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Composition of experimental New York State grape brandies

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Although New York State has no brandy distillation industry, it is possible that distillation may be developed in the future with increased grape and wine production and availability of considerable quantities of other fruits. A preliminary experimental distillation study on New York State wines was reported a few years ago from this laboratory (1). It was shown that a beverage brandy with desirable aroma can be produced from New York State's major grape, the Concord. It was suggested that brandy distillates should be prepared at the highest possible proof in order to reduce the presence of undesirable varietal aromas. As a series for study, we selected several of the major varieties of grapes grown in New York State and prepared brandy distillates by means of small laboratory-scale distillation equipment. This report summarizes the study on chemical constituents and organoleptic quality of the New York grape wine distillates.

The wines were prepared from cold-pressed grape juice, adjusted to 21° Brix with sucrose* and added 100 ppm SO₂. Fermentation took place at room temperature with a pure yeast culture until the final alcohol content reached 10-12 per cent by volume. After the wines were diluted with water to 8 per cent ethanol, distillation was conducted using a 10-plate Oldershaw pot still as described in a previous paper (1). The "heads" from the overhead condenser (1% of the feed) were removed. The brandy distillate was taken at 1 C plate temperature gradient as a side stream simultaneously from each of the 10 plates except the bottom one.

*At present, federal law prohibits addition of sugar to produce distilling wines.

Chemical composition such as acidity, pH, esters, and aldehydes was analyzed by the methods described in a previous paper (1). Higher alcohols were analyzed by a gas chromatographic method (2) using an Aerograph 200 equipped with an SP-1000 column and a flame ionization detector at 85 C isothermal condition. n-Butyl alcohol was used as an internal standard. Some distillates were diluted to 100° proof with distilled water and aged in 3-gallon used oak barrels for 3 to 4 weeks for the sensory evaluation. For comparison, several commercial brandies produced in the United States and Europe were analyzed for their chemical constituents. Since acids and esters are known to be increased during the aging process in wood, their measured values in aged brandies cannot be used as an estimate of the amounts in the original distillates. To minimize the effect of aging, chemical constituents of commercial brandies were analyzed after redistillation.

Table 1 shows the proof and composition of distillates prepared in the Geneva laboratory from different varieties of grapes. All samples show relatively high proof (close to neutral brandy's proof), because the distillates were prepared in such a way that the presence of undesirable aromas could be reduced according to our preliminary study. However, in general, the chemical compositions are in the range of those found in California commercial distillates (2) except for aldehyde contents. All experimental samples show a higher content of aldehyde than did the California commercial brandies. Among the distillates, Concord grape contained the highest ester contents, but was lowest in aldehyde content. Elvira distillate contained relatively less amounts of esters and aldehyde. Niagara distillate contained the highest

Table 1.—Composition of New York Grape Brandy Distillates¹⁾.

Grape Variety	Proof	Esters ²⁾ (ppm)	Aldehyde (mg/100 ml)		Acidity ³⁾ (mg/100 ml)	pH
			free	total		
Catawba	168	69	7.5	8.8	3.3	4.5
Concord	169	176	2.1	2.5	5.9	5.2
Delaware	172	76	5.7	7.1	2.9	4.7
Elvira	175	42	3.2	3.6	5.9	4.3
N. Y. Muscat	168	90	5.3	7.6	7.2	3.8
Niagara	174	78	7.7	10.4	3.4	4.4
Ravat 51	172	63	8.4	10.1	3.3	4.5
Riesling	172	52	7.5	9.5	3.3	4.5
Seibel 10868	174	66	3.7	4.5	3.3	4.8

1) Analytical results based on 100° proof distillate

2) Calculated as ethyl acetate

3) Calculated as acetic acid

amount of aldehyde.

Table 2 shows the chemical composition of commercial grape brandies. Since they are diluted to a standard proof for the commercial product and aged under various conditions and periods, there is no way to compare directly the original distillates with the New York experimental samples. However, the average contents of esters (174 ppm), aldehyde (15.0 mg/100 ml), and acids (20.7 mg/100 ml) in redistilled commercial brandies are generally higher than the experimental results reported in Table 1. Contents of the higher alcohols in the sample distillates and in commercial brandies are shown in Table 3. Average contents of n-propyl alcohol, isobutyl alcohol, and amyl alcohol in New York grape distillates are 15.6, 15.2, and 61.0 mg/100 ml, respectively. Corresponding values of California distillates (2) are 17.2, 15.7, and 50.8 mg/100 ml, respectively. Among the sample distillates, Niagara grape contained the highest amount of higher alcohols. New York muscat contained the highest amount of isobutyl alcohol among the New York grape distillates. Contents of higher alcohol in commercial brandies are higher than those of New York grape distillates. It may be reasoned

that some commercial brandies were distilled at a low proof so that they would contain large amounts of higher alcohols.

