	Found.	Formic acid.	Acetic acid.
Percentage of silver	65.44	70.59	64.66

This result we take to indicate the presence of ethyl formate (54.9°) and methyl acetate (57.3°).

The silver salt from fraction 55°-60° gave 64.99 per cent. of silver (calculated for acetic acid, 64.66). It hence consisted almost entirely of methyl acetate (57.3°).

The presence of acetic acid was also indicated by qualitative tests in fraction 70°-75°. Satisfactory results from the silver salt were not obtained because of the small quantity at our disposal.

The same statements apply to fractions 75°-80° in which the boiling-point and odor indicate the presence of methyl propionate (79.5°).

From the fraction 102°-105°, by acidifying with sulphuric acid, an oil separated which was by odor butyric acid and indicates the presence of methyl butyrate (102.3°).

The investigation was necessarily interrupted at this point but will probably be taken up at some future date.

There seems to be enough of interest in the wide difference between this oil and that from other varieties of wood to warrant further investigation.

SEATTLE, WASH.,
March 3, 1902.

INVESTIGATION OF THE OIL OF THE RED ELDERBERRY, "SAMBUCUS RACEMOSA ARBORESCENS."

BY H. G. BYERS AND PAUL HOPKINS.

Received May 17, 1902.

ON the western slopes of the Cascade Mountains and on the lowlands about Puget Sound grow great quantities of a red elderberry which, by reason of its large size, is denominated a variety of the species *racemosa*. The berries are a bright crimson and serve as food for birds but because of an unpleasant odor and the presence in them of a considerable quantity of a yellow oil are not used by the people as food nor are they converted into wine.

An investigation of this oil was made with the following results. From about 10 gallons of the berries it was possible to get about 500 cc. of the oil by pressing the juice from berries and ex-

tracting with ether the layer of crude oil which rose to the surface of the liquid. The oil as obtained from the ether solution by spontaneous evaporation is of a light yellow color but darkens markedly on standing or when the ether is evaporated by means of a water-bath.

The oil has a specific gravity of 0.9072 at a temperature of 15° C. It solidifies at —8° and melts at about 0°. It has no definite boiling-point but decomposes when distilled even at a pressure of 20 mm. It proved to be a mixture of the glycerides of the fatty acids and contains 6.65 per cent. free acid calculated as oleic acid. Because of a marked resemblance to olive oil a very careful determination of its constants and composition was made.

Unsaponifiable Matter.—The unsaponifiable matter of the oil, which contained the characteristic odor of the oil, formed 0.66 per cent. of the whole. It crystallizes in light yellow hexagonal plates.

Glycerol.—The fats were saponified and the glycerol determined, the amount being 11.4 per cent.

Fatty Acids.—The lead salts of the acids were made and thoroughly extracted with ether in a Soxhlet apparatus. The insoluble residue was converted into its barium salt and crystallized from alcohol in three fractions. These fractions gave the following results when their barium content was determined as barium sulphate.

	I.	II.	III.	Calculated for palmitic acid, $C_{16}H_{32}O_2$.
Percentage of barium	21.06	21.24	20.14	21.17
	21.11	21.21	20.13	....

The crystals from the first two fractions were white plates. The third fraction was discolored by the impurities of the mother-liquor. The oil evidently contains no saturated fatty acid save palmitic acid.

The solution of the lead salts in ether was fractionally crystallized and converted into the barium salt. The barium salt was refractionated and the barium determined in the first fraction.

		Calculated for oleic acid, $C_{18}H_{32}O_2$.
Percentage of barium.....	19.46	19.59
	19.38	....

The iodine absorption of the fatty acid from this fraction was also 90.6 and 89.5, the calculated value for oleic acid being 90.07.

A number of fractional precipitations of the potassium salt of the mixed acids were made from a weakly ammoniacal solution by means of barium chloride.

The iodine numbers of the free acids from these fractions were:

Fraction.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Iodine number.	21.0	36.2	88.2	89.3	87.3	90.6	111.3	120.6
Quantity of salt	2.0	1.2	1.5	1.0	1.0	0.8	0.5	2.0

The fatty acid from VII and VIII was highly colored and somewhat impure from oxidation, yet the results indicate the presence of an acid, probably linoleic, having an iodine absorption greater than that of oleic acid. If linoleic acid, it is present to an extent of not less than 7-8 per cent.

The presence of soluble acids was determined by the method of Muter.[1] The Reichert-Meissl number being but 1.54, thus showing the practical absence of butyric or other volatile acid, the results of the titrations were calculated to an acid having a molecular weight of 136, which is the mean of the molecular weights of capric, caprylic, and caproic acids. The results showed the presence of 2.95 per cent. of these acids.

The quantity of palmitic and oleic acids was determined by Lang's "Modification of Muter's Method".[2] The results show oleic acid and linoleic acid 72 per cent.; palmitic acid 21.66 per cent. The saponification equivalent was found to be 209.3.

The Hehner number is 91.75.

From the results indicated in the foregoing discussion the properties and composition of the oil are as given below. For convenience of comparison the corresponding values for olive oil are given in parallel.

	Elderberry oil. Per cent.	Olive oil. Per cent.
Palmitin	22.0	28.0
Olein and linolein	73.6 { 92.2 / 7.8 }	72.0 { 93 / 7 }
Caprin, caproin and caprylin	3.0	....
Unsaponifiable matter	0.66	....

[1] Allen's "Commercial Organic Analysis," Vol. II, Part I, p. 189.

[2] *Pharm. J.*, **59**, 61.

	Elderberry oil.	Olive oil.
Specific gravity	0.907	0.914–0.917[1]
Solidifying point	—8°	2°
Melting-point of fatty acids	38°	26°
Saponification equivalent	209.3	191.7
Iodine number	81.44	80–82
Hehner number	91.75	94.03
Reichert-Meissl number	1.54	1.50
	Per cent.	Per cent.
Free acid	6.65	8.07

SEATTLE, March 14, 1902.

A VOLUMETRIC METHOD FOR THE ESTIMATION OF SULPHURIC ACID IN SOLUBLE SULPHATES.

BY YASUJURO NIKAIDO.

Received September 12, 1901.

THE method is based on the following reactions:

$$(1)\quad K_2SO_4 + Pb(NO_3)_2 = PbSO_4 + 2KNO_3.$$
$$(2)\quad 2KI + Pb(NO_3)_2 = PbI_2 + 2KNO_3.$$

Under proper conditions it was found that lead salts will not react with iodides in the presence of sulphates until all the sulphuric acid has been precipitated by the lead, whereupon the yellow color of the lead iodide becomes visible. It is, therefore, possible to use potassium iodide as an indicator for the end reaction between lead and sulphuric acid.

To test the accuracy of the method, N/10 solutions of lead nitrate and of potassium sulphate were used. Then 10 cc. of the potassium sulphate solution were taken, about 0.2 gram of potassium iodide added and the solution was titrated with a lead nitrate solution. It was found that on adding lead nitrate, lead iodide was first formed, imparting a yellow color to the solution. This color quickly disappears, owing to the formation of lead sulphate. As soon as all the sulphuric acid is precipitated the yellow color becomes permanent. In water solutions alone, however, the reaction is not complete, lead sulphate being somewhat soluble in water and the yellow color of the lead iodide showing slightly, even when an excess of potassium sulphate is present.

To avoid this, it was determined to try the reaction in an alco-

[1] Meyer and Jacobson: "Lehrbuch," Vol. I, p. 594.