more owing to their mode of application. For neurasthenies and dyspeptics, the dry, bracing air, pure water, and easily obtained hill exercise of such places as Tunbridge Wells, Buxton, and Malvern cannot be excelled if their natural advantages are supplemented by a course of rational hydrotherapeutics. The Delaware Water Gap region rivals the English resorts; and the sanitarium at Experiment Mills, Pennsylvania, three miles back of the Gap proper, is said to unite all the requirements of situation, beauty of scenery, and sensible management. More accessible than Bagneres de Bigorre and of the same class are the Rock Alum and Rockbridge Alum Springs. The water of Eaux-Bonnes is somewhat like that of the Greenbrier White Springs of West Virginia. It is almost always possible to find on this side of the Atlantic springs and localities as useful as European resorts. But the extramedicinal factors, the mechanics of the situation, are too often in a crude state. This is not always so. As Dr. Coan says, when we come to have more of such admirably appointed establishments as the sanitarium at Dansville, New York, foreign travelers will frequent our waters as we do theirs at the present time. For the overstrained inhabitants of large cities, jarring their brains and spinal cords by the continual treading of stone and brick on an almost uninterrupted level, wearied by incessant noise and the absence of any wide range for the eye, with nothing in particular for the arms to do at any time, and the consequent lessened chest expansion, air treatment and water treatment hold a unique place as restorative measures. Such a hygienic course as has been indicated is entitled to a recognized place in the list of scientific methods.—*N. Y. Medical Journal*.

[AMER. CHEMICAL JOURNAL.]

(Contributions from the Chemical Laboratory of Vanderbilt University.)

1.—SOME MODIFICATIONS OF THE METHODS OF ORGANIC ANALYSIS BY COMBUSTION.

By WM. L. DUDLEY.

THE investigations recorded here were undertaken with the hope that the method of ultimate organic analysis by combustion might be so modified as to be more rapid and none the less accurate.

The time required in preparation for the combustion by ordinary methods is much greater than that for the operation itself; it being consumed in drying and mixing materials, filling and heating up the tube, and in case several combustions are to be made at once, the time required in cooling the tube is very considerable. Then again the liability of loss by breaking the tube in heating and cooling is of no little importance.

The method of burning the substance with a current of air or oxygen in a glass combustion tube containing copper oxide is well known. It is stated, however, without satisfactory reason,* that the discrepancy in the hydrogen determinations is as great in this method as in that where the substance and copper oxide are mixed, even though in the former the copper oxide is kept hot and the substance introduced in a boat. Kopfer has described a method in which he employs platinum-black mixed with freshly ignited asbestos, instead of copper oxide; and to prevent the gases from passing through the tube without decomposition, he interposes three plugs of asbestos wound with fine platinum wire. The method is said to give very accurate results under careful management.

The platinum combustion tube which is being so generally used in carbon determinations in iron has, as far as I am aware, never before been used in organic analysis, and the method that I shall describe here can be used with a glass as well as a platinum tube, though the description will be confined to the latter, as it is much preferred. Fig. 1 shows a section of the platinum tube which is used in this laboratory, the main body of which is 48.5 cm. long and 1.5 cm. in diameter. The tail, D, is 13 cm. long and 0.5 cm. in diameter. The tube is filled from one-third to one-half full with manganese oxide in a coarse granulated condition, several lumps too large to pass through the tail, D, being put in first. The manganese oxide is prepared as follows:

FIG. 1.

Manganous carbonate is decomposed with moderately dilute nitric acid in the cold, and evaporated to dryness. The residue is heated to redness over a blast lamp until all of the nitrate is decomposed. The mass, which is for the most part the oxide Mn_2O_3 , is cooled and easily granulated to any degree of fineness. No channel is left in the tube, as the manganese oxide should be coarse enough to allow the products of combustion to pass with sufficient freedom. If a glass tube be used, a slight channel should be left. The substance is introduced in a porcelain or platinum boat,† B, and followed by a roll of platinum gauze, C, 3.5 cm. long, which has a loop in front so that it can be easily withdrawn. At E a gas-tight brass coupling is inserted; this carries a tube 0.5 cm. in diameter, to which is connected the apparatus furnishing either air or oxygen as desired.

Instead of the size of the tube being reduced to 0.5 cm. in the tail, D, Fig. 1, the design shown in Fig. 2 is

FIG. 2.

proposed to facilitate the passage of the water into the calcium chloride tube. The tube, B, is only slightly smaller than the main body, and the end is closed with a stopper carrying the stem of the calcium chloride tube. At A is placed a platinum basket to retain the manganese oxide.

* Lieben, Ann. Chem. (Liebig), 187, 142.

† J. Chem. Soc., 29, 660.

‡ A porcelain boat is preferred in most cases, as the substance burns more uniformly in it than in a platinum boat.

