The occurrence of benzaldehyde in living plant material may well be taken as indication of possible presence of benzoic acid in any subsequently dried form of the part.

The tannin is the bitter principle as well as the astringent constituent.

The bitter principle, which is the tannin, is not the fluorescent principle.

It permits of better understanding of the troublesomeness of the preparations of wild cherry bark to know that the free benzoic acid contained in the drug decomposes the cold-water-soluble tannin with production of cloudiness or sediment; and, because of this action, the blame, which in the past has been placed entirely upon the tannin, may now be equally accorded to the benzoic acid.

The addition of glycerin to the water used for extraction of the bark in the preparation of the syrup will now be fully appreciated as warranted by the association in the bark of the tannin and benzoic acid, as well as by the teaching of experience with its use.

Also, due allowance must be made for variation in the products of those vegetable drugs which bring into the course of preparation the resumption of an interrupted plant process. For this reason, variation in the preparations of wild cherry bark must be expected, even though glycerin or acetic acid (both solvents for the decomposition products of the tannin by the benzoic acid) or both, be employed in the menstruum.

A STUDY OF PACIFIC COAST PEPPERMINT.

BY C. W. JOHNSON AND ROBIN WILKES.

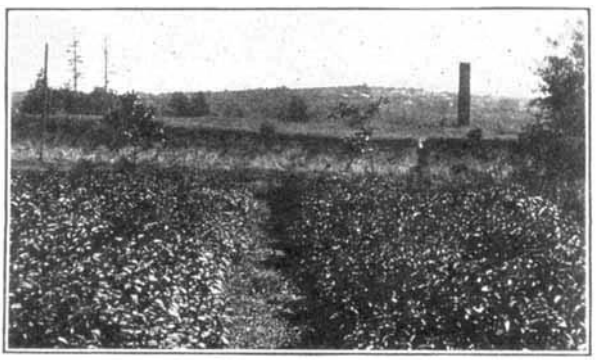
During the last two years a study of Pacific Coast peppermint has been made at the University of Washington. This study was made to show the advantages that Washington and Oregon have over eastern states in the production of peppermint oil. The age of the industry in the northwest is very young, but old enough, especially in Oregon, to show us that it is a very profitable and promising industry in these parts of the United States.

The peppermint industry appears to have been introduced into the United States by the early settlers of New England. The plants were first grown in Wayne County, New York. Then gradually the industry extended west to northern Ohio and from there into Indiana and Michigan. At the present day there are about 25,000 acres under mint cultivation in the United States, nearly all of which are in the states of Michigan, Indiana, New York and Oregon. This country furnishes about 250,000 pounds of peppermint oil yearly and, at the present time, we also import 88 per cent. of Japan's crop.

Peppermint was first introduced into Oregon about 1908 by Mr. O. H. Todd of Eugene and it has been produced in the state for the last fifteen years. Mr. Todd imported the roots for the first planting from England. Oregon is especially adapted to peppermint cultivation because it possesses the valuable and rich beaver-dam land of the Willamette Valley. This swamp-like land is rich in humus and retentive of moisture but fairly open in texture and when well drained, either naturally or artifically, is most suitable for peppermint cultivation. The district of Lake Labish contains several hundred acres of this type of land. The average

yield of mint oil per acre in this district is 70 lbs. In 1922 a little more than 300 acres in the Willamette Valley were under peppermint cultivation. During the last season, of 1922, two acres of the mint produced 186 lbs. of oil or 93 lbs. per acre. This is an extremely large yield. In a statement from G. J. Moisan, secretary of the Oregon Mint Growers Coöperative Association, he reports that the season of 1922 was very dry in the Willamette Valley and the yield on some of the land was very small, yet the returns were far better than they would have been for grain or hay. About 12,000 lbs. of single distilled oil were produced on the 300 acres in 1922. Tests have demonstrated that good bottom land almost anywhere in the Northwest will yield 50 to 60 lbs. per acre in a normal year.

These broad level stretches of land are easily tilled because large horse tools can be used. In the spring when the soil is usually very soft it is necessary to use mud shoes 9 or 10 inches wide on the horses. These shoes are generally made of wood and leather and fastened by straps and metal bolts to the hoofs or ordinary shoes of the horse. Planting begins as early in the spring as possible and the har-



This picture shows two beds of peppermint in the Garden of Medicinal Plants, University of Washington. The plants on the right came from New York and those on the left from a producer in Oregon.

vesting of the mint starts in August when the plants are in full bloom. It has been said that due to the early spring in Oregon the growers there should be able to get their product on the market before the Michigan growers and so profit by the higher price offered for the first oil. Only three crops can be raised on the sandy river-loam type of plantation while on the rich muck-land, peppermint can be grown year after year for five or six successive years before it becomes necessary to plant the field with something else.

A number of varieties of mint have for the last six or seven years flourished in the Garden of Medicinal Plants of the University of Washington. The plantings came from different parts of the country, some from New York, some from various producers in Oregon and one bed from a producer in the southern part of the state of Washington. There are thirteen plats in all covering an area of about 3600 square feet.

