that have been provided with rods that externally appeared to be everything requisite, but underground they have been found to be too short, and ending in dry earth or gravel but a foot or two below the surface. To be sure, the rules all call for the rod to end in a well of water or in earth always damp; and to secure this in places charcoal has been recommended as a proper material to surround the rod in the ground, as it is supposed to absorb and retain moisture.

With the knowledge we possess to-day, it is easy to understand that no amount of charcoal will be of service if the charcoal itself be in dry earth. A house with a poorly constructed rod upon it is in more danger than it would be without it. I knew of a house provided with a rod which was raised up to put another story under it. The rod was pulled out of the ground and the lower end left dangling in the air six or eight feet from the earth. While in that condition the lightning struck it and did considerable damage to the building. Formerly all lightning rods were fixed upon insulators upon the building; now such provisions are discarded as quite useless, and the rod is made fast in the most direct way to the part to be protected. The wetted surface of buildings furnishes ample conductivity to electricity of the high potential of lightning. It was once thought that lightning rods should be made of large surface rather than large cross sections, and the changes have been rung on that idea. Hollow rods, strips, straps, twists, and braids, and these made of copper or iron or steel, painted or galvanized, have been put upon houses by enterprising lightning rod men, glibly quoting Sir Snow Harris and Prof. Henry. It has, however, long been known that conductivity is what is wanted, and not area, and Prof. Carhart has demonstrated that Prof. Henry's conclusions were wrong. Conductivity can be secured with either iron or copper. I have seen miles of telegraph poles that have been struck by lightning, but I do not remember to have ever seen a No. 8 telegraph wire that has been fused by lightning. Possibly it may have been in some instances, and in my judgment a No. 4 telegraph wire of iron has conductivity sufficient for the protection of any ordinary building if its ground connection is properly made.

Whatever may be the source of atmospheric electricity, it should be remembered that, whenever it is generated, there is practically an area of cloud and of earth between which there is a difference in electric potential. Sometimes the areas are large, and then it is not the contour of the ground that determines where the discharge shall take place so much as the conductivity of the earth itself within the region of the electrical action. If there were a hill made of glass or of hard rubber, and there were buildings and trees upon it, it is not in the least degree probable that either would be in the least degree in danger from lightning, for the difference in potential could never rise high enough to discharge through it, and there could be no discharge into it any more than into any insulator.

The principle of least work holds for electricity as in other forms of energy, and the discharge would take place, if at all, to another field of ordinary conducting earth one, two, or more miles away, as offering less resistance, and therefore requiring less work than the destruction of a quarter of a mile of glass. It is familiar enough to every observer that lightning seldom goes vertically to the ground. It generally takes the hypotenuse of the triangle rather than the perpendicular. That it does so over large bodies of water I have no knowledge. I should expect it would not, but would in every case go vertically into the water. If any one knows of its being otherwise, I should like to know of it. There are some kinds of trees that are more often struck by lightning than others. For instance, poplars and locusts seem to be more subject to lightning than many others as common, while beeches are seldom or never struck. It is possible that these peculiarities may be due to the difference in the distribution of their roots, some trees having surface roots covering a large area of ground, while others go deeper with tap-like roots. One of these would discharge a large area, while the other could not. But there are some areas of considerable extent that appear to be not subject to lightning, while others are frequently struck. On mountains above tree level the lightning does not strike the mountain, but goes between clouds. It is plain that there can be no distribution through rocks, and hence one might expect that there would be hills on a lower level which would be less likely to be visited by lightning than others on account of their rocky foundations, and hence houses built upon such eminences would be more secure without lightning rods than others on a better conducting surface would be with them. Thunder showers generally follow water courses through valleys, unless they are extensive enough to cover a large area, and then the destructive effects are generally in the lower lands and not on hills. This is the same as saying that the storms follow the areas of country of highest conductivity, and do their minimum of work in sections of high resistance.—*Practical Electricity.*

ON A PARTIAL SEPARATION OF THE CONSTITUENTS OF A SOLUTION DURING EXPANSION BY RISE OF TEMPERATURE.*

By Prof. J. W. MALLEY, F.R.S.

