Quality evaluation of vinegar using near infrared spectroscopy

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The purpose of this research is to measure acidity and to identify the fermented natural vinegar apple, graph, persimmon and brown rice from artificial vinegar using scanning type NIR instrument.

Material and method

Sample name	Total Acid (W/V%)	Sample name	Total Acid (W/V%)
Yoodong apple	6.5–7.0	Yoodong persimmon	–4.0–5.0
Sinsong apple	65–7,0	Yoodong brown rice	45–5.0
Dongkuk apple	4.0 over	Oddugy brown rice	6.0–7.0
Hwayong apple	6.0–7.0	Samhwa brown rice	4.5–5.5
Sam11wasaehan apple	6.5–7.0	Chungungwonhwayong brown rice	4.5–5.0
Oddugy apple	6.0–7.0	Yoodong brew	6.0–7.0
Dongkuk persimon	5.5 over	Chamgroo brew	6.5–7.0
Sannaedul persimmon	2.6 over	Dongkuk grape	4.0 over
Acetic acid	Acetic acid 4% – 8% / 0.2% 21 Samples		

Method

NIR measurement

Instrument: InfraAlyzer500 (Bran+Luebbe, Germany) Range : 1100–2500 nm / 2nm

Data analysis

Linear discriminant analysis (Idas, Bran+Luebbe Co.,Germany) and SIMCA (Unscramblei-II6.0, Carno ÅS, Norway)
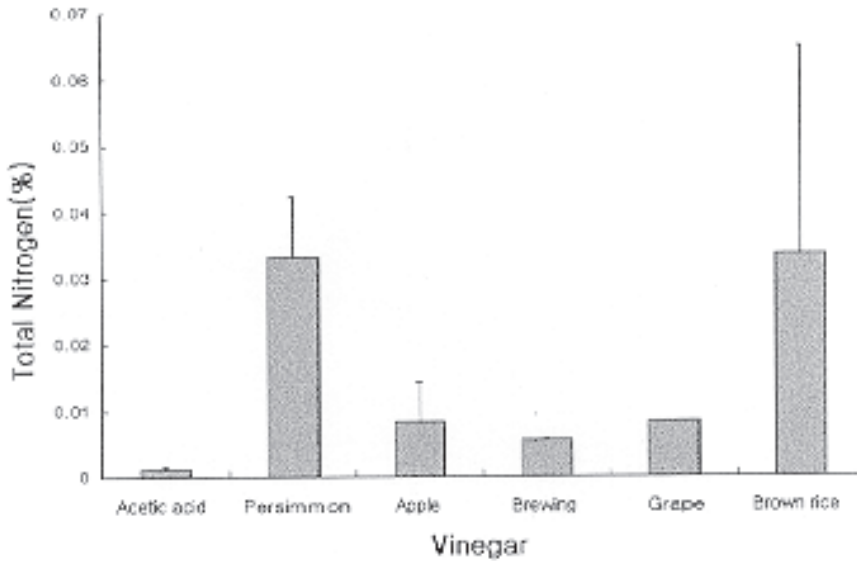
Chemical analysis