Most of these beds have been harvested for the last two years and the oil analyzed. The herb was cut and allowed to partially dry and then stems were

again cut into small pieces and steam-distilled. The still used at the University of Washington was very inadequate, for its capacity was far too small to care for the herb as it dried. After numerous distillations small amounts of oil were obtained from three varieties. The yields were not very large due probably to the poor facilities for handling and the fact that the mint has grown on the same plot of ground for about seven continuous years. The aqueous distillates were cohobated and this increased the volume of the oil about 6.5 per cent.

Samples of the 1921 crop of oil were secured from seven different producers in Oregon. These oils and also the oils from the Garden of Medicinal Plants at the University of Washington were analyzed for their menthyl acetate and total menthol content and in each case it was found that they assay considerably higher than eastern oils in both menthyl acetate and total menthol. One Oregon oil ran as high as 78 per cent. total menthol which is more than twice as high as the average Michigan oil. The average total menthol content of Oregon oils was found to be 62 per cent. The Oregon products are also very high in ester content, menthyl acetate averaging about 10 per cent. It is this compound that gives most of the fragrance and odor to the oils. The Oregon oils are sometimes mixed with the eastern oils in order to bring up the menthol content of the latter to standard of the United States Pharmacopœia. Oregon oils sell at about 50c. more per lb. than Michigan, Indiana or Illinois products, because they run much higher in menthol and menthyl acetate. The specific gravity of the western oils ranges from 0.8995 to 0.9436, averaging 0.9147, and the refractive index varies from 1.4600 to 1.4665. The optical rotation also is quite variable, ranging from —23.5824 degrees to —36.414 degrees.

The comparative analyses are shown on the chart below.

CONSTANTS OF OREGON AND WASHINGTON PEPPERMINT OILS.

Producer and location.	Menthyl acetate, per cent.	Total menthol, per cent.	Refractive index, 20° C.	Optical rotation.	Specific gravity, 15.6° C.
Claud Bevens, Lake Labish, Oregon No. 1	15.5	78.45	1.4600	—32.5994°	0.9070
Wilson and Davies, Independence, Oregon No. 2	15.08	77.24	1.4617	—29.1312°	0.9130
O. B. Marshall, Albany, Oregon (White mint) No. 3	10.28	73.04	1.4630	—27.7440°	0.9065
O. B. Marshall, Albany, Oregon (Black mint) No. 4	9.85	70.19	1.4620	—29.4780°	0.9030
Mrs. L. Hayes, Eugene, Oregon No. 5	7.90	59.99	1.4615	—23.5824°	0.8995
G. J. Moisan, Gervais, Oregon No. 6	13.60	63.82	1.4633	—36.414°	0.9218
E. B. Wallace, Albany, Oregon No. 7	9.37	61.20	1.4665	—26.875°	0.9436
Drug Garden, Univ. of Washington No. 8	12.12	68.73	1.4647	—31.216°	0.9113
Drug Garden, Univ. of Washington No. 9	20.46	63.84	1.4660	—28.3720°	0.9292
Drug Garden, Univ. of Washington No. 10	11.31	64.43	1.4653	—29.3210°	0.9156

A different indicator than that used in the United States Pharmacopœial assay of total menthol and menthyl acetate was used in the analysis of these western oils. The regular U. S. P. assay was followed in every other respect excepting this one; the indicator, phenolphthalein, was changed for phenol red. It was found in the determination of menthyl acetate and total menthol that phenolphthalein was not very satisfactory due to the fact that its colorless acid reaction was masked by the yellow color of the saponified oil. The characteristic color of an acid reaction to phenolphthalein should of course be colorless; because of the covering up of the acid reaction to phenolphthalein the end point is difficult to determine. Of the various other indicators used phenol red was found to be the most satisfactory. It gives a pink or red color, according to the concentration of the indicator, when alkaline, and a canary-yellow when acid. This yellow color shows up very distinctly and is not in any way interfered with by the color of the saponified oil. It is also a very sensitive indicator, one drop of either acid or alkali changing the color completely from pink to yellow, or vice versa.

In all ten samples analyzed the percentage of menthyl acetate and of total menthol ran very high as compared with the eastern oils of this country. The western oils assay more nearly like the Japanese and European oils. Perhaps western climatic conditions are responsible for the high menthol and menthyl acetate content. It has been shown by Umney and others that the climate and soil both have a considerable influence on these two constituents and it is thought that such is the case in Oregon and Washington. The air is very humid in both of these states throughout the summer and there is not the hot drying effect which is found in some of the eastern localities where peppermint is grown. This humid climate is probably one of the factors that cause the large yield of oil and the high percentage of menthol and menthyl acetate in the peppermint oil of the Northwest.

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CHEMICAL EDUCATION IN PHARMACY SCHOOLS.*

BY JOHN C. KRANTZ, JR.[1]

The schools of pharmacy holding membership in the American Conference of Pharmaceutical Faculties offer two well-defined courses. The first course covers a period of two years and is especially intended to train students for the intelligent practice of retail pharmacy, *i. e.*, the filling of physicians' prescriptions and the manifold other duties demanded of the pharmacist of to-day. The second course, which covers a period of three years, is intended to prepare students for the fields of analytical and manufacturing pharmacy, food and drug analysis work, etc. Many schools of the larger universities, however, offer advanced courses leading to the bachelor's, master's and doctor's degrees in pharmacy. The chemistry to be taught in the two-year course will be the chief consideration of this paper.

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