evolving putrid gases, etc.—that water is so industriously and incessantly turning the noxious into less hurtful compounds.

I have dwelt thus long on distilled water as all the substances found in that water, including the rejected distillate, are also found in the medicated waters of the Pharmacopœia. To these waters I now briefly call attention.

Aqua Anethi.—1 lb. of the fruit yields from 3 to 7 drachms of oil, sp. g. ·90. In a note to his translation of the P. L., Phillips says that this oil is soluble in 1,500 parts of water; if so, it is evident the proportion of fruit or oil is excessive in the B. P. form. This is a fact, and if m aceration had been ordered, the quantity might have been halved and a superstratum of oil still obtained.

Aq. Flor. Aurant.—The foreign preparation, with which a syrup is made, often substituted for syr. capillaire. The tests given for this water should have Gobley's test, Ph. J. Ap. 66, added to them; this test detects orange leaf and oil of neroli water. 1 lb. of orange flowers yields about 3 ss of oil, sp. g. ·88.

Aq. Camphoræ I have already referred to. If the camphor is beaten in a mortar without spirit, I find it can be reduced to a coarse powder, incapable of sifting through the muslin, but sufficiently fine to make the water quickly.

Aq. Carui is very similar to aq. anethi; both preparations are reduced in quantity from the P L., and by the adoption of maceration previous to distillation, might still further be reduced. 1 lb. of caraway fruit yields 3 iij to 3 x of oil of sp. g. ·94.

Aq. Cinnamoni is slightly altered in proportions from the B. P. Using the bark, we are not so likely to use cassia. Pareira says these barks may be known apart by the iodine reaction, but the oils are not so easily distinguished. 1 lb. of cinnamon yields 3 i to 3 iij of oil, sp. g. 1·006.

Aq. Fœniculi comes from Scotland. Possibly Englishmen are not yet alive to its value, as it is not much in request amongst us. 1 lb of fennel yields 3 ij to 3 vj of oil, sp. g. ·94.

Aq. Laurocerasi has been investigated by Draper, Pooley, and others. It is one of the most uncertain articles in the Pharmacopœia. Draper advised standardizing its hydrocyanic acid; a weak solution of hydrocyanic and sulphuric acids has been praised by others; some say make a stronger water and dilute when wanted; others omit the maceration process; so, altogether, it is a dangerous and uncertain article. The oil varies from ·06 to ·6 per cent. (Umney.)

Aq. Menth. Pip. and Aq. Menth. Vir. represent the Labiates; they are the only waters made from oils, as recommended by Haselden, and are improvements on the herb-distilled waters of the P. L. The oil should be divided by trituration with some solid before it is put in the still.

Aq. Pimentæ has been reduced ⅛th, that is, 2 oz. less pimento to the gallon. A thin layer of oil lies at the bottom of the water; this opaque water becomes clearer by age, and deposits crystals, to be afterwards noticed. 1 lb. of the berries yields 3 ij to 3 v of oil, sp. g. 1·02.

Aq. Rosæ, ordered to be made from rose petals, is often made with otto or rose geranium oil. Real otto is a scarce article, 100 lbs. of petals yielding less than 3 iij of solid otto fusing at 86°. To the salt process I shall refer presently.

The last water of the Pharmacapœia is Aq. Flor Sambuci; this, as well as aq. rosæ, the B. P. allows to be made from the salted flowers. I have found the use of salt unsatisfactory and injurious. Often after salting and keeping in a cool, dry place, I have found that before the next flower season came round, an odor of chlorine and sawdust was developed by distillation. The metal still was corroded; the water smelled like a dilute solution of chlorine and precipitated argentic nitrate; I therefore discontinued the salting process, and distilled a stronger water and diluted it when wanted. This water I have found to keep; I have some two years old. Elder flowers yield scarcely ·32 per cent. of a volatile oil slightly lighter than water, yellow, solid, and with a powerful smell of elder flowers even when largely diluted.

These are the waters of the Pharmacopœia, lime water is among the liquors—the B. P. definition of waters evidently being solutions of essential oils in water. Why is aq. pulegii omitted? It is wanted as much as some that are official. Standard forms are also wanted for aq. anisi and caryophilli.