It was observed in regard to a thermometer containing colored alcohol, the color due probably to cochineal, that on several occasions when rise of temperature occurred somewhat gradually in the room after rather severely cold weather, the upper part of the column of liquid was colorless or nearly so, while no deposition of any solid coloring matter could be seen in the bulb or the lower part of the tube. Colorless alcohol had apparently separated itself by expansion from a still perfect solution left behind.

This led to making some experiments with solutions, partly aqueous, partly alcoholic, of several colloid substances, such as starch, tannin, caramel, albumen, and gelatin. Each solution was placed in a flask of about half a liter capacity, which was brought to near 0° C. by being surrounded with ice, filled to the mouth with the solution at this temperature, and closed by a cork traversed by a glass tube of small but not capillary bore (about 4 mm. interior diameter), 15 or 20 cm. long, and having a glass stop cock in the middle of its length. The ice having been removed, the tempera-

ture of the flask and its contents was allowed to rise gradually in a warm room until the head of the column of liquid in the tube, originally one or two centimeters below the stop cock, had reached to about as far above it. The stop cock was then cautiously closed, and the small portion of liquid above it, removed by means of a capillary pipette, was submitted to appropriate tests for the substance in solution in the contents of the body of the flask. In contrast with a sample of equal volume taken from the flask itself, the portion which had been slowly driven up by expansion was found to contain a diminished amount of material in solution, often a very notably diminished amount, and in two or three instances practically none.

All the solutions tried were filtered beforehand through four thicknesses of fine, close filtering paper, so as to remove suspended particles of solid matter. No film consisting of, or rich in, the material dissolved in the bulk of the liquid could be detected on the inner surface of the tube in its upper part, so that the separation could not well be attributed to surface adhesion.

The extent of exposure to the air on the small cross section of the tube would hardly allow of an explanation being found in chemical change of the dissolved material.

The term *apantlesis* (*ἀπάντησις*) might be used to signify a draining away of some of the molecules of the solvent undergoing expansion from among those of the colloid solid in solution. Such draining away would seem to connect itself on to change in the opposite direction, but leading to the same result, when the colloid begins to separate out by gelatinizing on cooling.

The conditions which seemed most to influence the production and the distinctness of the phenomenon were—first, the proportion of the colloid solid in solution; and second, the time occupied in the rise of temperature of the liquid. In regard to each of these conditions, there appeared to be a certain point at which the separation was most notable, above or below which it became gradually less distinct, and sufficiently removed from which it was not observable at all.

SACCHARINE: THE NEW SWEET PRODUCT FROM COAL TAR.*

By Dr. CONSTANTIN FAHLBERG.

THE subject which I am going to bring before you is one which may, perhaps, be known to many of you, at least, by name. In the first place, I think it well to give you a short history of this new and interesting compound, stating how I came to discover it, and what my principal work was during the period of nine years, in developing it for purposes of manufacture on a large scale.

When, in the year 1879, I became connected with the Johns Hopkins University of Baltimore, part of my work was to repeat the older experiments of Latehinow, Anna Wolkow, Remsen, Beckurts, and others, on the toluene sulphamides. I prepared first the toluene sulphamides, in order to study their oxidation products; some of them, the "para" and "meta" compounds, had previously been studied by others, but the "ortho" compound had not been investigated up to that time.

By oxidizing pure orthotoluene sulphamide, I found that it yields a remarkably sweet compound, but the amount obtained by the process employed was so small that it was hopeless to think of making the laboratory experiment fit for a manufacturing process. Not discouraged by this fact, I set to work to study other reactions, in order to get a better yield of the sweet body.

In the first place, the costly anhydrous or fuming sulphuric acid was not fit for yielding sufficient orthotoluene sulphonic acid. It was found that by treating toluene with anhydrous sulphuric acid the parasulphonic acid was the principal product formed. Experimenting with different strengths of acid, it was found that sulphuric acid of 66° Baume answered the purpose best at low temperature, converting almost one-half of the toluene into the orthosulphonic acid.

The next step in the process was the treatment with phosphorus pentachloride—a reaction which cannot be carried out on a large scale. I therefore experimented with phosphorus trichloride, employing a current of chlorine gas, and found by this method of treatment that the action was less violent and more under control, but it gave the same results as when phosphorus pentachloride was employed. In order to manufacture phosphorus trichloride a new apparatus had to be devised, this compound not having been manufactured up to that time in sufficient quantities to warrant the hope of obtaining a continuous supply for my purpose.