The whole plan of the apparatus is shown in Fig. 3. Before introducing the substance, and connecting the calcium chloride tube and potash bulb, the portion of the tube containing the manganese oxide is heated to full redness and a rapid current of dry and pure air is passed through. The burners are shut off, except the last two or three, which are sufficient to keep about two inches of the tube red hot. The current of air is then stopped and the calcium chloride tube and potash bulbs are attached, and finally the substance is introduced in a platinum or porcelain boat (by removing the coupling at the posterior end), followed by the roll of platinum gauze. A slow current of air is then turned on, it having been purified by passing through the apparatus shown at A, Fig. 3, containing, 1st, a strong

FIG. 3.

solution of caustic potash; 2d, pumice and sulphuric acid; and, 3d, solid caustic potash. Two burners under the portion of the tube containing the roll of platinum gauze are now lighted, and the substance is gradually approached by lighting the burners under the manganese oxide. The red hot platinum gauze will decompose any condensable gases which may diffuse back, if the combustion should proceed a little too rapidly, and prevent a deposit in the posterior portion of the tube outside of the furnace. An asbestos shield, C, Fig. 3, protects the calcium chloride tube and potash bulbs from the heat of the furnace.

I prefer to use a Geissler potash bulb with tube for solid potash attached, in which case the air or oxygen may be forced in at the rate of two or three bubbles a second. It is also desirable to use a slight exhaust as well as pressure.

When all the burners have been lighted, the air is replaced by a current of oxygen, which is continued for about fifteen minutes, when the combustion will have been completed. The burners are then all turned off excepting the three at the end under the manganese oxide, and the bulbs are disconnected and set aside to cool. In a few minutes the platinum gauze may best be removed with a bent wire, and if a second set of bulbs be ready, another combustion may proceed at once. In this way a combustion may be made easily every hour, the actual time consumed in burning the substance being from thirty to forty minutes.

The manganese oxide is regenerated by the oxygen which is passed in during each combustion; it is never reduced below MnO , and therefore can do the platinum tube no damage. We have a platinum tube in which over fifty combustions were made during two months without removing the manganese oxide, and on examination afterward, the inside of the tube was found to be as clean and sound as ever.

As for the accuracy of the method, I will simply give five results of the analyses of sugar made by Mr. L. M. Donaldson under my direction.

No.	Carbon.	Hydrogen.
1.	42.00	6.62
2.	42.20	6.52
3.	42.02	6.56
4.	42.08	6.55
5.	42.07	6.24
Mean,	42.07	6.49
Theory,	42.10	6.44
Error,	-.03	+.05

I also give five results obtained by him by the same

method, using a glass tube instead of platinum. They are as follows:

No.	Carbon.	Hydrogen.
1.	41.90	6.43
2.	41.92	6.37
3.	42.05	6.41
4.	42.24	6.36
5.	41.99	6.37
Mean,	42.02	6.39
Theory,	42.10	6.44
Error,	-.08	-.05

The method of carrying on the combustion of liquids of high boiling point is similar to that for solids. The required amount of liquid is placed in the boat and the combustion proceeded with as before, except in most cases it is best to approach the substance with the heat a trifle more slowly. For convenience in weighing and handling such liquids, I have used the arrangement shown in Fig. 4. It consists simply of a

FIG. 4.

thin glass bottle with a stopper, B, through which passes a tube, C, reaching to the bottom. A is a rubber bulb attached to the end of the tube, forming an ordinary liquid dropper. The bottle containing the liquid

is weighed, and after the requisite amount of the substance for combustion has been transferred to the boat by means of the dropper, the whole is weighed again.

In the case of very volatile liquids, the following method is employed: The volatile liquid is drawn into the bulb, A, about 3.5 cm. in diameter, shown in Fig. 5, and the whole weighed. The bulb is then connected by the limb, D, to the combustion tube, and by the other to the purifying apparatus, A, Fig. 3. The combustion tube is filled three-fourths full of manganese oxide and heated to redness before the bulb containing the liquid is attached; the calcium chloride and potash bulbs are also previously connected. A slow current of nitrogen is then passed through the apparatus to serve simply as a carrier of the vapor of the substance,

FIG. 5.

no way interferes with the combustion of the substance, and the absorption of it by the potash bulb is not materially appreciable in the results. The nitrogen may be prepared sufficiently pure by passing air over red hot copper in a porcelain tube, and then through caustic potash to a gas holder.

As mentioned before, a glass combustion tube may be used, in which case, of course, it should be straight, with stoppers fitting at each end. When glass is employed, a little more time is necessarily required, owing to the caution which must be used in heating and cooling.

I do not deem it necessary to speak of the advantages of the platinum over the glass tube, but I will simply say that its cost is soon paid for in time and labor saved.