Total nitrogen: Kjeldahl Method, Acidity : Titration Method
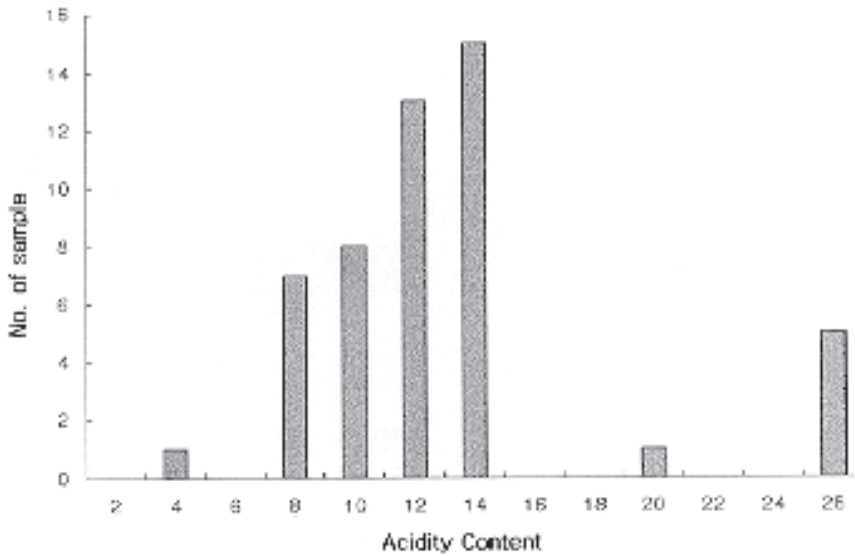Inorganic matter : ICP (Thermo jarrell Ash, USA).
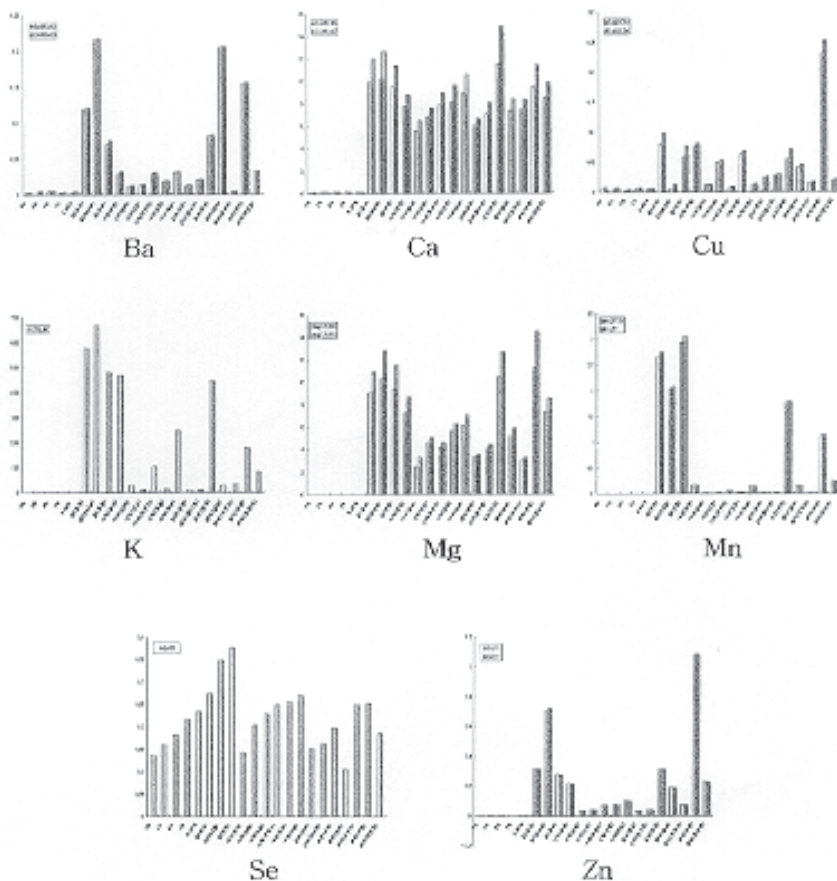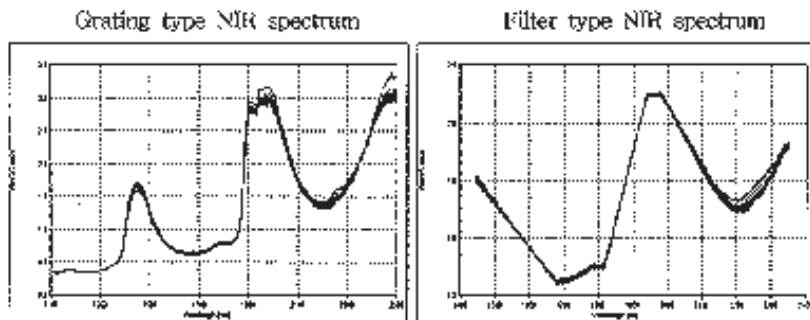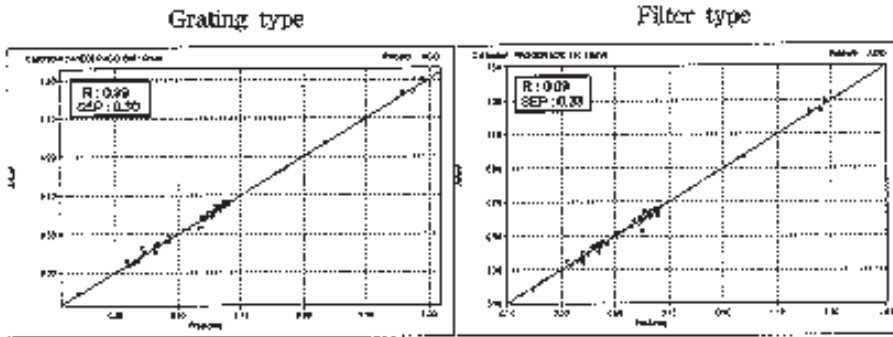
Results