The apparatus which I have devised for effecting this object is made of cast iron, and the phosphorus used is the yellow and not the red modification; the apparatus being so constructed as to allow of continuous flow of phosphorus into it through a funnel. With this apparatus an unlimited quantity of the trichloride may be manufactured, the cost of production being comparatively small, while the purity of the article is very high.

In my laboratory work I made use of aqueous ammonia for transforming the orthosulphonic chloride into the amide, but I found that the water was very dangerous, changing the sulphonic chloride frequently back into the sulphonic acid, and not into the amide as desired, and so rendering this step of the process very uncertain. To avoid this inverse reaction, water had to be excluded, and dry ammonia gas had to be used, which again required complicated apparatus and study of the conditions under which the reaction progressed most favorably.

My apparatus as now constructed, and the knowledge which I have gained by patient study of this part of the reaction, have so overcome this inverse reaction as to make the yield almost a theoretical one.

The oxidation of toluene orthosulphamide into saccharine requires great precaution, and it was found necessary to change very materially the work at this stage of the process from the laboratory method to that necessary for a manufacturing operation. In my previous work I had stated that toluene sulphamide

yields on oxidation with potassium permanganate two products—namely, saccharine and orthosulphamibenzic acid. At that time I had assumed the reaction to take place with elimination, not of ammonia, as a chemist would be inclined to suppose, but in that of nitrogen. Now I find that this reaction is an entirely different one, that neither ammonia nor nitrogen is formed, but that by oxidation part of the amide group is changed into nitrates in the presence of potassium permanganate.

To check this formation, very dilute solutions have to be employed, and the subsequent evaporation becomes a very expensive operation.

A discovery which took place at this time helped me greatly to utilize the sulphamibenzic acid formed during the process, by transforming it into saccharine. This discovery consisted in the following reaction: If a neutral salt of sulphamibenzic acid be treated with phosphorus pentachloride or with trichloride in a current of chlorine gas, the dichloride formed in this reaction yields, on treatment with ammonia, not, as might be assumed, a diamid, but an ammonium salt of saccharine from which saccharine can be easily separated, like from any other salt of it, by the addition of a mineral acid. The parasulphonic chloride, which forms a bulky mass, in order to carry through the operations to separate the orthosulphonic chloride, is now transformed in autoclaves under pressure, and by superheated steam, into toluene and sulphuric and hydrochloric acids. The toluene is made use of again, and by this reaction almost all the substance started with is transformed finally into saccharine.

Works of such an extensive character as those at Salzkote Westerhusen, Germany, erected to supply the whole world with saccharine, require very large quantities of potassium permanganate and phosphorus, and to work economically it is necessary to utilize the manganese hydroxide obtained as a by-product for reconversion into permanganate. It may also be necessary to utilize the phosphate residues for making phosphorus later on, if this material continues to be sold at its present high price, but I hope that the existing phosphorus manufacturers will be able to supply me for some time to come.

From the above statements you can easily conclude that there was much work to be done to put me in the position in which I am at present, to supply the world with a sufficient quantity of saccharine.

My previous publications on saccharine, although of an entirely theoretical value, had not been accurate enough in their statements, so as to leave no doubt about the constitution of saccharine. Remsen, Maumené, and others had speculated on various formulae for this new body. The former had assumed the formula

thought to find a similarity between saccharine and taurine, probably through his manipulative errors in the determination of sulphur.

For the formulae of the salts of saccharine I had assumed the non-existence of the orthosulphamibenzic acid, and had thought the salts of saccharine corresponded to the formula belonging to sulphamibenzic acid. Later on the existence of orthosulphamibenzic acid was proved by Noyes, who had oxidized sulphamide with ferricyanide of potassium in an alkaline solution. It now became of the utmost importance to decide between the two formulae assumed by Remsen and myself; and taking into consideration the work published by Noyes, whether the existence of orthosulphamibenzic acid was true or not, and which of the two formulae really belonged to saccharine—namely, $\text{C}_6\text{H}_4 \begin{array}{c} \text{COH} \\ \diagup \quad \diagdown \\ \text{SO}_2 \end{array} \text{N}$, or the formula

