

Thomas Thomson

**Chemistry of Organic
Bodies, Vegetables**

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Сначала мы отсканировали каждую страницу оригинала этой редкой книги на профессиональном оборудовании. Затем с помощью специально разработанных программ мы произвели очистку изображения от пятен, клякс, перегибов и попытались отбелить и выровнять каждую страницу книги. К сожалению, некоторые страницы нельзя вернуть в изначальное состояние, и если их было трудно читать в оригинале, то даже при цифровой реставрации их невозможно улучшить.

Разумеется, автоматизированная программная обработка репринтных книг – не самое лучшее решение для восстановления текста в его первозданном виде, однако, наша цель – вернуть читателю точную копию книги, которой может быть несколько веков.

Поэтому мы предупреждаем о возможных погрешностях восстановленного репринтного издания. В издании могут отсутствовать одна или несколько страниц текста, могут встретиться невыводимые пятна и кляксы, надписи на полях или подчеркивания в тексте, нечитаемые фрагменты текста или загибы страниц. Покупать или не покупать подобные издания – решать Вам, мы же делаем все возможное, чтобы редкие и ценные книги, еще недавно утраченные и несправедливо забытые, вновь стали доступными для всех читателей.



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the nature of resin, producing a suite of changes which terminate in artificial tannin, upon which nitric acid has no action.

Muriatic acid and acetic acid dissolve resin slowly, and it may be precipitated again from them unaltered. Mr Hatchett, to whom we are indebted for the knowledge of all these solutions, recommends acetic acid as an excellent solvent of resins for vegetable analyses. He employed it himself with much address in his analysis of the different varieties of lac.*

When resins are subjected to destructive distillation, we obtain, according to Gren, carburetted hydrogen and carbonic acid gas, a very small portion of acidulous water, and much empyreumatic oil. The charcoal is light and brilliant, and contains no alkali.†

When volatile oils are exposed for some time to the action of the atmosphere, they acquire consistency, and assume the properties of resins. During this change they absorb a quantity of oxygen from the air. Westrumb put 30 grains of oil of turpentine into 40 cubic inches of chlorine gas. Heat was evolved; the oil gradually evaporated, and assumed the form of yellow resin.‡ Mr Proust observed, that when volatile oil is exposed to the air, it is partly converted into a resin, and partly into a crystallized acid; usually the benzoic or the camphoric. Hence we see that the oil is converted into two distinct substances. During this change oxygen is absorbed; and Fourcroy has observed that a portion of water is also formed.§ It is probable, from these facts, that resin is volatile oil deprived of a portion of its hydrogen, and combined with oxygen.

All the resins have not the same tendency to unite with bases. Some indeed, seem to want that property altogether. Unverdorben has divided them into four classes.

1. *Strongly acid resins.* They dissolve readily in caustic ammonia. And the saturated ammoniacal solution may be boiled for a quarter of an hour without letting the resin precipitate. When the solution is evaporated we obtain a super-resinate of ammonia.

2. *Resins moderately acid.* They dissolve at the usual temperature of the air in ammonia; but when the solution is boiled for a quarter of an hour it is completely decomposed, the ammonia being driven off and the resin precipitated. The ammoniacal compounds of these resins are usually less soluble in water than those of the first class. But their acid properties are sufficiently strong to enable them to be precipitated from alcohol by an alcoholic solution of acetate of copper, and to dissolve by the assistance of a boiling beat in carbonate of soda, from which they drive off the carbonic acid.

Both the resins of the first and second class, when dissolved in alcohol, redden litmus paper.

3. *Resins feebly acid.* They are neither soluble in caustic ammonia, nor in boiling carbonate of soda; but they dissolve in caustic

* Phil. Trans. 1804.

† Crell's Annals, i. 1790.

‡ Handbuch, ii. 140.

§ Fourcroy, viii. 16.

potash and soda. Their alcoholic solution is not precipitated by acetate of copper, but it is by an alcoholic solution of acetate of lead. The alcohol solutions of the resins belonging to this class do not redden litmus paper.

4. *Neutral resins.* They are not soluble in caustic potash or soda. But some of them dissolve in a solution of potash saturated with another resin. They generally precipitate when we add to the liquid an additional dose of caustic potash.

So far as experiment has gone, the resins are all combinations of carbon, hydrogen, and oxygen. But the facts ascertained respecting these constituents will come in better when treating of the particular resins to which they refer, than they would do here.

In describing the resins it will be convenient to divide them into two sets, namely, *semifluid resins*, or *balsams*, as they have been called, and *solid resins*.

DIVISION I.—BALSAMS.

The balsams owe their semifluidity to a certain quantity of volatile oil which they contain. It may in general be separated by distillation, and then the solid resinous body remains behind. The most important of the balsams are the following:—

- | | |
|-------------------|------------------|
| 1 Turpentine. | 5 Styrax. |
| 2 Copaiva. | 6 Opobalsamum. |
| 3 Balsam of Tolu. | 7 China varnish. |
| 4 Balsam of Peru. | |

Let us take a view of these balsams in the order in which they have been named.