I prefer manganese oxide to copper oxide, even if the old method of combustion is employed, because it is much lighter, quite as effective, and forms a mass more easily permeable by the gases.

ANALYSIS OF SOME SOUTHERN FRUITS WITH REFERENCE TO THEIR FOOD VALUES.

By CHARLES L. PARSONS.

KONIG, in his well known work, "Nahrungs- und Genussmittel," gives a summary of all published analyses of fruits,* their nutritive ratio and food units. This summary contains the analyses of a large number of fruits, but singularly enough but one analysis of oranges is given, and that was made previously to the investigation by Buignet, in which the existence of cane sugar in acid fruits was conclusively proved.†

Of late years oranges have become so important both as a food and a luxury, and have become so great a source of wealth to some of our Southern States, especially Florida, that I decided to make food analyses of the prominent varieties grown in that State. I have also made analyses of pomegranates and persimmons, which, although seldom seen in the Northern markets, still form no inconsiderable part of the fruits of the South.

For my purpose I obtained direct from a friend in Oviedo, Florida, a box containing eight different varieties of oranges fresh from the grove. The oranges were carefully labeled, and each wrapped in tissue paper. The pomegranates and persimmons were obtained from Hawkinsville, Georgia. I commenced work on the fruits as soon as they arrived. For the analyses a number of oranges were taken of each variety; total acids and water determined in an average sample of the fresh fruit, and the remainder of the pulp dried at about 95° C. Pomegranates and persimmons were treated in the same way, with the exception that the pulp of the persimmons was separated from the seed by means of a large-meshed sieve, previous to drying.

In the following tables I have given a comparison of the dry substance of the fruits analyzed with the dry substance of bread, coconut, and banana, giving their nutritive ratio and number of food units. I selected the Navel as a type of the Florida oranges in this comparison, and the Guy Pope, a Messina orange, sold last season in large quantities from New York City, as a type of the Mediterranean orange, of which more than two million dollars' worth are annually imported.

* Konig, Nahrungs- und Genussmittel, 2d edition, Bd. II, S. 491-497.

† Ann. de Chim. et de Phys. [3d series], 61, 233.

The following results are averages of my analyses :

	H ₂ O.	Crude protein.	Free acids.	Glucose sugar.	Cane sugar.	Ether ext.	Crude fiber.	Ash.	Albuminoid nitrogen.	Nitrogen free extract.
Sweet pomegranates.....	78.27	1.33	0.365	11.61	1.04	1.24	3.63	0.761	0.177	15.77
Sour pomegranates.....	75.41	1.60	1.85	10.40	0.26	2.05	2.83	0.544	0.208	17.57
Persimmons.....	66.12	0.827	0.000	13.54	1.03	0.701	1.78	0.861		29.711
Florida orange, Bitter Sweet.....	86.86	0.815	0.417	5.71	0.84	0.243				
Florida orange, Tangerine.....	83.56	0.792	0.477	6.00	3.41	0.256				
Florida orange, Mandarin.....	79.95	0.834	0.555	4.77	8.07	0.146				
Florida orange, Bloods.....	85.57	0.700	0.670	5.70	3.94	0.100				
Florida orange, Navels.....	83.70	1.12	0.662	6.03	4.68	0.234				
Florida orange, Russels.....	83.18	0.905	0.817	7.29	4.51					
Florida orange, common Florida.....	86.58	0.862	0.756	4.60	4.38	0.076				
Florida orange, Florida sour.....	86.76	1.03	2.55	3.86	0.97	0.125				
Messina orange, Guy Pope.....	86.22	0.980	1.18	5.95	1.82	0.166				

	Nitrogen = Protein.	Pat.	Nitrogen = Free Extract.	Nitrogen = N. Nit.	Nitrogen = N. Nit.	Nitrogen = N. Nit.	Nitrogen = N. Nit.	Nitrogen = N. Nit.	Nitrogen = N. Nit.	Nitrogen = N. Nit.
Bread.....	10.94	87.07	0.71	8.7	1446.2					
Sweet pomegranates.....	6.12	72.52	5.70	13.5	1262.2					
Sour pomegranates.....	6.50	71.44	8.34	13.4	1289.9					
Persimmons.....	2.44	90.63	2.07	35.6	1090.4					
Banana.....	6.94	85.73	2.33	12.0	1274.1					
Solid portion coccanut.....	10.31	15.10	67.33	12.9	2586.4					
Mandarin orange.....	4.15	85.86	0.73	21.0	1085.2					
Navel orange.....	6.87	80.85	1.44	12.1	1195.2					
Guy Pope orange.....	5.78	71.11	1.22	10.9	1093.1					

To any one who is acquainted with the flavor and general edibility of the different varieties of Florida oranges, it will be apparent that these analyses indicate that the best varieties contain the highest percentages of cane sugar, and that if the analyzed varieties were to be placed in the order of their superior flavor, and in the order of their contents of cane sugar, the two series would be very nearly identical.—*American Chemical Journal*.