the work of Noyes, and found that he was correct in all his statements. At present I have an investigation in progress, which will prove that the above orthosulphamibenzic acid of Noyes can also be made in a different way, and with a better yield, which reaction I will make known at a future time. The formulae for the salts of saccharine, as assumed by me, were accordingly wrong in some respects, as it is impossible for two isomeric orthosulphamibenzic acids to exist. On re-examining my salts of saccharine I found them all

in which the hydrogen atom of the imide group is replaced by monad metals, or monad-organic radicals. The ethers, which in my first attempts I found impossible to prepare, I have finally succeeded in forming, and these were greatly instrumental in helping me to prove the constitution of saccharine and its salts, without any doubt whatever. If any of these ethers be inclosed in a sealed tube in the presence of hydrochloric acid, an alkylamine and sulphamibenzic acid are formed. I have proved, in one instance, the existence of ethylamine by the isonitrile reaction of Hofmann and the formation of the double salt of platinum chloride. This transformation proves beyond any doubt the constitution assumed by me, as given above, for saccharine and its salts, as well as for its ethers.

According to the above facts, we must look upon saccharine as an inner-anhydride or benzoylorthosulphonic imide, which yields salts and ethers entirely different from the orthosulphamibenzic acid; in fact, I have succeeded in transforming one into the other, and vice versa.

If orthosulphamibenzic acid be heated, it changes into saccharine (i. e., benzoylorthosulphonic imide) with the elimination of water; if, on the other hand, saccharine be subjected to a current of hydrochloric acid gas in the presence of alcohol, the ether of orthosulphamibenzic acid is formed, which also yields, on heating, saccharine, with the exception that in this case not water, but alcohol, is eliminated. A further interesting reaction of the ether of saccharine, and not of orthosulphamibenzic acid, is this, that it forms by saponification with an alcoholic solution of potash a double potassium salt of ethylsulphamibenzic acid having the formula $\text{COOK} \cdot \text{C}_6\text{H}_4 \cdot \text{SO}_2 \cdot \text{N} \cdot \text{KC}_2\text{H}_5$. If this compound be treated with hydrochloric acid, or any mineral acid, the potassium is eliminated, and an

* Read before the Chemical section of the British Association, Manchester meeting.

* Read before the British Association, at Manchester, September 5, 1887.

isomeric compound of the ether of orthosulphaminebenzoic acid is formed, which I have designated as ethylsulphaminebenzoic acid, and which is isomeric with the above stated ether of orthosulphaminebenzoic acid. I have an investigation in progress which will prove that these reactions hold good for all sulphimides; as, for instance, terephthalic and mesitylenic sulphimides, and other bodies of the same constitution.

Having mentioned the first difficulties which I met with, and having given you a short outline of the chemical side of the saccharine question (the material which has been of late so prominently before the public notice), I wish, at this stage of my paper, to call your attention to the uses of saccharine in the arts, in the household, and in medicine. I may say that there are at the present moment a number of manufacturers using saccharine already for the purposes of sweetening bread, cakes, champagne, lemonade, oils, essences, and medicines of all kinds. Its sweetening power being three hundred times greater than that of sugar, you can imagine that it will serve for many purposes to which sugar cannot be applied, such as disguising the unpleasant taste of medicines, and be used in flavoring the food of patients to whom the use of sugar would be injurious.

One very important fact must be here pointed out with respect to saccharine, and that is its non-fermentable character, distinguishing it from the sweetening materials belonging to the carbohydrate class or sugar family proper. It is in no way altered by the action of yeast or other ferments, in the way that the carbohydrates are degraded; in fact, it rather acts in such a way as to prevent fermentation, so that saccharine retains its sweetening property under all conditions for an indefinite time.

In addition to the high sweetening power of saccharine, it has also antiseptic properties, which will make it useful in preserving articles of food, as I have frequently seen suggested in the newspapers. It is nothing more than a condiment or spice, and should never be tasted in the pure state, because taken in too large a quantity it will act upon the nerves in such a way as to paralyze the sense of taste, just as powerful music stuns or deadens the auditory nerves, or a very bright light acts upon the optic nerves.

I may inform you that almond and other breads are now to be had sweetened with saccharine, as well as champagne similarly sweetened, for diabetic patients and those suffering from fatty degeneration.

[Continued from SUPPLEMENT, No. 618, page 9873.]

PLANT ANALYSIS AS AN APPLIED SCIENCE.

