegar diluted by 100

Inj. No.	Area	Conc.	Mean Conc.	Result	CV Conc.
1	42.46	3.591	3.565	NPOC:309.6mg/L TN:3.565mg/L	1.27
2	41.54	3.513			
3	42.47	3.592			

NPOC ⟩TN
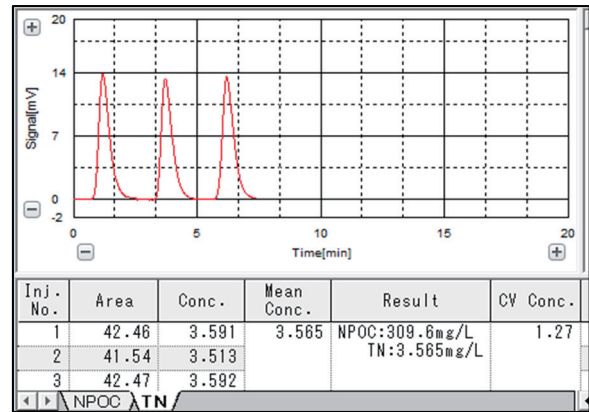
Sample: Grain vinegar diluted by 100

Inj. No.	Area	Conc.	Mean Conc.	Result	CV Conc.
1	2.850	0.2410	0.2440	NPOC:381.2mg/L TN:0.2440mg/L	2.54
2	2.970	0.2512			
3	2.837	0.2399			

NPOC ⟩TN
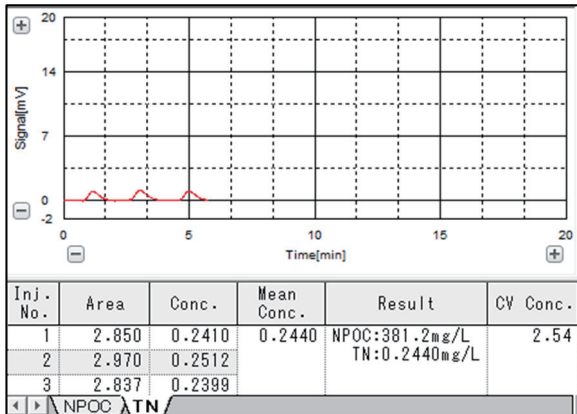
Sample: Apple cider vinegar diluted by 100

Inj. No.	Area	Conc.	Mean Conc.	Result	CV Conc.
1	23.72	1.831	1.825	NPOC:421.1mg/L TN:1.825mg/L	0.50
2	23.71	1.830			
3	23.51	1.815			

NPOC ⟩TN
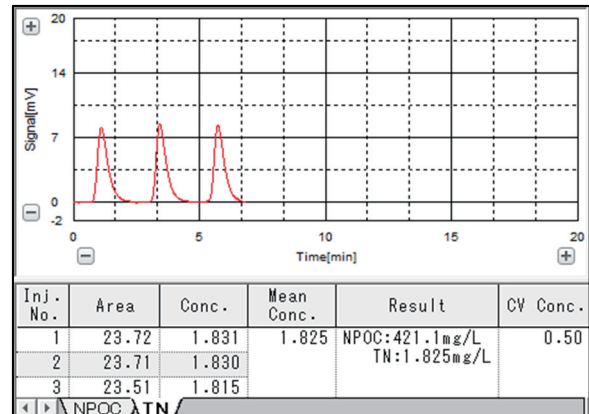
Sample: Balsamic vinegar diluted by 500

Fig. 1 Measurement Data

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