When first made, many of these waters are harsh and musty, but by keeping they mellow down. What is the cause of this? Returning to what I noticed in aq. destillata, has there been any of that slow but surely oxidizing force of water at work on these aqueous solutions of oils? Alcohol has been shown by Warington to change in distilled water to acetic acid. And these essential oils, composed of alcohols and camphors, probably succumb to the same influences. At the bottom of such waters as aq. pimentæ and aq. cinnamoni, resinous matter has often been noticed. But what is resin? The term is as correct chemically as copperas for ferri sulph.; it is only a generic name for a series of acids probably oxidized from oils. This goes a long way to show that essential oils are changed as well as alcohol. By which of the compounds in the oils is the resin yielded—the alcohol, the camphor, or both? But resinification or change commencing, what is to hinder the new product modifying or etherifying the remainder? Such action would, in the case of a water, be slow and small in quantity, but such a re-arrangement of matter would remarkably alter some of the characteristics of the oil and water, In the laboratory it may be difficult to acidify some of these oils, but to acidify quickly and completely is one thing, to acidify or modify small quantities in the presence and by the aid of powerful agents constantly at work is another; some action, we know, takes place which mellows the waters as they are kept after distillation. So much for what is in solution. These waters should always have a superstratum of oil (except, of course, pimento and cinnamon) floating on them, as Haselden suggested; adding, also, that such oil is as good as the original oil. So it is, but I have sometimes noticed an oleographic difference. After long contact with water, the oil drop does not give so good a "roll," and the figure is slightly altered and slower in its formation. Between the oil and water there is always a muddy layer. A great deal of this is *debris*, or matter floated over by the steam, as well as the results of changes in the water. On examining these formations microscopically I have sometimes noticed small crystalline forms which, when carefully separated, easily melt, and give an odor resembling the essential oil used. These crystals, as in cinnamon, pimento, caryoph., and menth. pip., have been nearly colorless, few in number, only seen with high powers, and possessed of polarizing properties. Are these the hydrates of a portion of oil similar to turpine hydrate? and if so, may not a hydration of the oil, especially of that dissolved, materially assist in maturing these waters? These are subjects opening a wide field of research from what appears a very simple subject.

Lastly, the modes of preparing medicinal waters require attention; the only authorized plan in B. P. is distillation (except in the instance of camphor.) The first conclusion one draws from these notes is that spirituous essences are objectionable; they make clear waters, but the result of oxidizing alcohol is acetic acid. This was found to be the fact by Warington in 1845, and every observer since has confirmed the fact. In rejecting the Dublin form for waters, the compilers of the Pharmacopœia were wise and justified by these facts. Oils have been rubbed down with magnesia and chalk; these, too, are objectionable, as soaps are formed as pointed out by Brady and Attfield; the water also acquires an unpleasant odor. Silex, according to the old London Pharmacopœia, and kaolin, or fine clay, as suggested by others, have been used for dividing the oil with variable results.

I find that if a small tube, containing an essential oil, is placed in water in a position opposite to the specific gravity of the oil, and the ends of the tube are closed with membrane, vegetable parchment, etc., exosmosis of the oil commences, and in twenty-four or forty-eight hours the water is saturated, and may be drawn off and replaced by a fresh portion. I do not propose this as a plan in opposition to distillation; it is too long in operation, perhaps, but as a convenient way of making those waters only wanted occasionally, and which are frequently made by rubbing down the oil with some other substance.

ON THE ANILINE OR COAL-TAR COLORS.*

BY W. H. PERKINS, F. R. S.

(Continued from p. 104, vol. III.)

Mauve, Magenta, and some of their Derivatives.

You will remember that in my last lecture we went over all the various steps between coal and color. We saw how coal-tar was produced from coal; how coal-tar, naphtha, and benzole were separated from coal-tar; how nitrobenzole and aniline were made from benzol, and concluded with an account of the preparation of aniline purple, or mauve from aniline. We will now proceed to the study of some of the most remarkable properties of aniline purple.

This coloring matter is sometimes supplied to customers in a clear and beautifully crystalline condition. This product is found to be a salt of a compound, chemically termed an organic base. This base has been called "mauveine;" it is composed exclusively of carbon, hydrogen, and nitrogen, in the following proportions:—

$$C_{27}H_{24}N_4.$$

Mauveine, although the base of aniline pur-

* The Cantor Lectures, delivered before the Society of Arts, published in the Chemical News.