By HELEN C. DE S. ABBOTT.

VERY many dye substances of vegetable origin are used industrially. It would detain us too long to enumerate the list, and I shall select a few of the well-known ones for illustration:

The dyewoods imported in a crude state are as follows:

<i>Camwood:</i>		
	Tons.	Value.
1884.....	659.82	\$65,461.00
1885.....	730	68,721.00
<i>Fustic:</i>		
	Tons.	Value.
1884.....	11,811	\$177,830.00
1885.....	8,090	119,689.00
<i>Logwood:</i>		
	Tons.	Value.
1884.....	55,921.59	\$875,291.00
1885.....	56,507.80	904,205.25

The madder plant was formerly grown to a large extent in many countries, and in France¹ large tracts of land were given up to its cultivation. "Madder" owes its importance to the beauty and fastness of the tints it yields, and to the fact that by a variation of the mordants used, it produces rose pink, black, violet, lilac, and puce colors." The character of the soil where the madder grows affects the color of the dye. The roots grown in a rich clay soil exhibit a rose pink color; under other conditions, a deep red coloration.

Alizarin, the chief coloring matter of madder, is now produced artificially from coal tar in large quantities, though the madder is especially in request for woolen dyeing. This plant, which yielded such large revenues to the growers, is replaced by a cheaper manufactured product. Very likely we should not have discovered the synthesis of its valuable dye if our attention had not first been directed to it in the plant.

When it is remembered that coal tar is undoubtedly of vegetable origin, the many brilliant dyes derived from this source are only evidences of what plant chemistry could have found in the carboniferous ages.

The following statistics show:

<i>The amount of imported madder:</i>		
	Pounds.	Value.
1884.....	253,385	\$13,521.00
<i>Ground or prepared madder:</i>		
	Pounds.	Value.
1884.....	1,458,313	\$111,456.00
1885.....	1,211,370	80,628.00
<i>The natural or artificial alizarin:</i>		
	Pounds.	Value.
1884.....	778,660	\$296,123.00
1885.....	1,470,864	404,002.00
<i>Total value madder and alizarin:</i>		
1884.....		\$421,100.00
1885.....		484,630.00

Many species of plants grown in different parts of the world, but especially the *Indigofera*, yield a glucoside called indican, which under the influence of dilute

mineral acids and certain ferments breaks up, yielding indigo blue and a substance resembling glucose.

"Indigo" has undoubtedly been known in Asia from a very remote period of antiquity, since there exists in very ancient records, written in the Sanskrit language, descriptions of its mode of preparation mainly not different from the methods yet in use." The manner of cutting the plant and extracting the indigo is not the same in all countries. In India, the plants are grown from seed which are sown in the fall and spring, according to the kind of plant. As soon as the young plants are sufficiently forward, they are replanted in regular rows. The flower buds are pulled off before they are fully developed, experience having taught that by so doing the leaves of the shrub become larger and yield more indigo, the coloring matter being chiefly present in the leaves.

The indigo of commerce is a blue dyestuff extracted by fermentation. Other plants² used occasionally for the extraction of indigo are more frequently employed directly in dyeing; they belong to the *Polygonaceæ* family. These plants are from India, China, Central Africa, and South America, and they can be acclimated in all warm countries. In the mode of indigo manufacture³ two processes are employed. In the one the dry leaves are used, in the other the green leaves. This is the one in most common use. When the plant begins to flower, it is cut down at about six inches from the ground and carried to the steeping vats with as little delay as possible, strewn horizontally into the vats, and pressed down by means of beams fixed into side posts, bamboo being placed under the beams. Water is immediately run in just sufficient to cover the plant. The pure water from the Ganges is especially sought for in these manufactories, and many indigo factories line the river banks. The time for steeping depends much on the temperature of the atmosphere, and can only be learned by experience and careful watching of the vats; but in close, sultry weather, with the thermometer at 96° in the shade, eleven or twelve hours is sufficient. In cooler weather more time is requisite.

When fermentation is established, the surface of the vat is covered with a violet scum. The liquid is drawn off through plugholes, in the wall of the vat. The fecula at the bottom is then removed to the boiler. It is brought to the boiling point as quickly as possible, and kept there for five or six hours. While boiling it is stirred to keep the indigo from burning and skimmed with a perforated ladle. When sufficiently boiled it is run off to the straining table, where it remains twelve or fifteen hours draining. It is then taken to the presses and gradually pressed. This process takes twelve hours. It is then ready to be taken out, cut, stamped, and laid in the drying house to dry.