As a standard of identity for beverage brandy, a maximum limit of 170 "Proof" was proposed by a committee of the U.S. Internal Revenue Service in 1965 (3) to insure that sufficient minor compounds of wines or other distilling material pass over into the distillate to impart characteristic aromas and flavors. However, since the proof of distillation as a criterion was found to be insufficient, a new concept of congener content, referred to as "natural flavor components," was proposed. Natural flavor components were defined as the sum of the acids, esters, and higher alcohols in the original distillate. The required limit of natural flavor components proposed for beverage brandy was "not less than 40 grams per 100 liters at 100° proof." All samples from New York grape distillates exceed this minimum limit.

For organoleptic tests, the distillates were diluted to 50° proof and examined for their sensory characters by five panel members. First, odor impressions were recorded; then, they were tasted after one part of water was added. Overall relative quality was rated

Table 2.—Composition of Commercial Grape Brandies¹⁾.

Sample (origin)	Proof	Esters ²⁾ (ppm)	Aldehyde (mg/100 ml)		Acidity ³⁾ mg/100 ml	pH
			free	total		
A (U.S.)	80	95	9.4	10.7	5.8	4.2
B (French)	80	225	14.1	16.1	47.3	3.4
C (French)	80	235	14.7	17.9	20.6	3.8
D (Italy)	90	214	16.2	18.4	18.4	4.8
E (U.S.)	80	104	10.6	12.0	11.7	3.9

1) Calculation was made on 100° proof

2) Calculated as ethyl acetate

3) Calculated as acetic acid

Table 3.—Contents of Higher Alcohols¹⁾.

Samples	n-Propyl Alcohol	Isobutyl Alcohol	Amyl Alcohol ²⁾
Catawba	14.2	15.4	64.0
Concord	19.8	16.4	67.2
Delaware	17.8	15.0	62.2
N. Y. Muscat	17.2	22.4	64.2
Niagara	11.2	13.6	78.6
Ravat 51	14.6	12.4	56.2
Riesling	13.4	12.0	46.0
Seibel 10868	17.2	14.4	49.6
Commercial Brandy ³⁾			
A	24.0	19.4	55.2
B	26.0	51.9	134.4
C	22.6	23.2	70.4
D	19.8	21.6	86.8
E	28.4	22.4	59.4

1) Analytical results based on 100° proof distillate, mg/100 ml

2) Including isoamyl and active amyl alcohols

3) Analysis based on aged brandy

Table 4.—Sensory Character of the Original Distillates.

Grape Variety	Descriptive Comments	Relative Quality (1 to 10)
Catawba	Fruity, pleasant but hot	6
Concord	Perfumy but not desirable, harsh, rubbery, burn	2
Delaware	Green, astringent, slightly rubbery	8
N. Y. Muscat	Muscat flavor, slightly green, pleasant flavor	9
Niagara	Acetol odor, harsh, green, heavy	2
Ravat 51	Nice, delicate, blended, fruity aroma, harsh	10
Riesling	Rubbery, neutral, pleasant fruity, burn	4
Seibel 10868	Medium body, harsh, flowery, green	7

from 1 to 10 (bad to good) as shown in Table 4. Among the distillates, Ravat grape distillate exhibited the highest quality score, and the general impression was a fine, delicate, and blended fruity aroma. New York muscat distillate carried a characteristic aroma of muscat grape. A harsh and hot sensation was experienced with many distillates. No direct correlation could be made between chemical composition and sensory characters. It was found that the Concord grape distillate, originally assigned the lowest quality rating, exhibited a smooth, fruity, and good-bodied sensory character after barrel aging in oak. As shown in Table 5, some distillates of New York grapes aged in 3-gallon charred oak (used) for 3-4 weeks compared favorably in quality with some of the commercial brandies. Concord and muscat distillates show sensory scores comparable to those of commercial brandies.

Table 5.—Relative Quality of Aged Distillates and Commercial Brandies.

Relative Quality (1 to 10)	Aged Distillates			Commercial Brandies			
	New York Muscat	Riesling	Concord	A	B	C	E
	5	2	6	7	10	8	4

In general, it can be concluded that New York grapes can produce beverage brandy with desirable aromas. Distillation conditions should be chosen carefully for each distilling material so that the characteristic grape aroma will carry over to the distillate.

LITERATURE CITED

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