NOTES ON ESSENTIAL OILS.*

Wintergreen Oil.—Mention is made that recently samples of wintergreen oil from Java have been received, and some doubt is expressed as to its botanical origin. [It may be mentioned that seventeen years ago Dr. Vrij stated in this *Journal* (vol. ii., p. 503) that probably wintergreen oil could be distilled profitably in Java from the leaves of *Gaultheria punctata*.]

Ylang-Ylang Oil.—According to information received from Manila, the differences in quality of the numerous varieties of this oil met with in commerce depend principally upon the method of preparation and the selection of blossoms, as these possess the finest aroma when freshly picked. In the distillation the first, most volatile, portion of the oil has an incomparably fine perfume, while that distilling over afterward gradually manifests a stale odor; the finest oil is therefore sent out by those firms that distill only the first portion.

In practice if 100 kilos of fresh flowers would yield 1,200 grammes of oil, the finest aroma would be concentrated in the first 600 grammes that passed over.

Dilem Leaves Oil.—From Java a sample of "dilem leaves" has been received, possessing a very fine perfume and yielding about one per cent. of an ethereal oil that in odor is said to resemble patchouli oil, but to smell essentially fresher, finer, and less musty. It is a yellowish green, moderately thick liquid, has a specific gravity of 0.960 and boils between 250° and 300° C. It is considered that if the cost of producing this oil should prove to be not too great, it might take an important place in perfumery, and steps are therefore being taken to determine the origin of the leaves and obtain a supply.

Massoy Bark Oil.—A large supply of massoy bark having been secured through the agency of the German New Guinea Company, an appeal is made to the patriotism of German perfumers and soap makers to find an application for the first product of this kind from a German colony. The oil is described as having an agreeable aromatic odor resembling cloves and nutmeg, and as being suitable as a perfume for cheap toilet soaps. The plant from which the bark is derived was discovered by D'Albertis in south New Guinea and named by Beccari *Massoa aromatica*. Gmelin, who attributes the bark to *Cinnamomum Kiamis*, Nees, gives in his "Handbuch" (iv. 356) the constituents of the oil as follows: (1) an almost colorless thin light oil, with an odor of sassafras; (2) a thick, heavy, less volatile oil, with a weaker odor, but tasting strongly like sassafras; and (3) massoy camphor, a white powder, heavier than water, less soft to the touch than fatty substances, odorless and almost tasteless, allied to laurin and carvophyllin and soluble in hot alcohol and in ether. In preliminary experiments Messrs. Schimmel have obtained from the bark about 7 per cent. of an oil having a specific gravity of 1.04, boiling between 200° and 300° C., and containing about 75 per cent. of eugenol. The portion of the oil insoluble in soda liquor boiled between 210° and 245° C., and among other bodies contained safrol.

Matsu Oil.—The Japanese oil mentioned under this name in a former report, and supposed to have been a distillate from a birch or beech tar, has now been ascertained to have been derived from a tar of either *Pinus massoniana* or *P. densiflora*, both of which trees pass under the name "matsu" in Japan. The former is said to show great similarity to *Pinus austriaca*, and the latter to *P. sylvestris*.

Citronelle Fruit Oil.—A large consignment of the

* From Messrs. Schimmel's report.

small round berries of the size of a pea, designated "citronelle fruit," has been received from Java, and has yielded about 3½ per cent. of essential oil. This oil resembles verbena oil, and is usually powerful and rich; its specific gravity is 0.980 and it boils from 180° to 240° C. It contains a terpene and citral (see under eucalyptus oil). In the Indies it is known under the name "minjak sereh," and is credited with being a panacea.

East Indian Oils.—Messrs. Schimmel also report upon fifteen samples of essential oil received from India, only one of which was found to be a pure distillate. This was described as "lemon oil," and had a fine lemon and melissa odor, essentially finer than that of citronelle oil, and at a moderate price would probably prove acceptable. The others were all mixtures having a basis of sandal-wood oil, and were all condemned as useless.

From St. Domingo samples of oils have been received under the following names:

Bergamot Oil.—A distilled yellow oil with a powerful and fine aroma, resembling oil of petit grain in odor, but not recalling bergamot oil. Probably the distillate of the leaves and unripe fruit of some species of *Citrus*.

Lavender Oil.—A water-clear essential oil, quite different from the European varieties of lavender oil, and rather recalling spike oil in odor.

Rosemary Oil.—A powerfully aromatic oil, approaching nearer to European lavender oil in odor, and probably utilizable if the cost allows.

Bay or Mountain Laurel Oil.—An essential oil with an odor like that of laurel oil.—*Pharmaceutical Journal*.

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