In the manufacture of indigo the ordinary processes of fermentation, drawing off the liquor, beating, and collecting the fecula are generally well known, and are followed with but trifling variation in different provinces and manufactories in India. The main points appear to be the watching and the soaking of the plant so as to be able to tap off the infused liquid exactly at the right point of fermentation, and next to beat the liquid in the second vat long enough.

Indigotin as it is contained in the vegetable tissues is colorless, but it becomes blue on contact with air. If it is desired to change indigo blue to indigo white, it is only necessary to place it in the presence of a deoxidizing and alkaline liquid, but as soon as air is admitted its blue color is resumed.

The dyeing of fabrics is based upon the transformation of indigo blue into soluble indigo white. The colorless matter is placed on the stuff, which becomes blue by exposure. The solubility of indigo in sulphuric acid is utilized for blue dyeing of wools.

Indigo has been made artificially by several methods, though the process so far is too expensive to manufacture the compound to replace the commercial supply from plants.

The table of statistics is as follows:

<i>Amount of indigo imported:</i>		
	Pounds.	Value.
1884.....	3,074.48	\$2,267,048.00
1885.....	3,035,934	2,007,066.00
<i>Artificial indigo:</i>		
	Pounds.	Value.
1884.....	None.	
1885.....	3,300	\$3,600.00

The dye commonly known as logwood has been cultivated in Jamaica⁴ since 1715, and has been known and used in Europe from a short period after the discovery of America. The commercial supply of the dye is from *Hæmatoxylin campechianum*, a tree belonging to the natural order *Leguminosæ*. It is the wood of the tree which is used, and is met in commerce in the shape of large irregular blocks.

The only other tree besides logwood in which hæmatoxylin so far has been discovered is the *Saraca indica* of the same natural order.

I stated⁵ before the Academy of Natural Sciences, in November, the discovery of this principle in my analysis of the bark of the *Saraca indica*.

The *Saraca indica*⁶ is called in India the asok or asoka tree, and it is said when this tree is in full blossom there is nothing in the vegetable kingdom which affords a more beautiful object. Frequent mention is made of the plant in Hindoo mythology, and the bark is much used by native physicians in some diseases.

I undertook the analysis of this bark at the request of Messrs. Parke, Davis & Co., of Detroit, Mich., who liberally furnished me with a supply of the drug. The coloring principle exists in the bark in two or more conditions—as hæmatoxylin and as oxidized products. The former was separated as yellow crystals, analogous in form to hæmatoxylin crystals from the true logwood. The alcoholic extract of the bark contained about 18 per cent. of a red colored substance, which agreed in

color and dye tests with like constituents found in logwood. Mordanted cotton fabric was dyed with hæmatoxylin from *Saraca* bark, and presented the characteristic logwood dye colors.

The extracts of *Saraca indica* bark containing its coloring principle were tested with various reagents,⁷ and it was observed that the reactions agreed with hæmatoxylin colors, and in no case with those of brazillin.

The bark of the commercial logwood tree is not used for extracting the dye, the wood of the tree being employed for this purpose. I determined the presence of a small quantity of hæmatoxylin in the logwood bark, and obtained with its extracts the same reaction without alkalis and other reagents as with the other wood extracts. But owing to the smaller percentage of dye in the bark of the specimens examined, the colors were less intense. In the case of the *Saraca indica* bark, the colors were very brilliant, and certainly indicated the presence of a large proportion of coloring matter in it. It would be of interest to secure specimens of the wood of *Saraca*, in order to determine if it contains the coloring principle, and should this be so, if it exists in sufficiently large quantities to warrant its introduction as a new source of this commercial product.