Chemical components

Total nitrogen

Acidity

Inorganic matter

Ba

Ca

Cu

K

Mg

Mn

Se

Zn

NIR measurement

Grating type NIR spectrum

Filter type NIR spectrum

Acidity

Grating type   Filter type

Discriminant

Raw Spectrum   2nd Derivative Spectrum
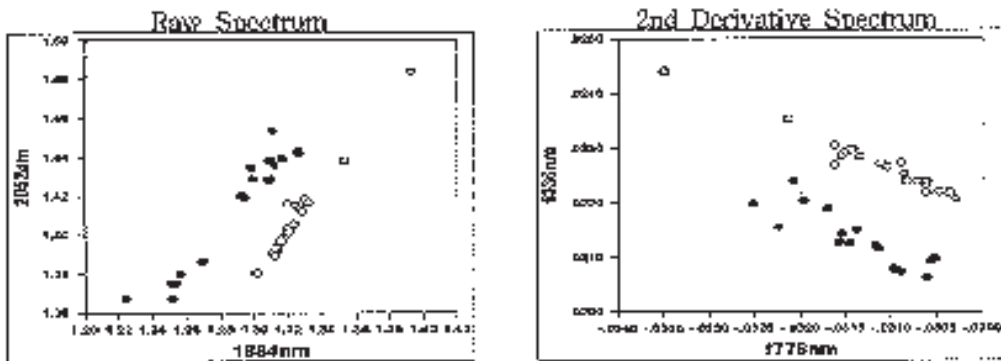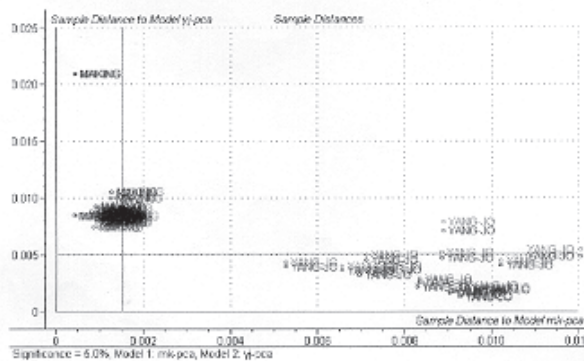

SIMCA

Summary

The accuracy for measuring acidity was very high, 0.997 of R and 0.3% of *SEP*. Similar results were obtained from the filter-NIR instrument. The fermented vinegar had a higher nitrogen content than the artificial vinegar, but the artificial vinegar had hardly any inorganic matter, whereas the fermented vinegar had a comparatively high level of inorganic matter, such as Be, Ca, Cu, K, Mg, Mn and Zn. These components were considered to be a major cause for discrimination against each other. Linear discriminant analysis (LDA) and soft independent modelling of class analogy (SIMCA) were used to develop identification models. The LDA identification model, using the second derivative spectra, showed a very good identification of 11.79 Mahalanobis distance, using only three wavelengths, 1596, 1882 and 1921 nm. Both the LDA and SIMCA models showed the possibility of recognising the fermented and artificial vinegars. However, there was a slightly different pattern in the NIR spectra for the different kinds of fermented vinegar. The results of the present study shows that NIR spectroscopy can be used for rapid measurement of acidity and identificaiton of fermented vinegar.