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The Story of Korean Alcoholic Beverages

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Each alcoholic beverage has its own cultural background. Alcoholic beverages were spontaneously made from fruits or grains by help of microorganisms in natural ways. Now, we can make our own alcoholic beverages by the method of brewing improved.

Korean traditional alcoholic beverages were made from grains and *Nuruk* that is made from whole wheat flour/grits, allowing the development of numerous types of molds, bacteria and yeasts. The characteristic in this type of brewing process is that hydrolysis (hydrolyze polysaccharides to glucose and other monosaccharides) and fermentation (ferment sugars to ethyl alcohol) are done simultaneously. Therefore, It is very complicated and difficult to predict the quality of traditional alcoholic beverages. Their qualities depend on kinds and quality of materials, composition of microorganisms and their interaction in *Nuruk*, brewing process including brewing temperature and steps, etc..

Considering a matter from the manufacturing point of view, it is better idea to inherit and develop cultural brewing process than to produce it as it was again. We try to present two representative traditional alcoholic beverages, *Samhaeju* and Rice-Grape Wine, in order to prove traditional alcoholic beverages are not things to be slumped and to become extinct but to have infinite possibilities and to be worthy of notice.

1. *Samhaeju*

The process of *Samhaeju* brewing was referred to the literatures including <*Jubangmon*>, <*Sanlimkyungje*>, <*Yangjubang*>, etc. and was revised based on lots of results from different ways of brewing.

This *Samhaeju* processing has characteristics :

The temperature of its brewing is low (15°C), comparing that(25°C) of general industrial brewing. Its fermentation time (36days) is longer than others(8-12days). It shows further addition of materials (three-step) at intervals of 12 days as compared with other brewing(usually, two-step). *Samhaeju* is a *Yakju* that is brewed traditionally through three-step addition of materials, at low temperature and longer brewing time

1) Preparation of *Samhaeju*

Nuruk was prepared with inoculation of *Rhizopus sp.* that can affect on raw materials with high enzyme

activities. In the first brew, rice was soaked in water for three hours, and then drained and pulverized. Hot boiling water was added to rice powder and cooled.

Blend one part *Nuruk* with ten parts lukewarm (35-40°C) water. *Nuruk* and water was added to the rice dough with lactic acid and yeast. The addition of sufficient active yeast and lactic acid was very helpful for preventing growth of bacteria and wild yeast. It was fermented for 12 days at 15°C (first brew). For the second brew, the preparation process of the first brew was repeated in the absence of yeast and lactic acid. The volume of materials used was increased by ten times. This was then added to the first brew. After incubation for 12 days at 15°C, three times the cooked rice, *Nuruk* and cooling water used in the second brew was further added to produce the third brew. After 12 days of third brew, it was filtered to collect rice wine.

2) Changes of Components and yeast in *Samhaeju* during fermentation

It was shown in this study that reducing sugar production immediately started after the first brew of *Samhaeju*, even though materials were partially uncooked, because *Rhizopus* sp. in *Nuruk* has high activity of enzyme to hydrolyze polysaccharide to fermentable sugars. On sixth day, the alcohol content was 13.5% and the yeast count was 1.4×10^8 cfu/ml. Low temperature made slow but continuous progress.

According to increased alcohol content, the rate of alcohol produced was getting decreased and saccharification was processed continuously. That was a good time for the addition of materials.

On thirty fourth day, considerable amount of acid forming bacteria was found. The low temperature and high alcohol content limited the acid producing activity, as acidity 6.0. However, overproduction of acid can cause quality deterioration of rice wine. On thirty sixth day, when fermentation was complete, *Samhaeju* had 6.7 acidity, 17.65% alcohol and 213mg/ml reducing sugar.

3) Sensory evaluation of *Samhaeju*

Sensory evaluation of *Samhaeju* showed good scores. Panelists described that natural sugar and oligosaccharides, organic acids and flavor compounds contribute to the taste and odor of *Samhaeju*. This alcoholic beverage has natural harmony of sugar and acid to make soft taste in spite of high content of alcohol.