Last summer⁸ I extracted from a Honduras plant, called "chichipate," a yellow dye. It yielded with mordanted wool fabrics colors resembling somewhat those yielded by fustic wood. A plant⁹ was analyzed in the laboratory of Parke, Davis & Co., named *Cascara amargo*, from which a new alkaloid, pascarnine, was separated. This alkaloid is like berberine in its properties. Specimens of this plant were lately forwarded to me, and there is every indication of the relationship of identity of "chichipate" and *Cascara amargo*. This incident is significant as deciding by means of chemical analysis the identity of plants under distinct names from different regions. No analysis under the name of "chichipate" had ever been published until my own report. The dyeing property of the substance, chichipatin, separated from "chichipate," I think is quite independent of the alkaloid, though berberine, it is well known, yields yellow colors with wool. I also separated a new camphor from this plant. It is crystalline, and under polarized light gives a beautiful play of colors.

During the year 1886, Prof. Trimble¹⁰ separated a new crystalline camphor, piloxol, from the underground portion of *Phlox carolina*. This substance resembles the camphor found in chichipate. It is soluble in petroleum ether, and this solvent is suggested as a means of distinguishing powdered *Phlox carolina* from *Spigelia*. The latter contains no camphor. *Phlox* is frequently put on the market for *Spigelia*. The two drugs in the normal condition can be readily identified.

An estimate of the profitable ends of the chemical analysis of plants may be gathered from the above statements.

Plant analysis covers a wide field, for it includes the chemistry of the living and the dead plant. Its application to various industries is far reaching.

Plant analysis in this country has been called an "infant industry." There are probably differences of opinion about the infant needing protection. It certainly needs encouragement and support, when its importance as a citizen is recognized.

Plant chemistry should not only be directed toward the study of new plants, but in the study of old plants it is to be encouraged, for each new investigation of many well known plants has revealed new chemical principles, and given additional knowledge of the old ones. We can never know to what practical uses the constituents of any plants may be brought, and the money value of this information should be considered.

Many chemical compounds which are of the most practical use, now made by synthesis, were first discovered in plants, products of living matter.

Synthetic chemistry has derived its knowledge from the results of analytical study. Researches in plant analysis have revealed many facts, though the exploration field is still wide.

In our present state of knowledge, plant chemistry is a safe political ground for either the protectionist or free trader. The vegetable cell has placed the tariff of human penetration so high, and protected so well its industry, that the plant enjoys the monopoly of proteids and a magazine of other substances. The free trader may console himself, for if he is intelligent enough he can find out the processes, and start his own factory, duty free.

Prof. Cohn, of Breslau, tells us that it is only a question of time when we may hope for the chemist to succeed in doing what the simplest *Alga* and mosses are able to do, namely, to produce starch from carbonic acid and water. On that day the bread problem, which is in fact the greatest of all social problems, will be solved.

It is indeed true that those organic compounds which are of the most importance in the life of the plant, the hydrocarbons and the albuminoids, are those which as yet have not permitted the secrets of their production to be discovered.

In the future, when synthesis has accomplished this prophecy and the synthetic chemist reigns supreme, our coming race to my imagination will be chemists, and our farmers will manufacture our food supply of proteids, sugars, and starch. The surface of the land will be one huge teeming laboratory. The plants, the analytical chemist and others of his race, asphyxiated by their environment, will have long ago passed away into a suffocating forgetfulness.

But, for the present, we must be satisfied to depend upon our humble colleagues, the plants, for our food and beverages, our fabrics, perfumes, and dyestuffs, our medicines, and other things too numerous to mention.

MANIA AND INEBRIETY.

By T. D. CROTHERS, M.D., Hartford, Conn.

The following cases bring out the facts I wish to present:

A— had two attacks of acute mania in five years

¹ S. P. Sadler and W. L. Rowland. *Amer. Jour. Pharm.* Feb., 1881.
² Preliminary Analysis of a Honduras Plant, named "Chichipate." Paper read before the A. A. A. S., at Buffalo, August, 1886.
³ "Cascara Amargo." By F. A. Thompson. *The Ther. Gazette*, Jan. 15, 1884, p. 8.
⁴ "An Analysis of the Underground Portion of Phlox Carolina." By Henry Trimble. *Amer. Jour. Pharm.*, October, 1886, p. 479.
⁵ Hand Book of Dyeing and Calico Printing. W. Crookes. P. 447.
⁶ Matieres Premieres Organiques. Par Penetier. P. 518.
⁷ Matieres Premieres Organiques, p. 516. Bul. de la Societe Industrielle de Mulhouse, vol. xxviii, p. 307.
⁸ Bureau of Statistics. 1885.
⁹ Crookes, p. 342.
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