On the Refractometric Quantitative Analysis of Alcohol and the Extract in Sake.

By Mitsuji Ito.

Experiments on the refractometric quantitative determination of ethyl alcohol in spirituous liquor have been made by several authors, but so far its application for the analysis of Sake, a Japanese alcoholic beverage made of rice, has not been done.

In order to determine alcohol and the extract in Sake quantitatively by the use of Pulfrich's refractometer, I have examined many kinds of Sake produced in various districts of Japan; and have found the following formulae for the calculation of alcohol and the extract indirectly. These resulting figures were compared with those obtained directly by the ordinary method.

I. For the calculation of alcohol in volume %.

\[ X = \frac{R - (W + U \times E)}{D} \]  

\[ A' = X \pm x \] \hspace{1cm} (1)  

\[ U = \frac{r - r'}{e} \] \hspace{1cm} (2)

Where,  
\[ X = \text{Calculated \% of alcohol in volume.} \]  
\[ A' = \text{Required \% of alcohol in volume.} \]  
\[ x = \text{Average supplemental number found from the examination of many kinds of Sake.} \]  
\[ R = \text{Refractive index of Sake, measured by the Pulfrich's refractometer at 20^\circ C.} \]  
\[ W = 1.33274, \text{ refractive index of water at 20^\circ C.} \]  
\[ E = \text{Weight of extract, gram in 100 c.c. of Sake.} \]  
\[ D = 0.0005, \text{ mean value of the refractive index corresponding to one volume \% of alcohol at 20^\circ C.} \]
\[ r = \text{Mean value of the refractive index of Sake.} \]
\[ r' = \text{Refractive index of the alcohol solution, the concentration of which is equal to the mean value of that in Sake.} \]
\[ e = \text{Mean value of the extract in 100c.c. of Sake, in gram.} \]

U is calculated as follows: 0.00192 is the mean value for 72 kinds of new and old Sake, 0.00190 for 59 kinds of old Sake, 0.00188 for 35 kinds of Honshu old Sake, 0.00189 for 31 kinds of Kwansai old Sake, 0.00193 for 24 kinds of Hokkaido old Sake, and 0.00203 for 13 kinds of Hokkaido new Sake. Using 0.00197 (mean value between 0.00190 and 0.00203) for the value of U, the above formula may be shown as follows.

\[
X = \frac{R-(1.33274+0.00197 \times E)}{0.0005} = (R-(1.33274+0.00197 \times E)) \times 2000 \ldots \]

Formula a'.

II. For the calculation of the extract, gram in 100c.c.

\[
X = \frac{R-(W+D \times A)}{U} \]

Formula b.

\[
E' = \text{Required weight of the extract in 100c.c. of Sake.} \]

Where, \[ y = \text{Average supplemental number found from the examination of many kinds of Sake.} \]
\[ A = \text{Volumetric \% of alcohol in Sake measured by specific gravity of the distillate as usual.} \]

R, W, D and U are the same as the above.

The above formula b may be shown as follows.

\[
Y = \frac{R-(1.33274+0.0005 \times A)}{0.00197} = (R-(1.33274+0.0005 \times A)) \times 508 \ldots \]

Formula b'.

The values of X calculated for the many kinds of Sake by the formula above described are nearly consistent with those of A obtained by ordinary method, and the mean value of x between X and A is -0.24 \% for Kwansai old Sake, 0.07 for Kwantu and Tohoku old Sake, 0.18 for Hokkaido old Sake, 0.61 for Hokkaido new Sake, and 0.06 for all these kinds of Sake mentioned above. A' is calculated from these X and x above obtained.

In like manner values of Y are nearly consistent with those of E obtained by ordinary gravimetric way, and the mean value of founded between Y and E is -0.0546g. for Kwansai old Sake, -0.0013 for Kwantu and Tohoku old Sake, -0.0108 for Hokkaido old Sake, 0.1495 for Hokkaido new Sake; and -0.0002 for all these kinds of Sake above said. E' is calculated from these Y and y above obtained.
From the above results, it may be stated that the practical use for the refractometric quantitative analysis of alcohol and the extract in Sake or other its analogous alcoholic beverage is to be applied. The difference between the values of alcohol obtained by the refractometric method and those by the ordinary method is rather smaller than the experimental error which occurs between the primary distillate and the redistillate.

Aldehyde in Connection with the Sake-brewing.

By Masakazu Yamada.

Recent works of Neuberg, Neubauer, Kurono, Embden, Oppenheimer etc., have showed that aldehydes and ketones play an important rôle as the intermediate products in various phases of fermentation.

In the main fermentation of Sake-brewing aldehydes have also been observed everytime but little study was made on them.

The author studied them from the standpoint that they might have relation to the delicate flavour of sake and as well as to its keeping qualities.

The only aldehyde, obtained by steam distillation of sake was acetaldelyde. It was identified from the melting point of its aldomedon of its paro-nitro-phenyl-hydrazone and also from the content of nitrogen of the latter. The content of acetalddehyde was estimated by Ripper’s bisulphite method at each period of brewing and storage.

At the stage of “moto”—cultivation of Sake-Yeast—and “moromi”—mainfermentation of sake—the content of acetalddehyde was quite small and showed little variation. Fresh and old sake are easily distinguished by the estimation of the aldehyde content, for aldehyde increases gradually during the storage period, thus the average content being 0.0057 percent in the fresh sake in April and 0.01117 percent in the old in October.

From the antiseptic nature of the acetalddehyde, though not very strong it might be supposed that its quantity is in relation of the resistance of sake against “hiochi”—a putrefactive phenomenon of sake caused by some lactic and acetic acid producing bacteria. The content of the acetalddehyde has been, in practice, measu-