2. Rice-Grape Wine

Wine was introduced into the Korean Peninsula from Yuan Dynasty in China. In the beginning of 18th century, <Yangjubang> had a record about Rice-Grape Wine that was made from rice, *Nuruk* and grape. <Imwonsipyukji(1987)> had a record about Rice-Grape Wine making that put glutinous rice, grape juice and powdered *Nuruk*. In the beginning of 20th century, famous grape farms and breweries were established in Kyungsang-Do.

Campbell Early, one of major species in Korea, has 14 brix and is consumed as a fruit because of its harmonious sweet and sour taste. This report use rice instead of sugar for fermentation like a traditional way.

1) Preparation of Rice-Grape wine

In the first brew, rice was soaked in water for three hours, and then drained and liquefied. Clude enzyme, yeast and water were added to the liquefied rice. It was fermented for one day at 25°C (first brew). For the second brew, grape was chopped up small pieces and added with 0.01%(w/v) Pectinase and 100ppm Potassium metabisulfite. Leave it for at least 4hours. Press the chopped grape. Concentrate the juice and store it under refrigeration to prevent quality deterioration and fermentation. Induce fermentation by introducing the seeds, fruit pulp and skins to the first brew. During the wine making process, it is very important to keep fermentation temperatures stable at 25°C. Getting the fermentation too cool could result in the fermentation stopping before all the alcohol is made. Getting the fermentation too warm could result in off-flavors in the wine. Never allow wild yeast to ferment the wine naturally as this can ruin the fermentation. While fermentation is active in a wine, the seeds and skins will rise to the top of the fermenting vessel. This "cap" needs to be kept wet with fermenting juice for maximum extraction. To achieve this, punch down the cap at regular intervals. After seven days of the second brew, it was pressed and filtered to collect rice wine. Separate the juice from the skins, seeds, and fruit pulp. The wine was racked (draw off) from the settled yeast cells and sediment, which is called the lees, once a week for 2 weeks in a freezer. Most solids suspended in the wine will settle out on their own specially in a refrigerator, given a little time. However, this could take months, and does not always result in a crystal-clear wine. So filtration is also used to remove solids from wine and to remove all yeast and some bacteria cells. Blend wine with concentrated juice. Wine was transferred to storage tanks for several months. Pasteurize it at 63°C for 2 minutes before packaging.

2) Changes of Components and yeast in Rice-Grape Wine during fermentation

After grape's skin and pulp was added in the first brew on the second day, acidity was changed from 1.5 to 5.2. The acidity was increased up to 6.3 without any appearance of pathogenic organism. Final acidity in a wine was affected by kind of grape, the climate of cultivated land, environment of cultivation and ratio of pressure for juice.

Initial saccharinity should be under 29 brix for making yeast safe and would be diluted by adding a grape skin and pulp next day. Rice was liquefied to be converted into reducing sugar partially and was continuously producing monosaccharides during fermentation.

On eighth day when fermentation was completed, Rice-Grape Wine had 6.3 acidity, 14.5% alcohol and 27.2mg/ml reducing sugar. As wine has generally 12% alcohol, Rice-Grape Wine, having 14% alcohol, was easily controlled by lessen a reproductive rate of pathogenic organism.

3. Results and Future Study

The uniqueness in Korean alcoholic beverages is making rice wine by various processes of materials and using *Rhizopus sp.* that can affect on raw materials with high enzyme activities.

It is very important to keep the balance of saccharification and fermentation in brewing process and to

have alcoholic beverages naturally harmonious taste.

Campbell Early, one of major species in Korea, is consumed as a fruit because of its harmonious sweet and sour taste. If making a wine from Korean grape needs refined sugar or another sweetener before fermentation because its saccharinity is mainly around 14. This Rice-Grape Wine used rice instead of sugar like traditional way. So, the brewing process of the Korean rice-Grape Wine is very special and unique and different from that of the western wine. This process will draw attention on zymurgy. Rice-Grape Wine will be a representative one that suits Korean taste. Clude enzyme (from *Rhizopus sp.*) used showed an effect on inhibition of browning and extended shelf life of bottled wine for 6 months.

This institute is researching several other type of alcoholic beverages including sweet potato Soju. Brewing Sweet potato and rice made alcohol content higher for safe brewing. We tried to differentiate this sweet potato Soju from others by separating and cultivating germs that propagate in potato by itself.

It needs further study.