SECTION I.—OF TURPENTINE.

The name turpentine has been given to a semifluid resinous body which exudes from various species of the *pinus*. Its properties differ according to the species of pine, the age of the tree, the time of the year when it is collected, and the climate in which the tree vegetates. But the great constituents of it are always *colophan*, or *common rosin*, and oil of turpentine.

(1.) *Common turpentine* is extracted by incision from the *pinus abies*, or *spruce fir*, and the *pinus sylvestris*, or *Scotch fir*. It is thick, viscid, and has a greyish-yellow colour, a very slight smell of oil of turpentine, and a bitter burning taste.

It is composed, as Unverdorben has shown, of a volatile oil, *oil of turpentine*, and two resins which he has distinguished by the names of *pinic* and *silvic* acids. Berzelius calls them *resin alpha*, and *resin beta* of turpentine.

The volatile oil varies from 5 to 25 per cent. of the turpentine. The two resins are no less various in their quantity. Unverdorben separated these three substances from each other in the following way:—The turpentine was mixed with water, and distilled to separate the oil. The residue was dried and reduced to powder,

and digested in alcohol of 0.867 specific gravity. It dissolves the *pinic acid*, but leaves the *silvic*. At the same time with the pinic acid the alcohol dissolves a small quantity of *neutral resin*, which may be called resin *c*. If we pour into this alcoholic solution an alcoholic solution of acetate of copper, the pinic acid is precipitated in combination with the oxide of copper. If we evaporate the alcohol and dilute it with water, the resin *c* precipitates.

1. The properties of oil of turpentine have been detailed in the preceding Chapter.

2. The properties of pinic acid have been given in detail in the work on the *Chemistry of Inorganic Bodies* (vol. ii. p. 145). The *pinates*, or combinations of this substance with the alkalies, may be obtained by digesting an ethereal solution of pinic acid over the alkaline carbonates. The carbonic acid is driven off, and the alkaline pinate dissolves in the ether. The earthy carbonates, with the exception of carbonate of magnesia, are not decomposed by this process. But the carbonic acid is driven off and a pinate formed, when we mix the carbonates of the earths with fixed pinic acid, or when we boil a solution of pinic acid in oil of turpentine over them. The greater number of these pinates dissolve both in melted pinic acid, and likewise in an alcoholic solution of that resinous acid, even when the salt is insoluble in pure alcohol. It is probable that in these cases a bipinate of the base is formed. The pinates, with bases of metallic oxides, may be obtained by double decomposition. We must drop the metalline salt very slowly and cautiously into the alkaline pinate. If we adopt the opposite method by dropping the alkaline pinate into the metalline salt, the precipitate is mixed with a quantity of subpinate of the metalline base. These double decompositions may be made by dissolving the salts, when that is practicable, in water, and when not, in alcohol.

The pinates formed by Unverdorben, who has alone examined them, have been described in the *Chemistry of Inorganic Bodies*, while treating of the salts.*

3. That portion of the resin which remains undissolved when the turpentine freed from its oil is digested in cold alcohol of 0.867, has been called *silvic acid* by Unverdorben, and *resin beta* by Berzelius. It is not quite free from pinic acid. To obtain it pure, dissolve it by boiling in twice its weight of alcohol of 0.867, and filter the solution while hot. During the cooling the silvic acid falls down in crystals, but still retains about 4 per cent. of pinic acid, from which it may be freed by repeated crystallizations. Its properties have been described in the *Chemistry of Inorganic Bodies* (vol. ii. p. 149); and the salts which it forms, in the Chapter in the same work on the salts, have been enumerated and described, as far as they have been examined by Unverdorben.

Henry Rose has concluded that silvic acid is a compound of 1

* See vol. ii. pp. 400, 440, 469, 492, 524, 539, 547, 577, 585, 595, 602, 609, 621, 649, 677, 686, 693, 699, and 713.

atom oil of turpentine and 1 atom oxygen, or that it consists of $C^{10} H^8 O$.^{*} But Trommsdorf analyzed it, and obtained

Carbonic acid	. . .	78.73
Hydrogen	. . .	9.80
Oxygen	. . .	11.47

100.00†

If we adopt the formula of Rose, we get

10 atoms carbon	= 7.5 or per cent.	78.94
8 atoms hydrogen	= 1.0 — —	10.53
1 atom oxygen	= 1.0 — —	10.53

9.5 100

Trommsdorf considers the composition to be $C^{10} H^{7.4} O$, a formula which comes nearer the result of his analysis, and which was confirmed by a subsequent analysis of Liebig.

But from the analysis of silvate of copper, Trommsdorf reckons the atomic weight of silvic acid $37.75 = 4 (C^{10} H^{7.4} O)$. This gives us the composition

40 carbon	= 30	or per cent.	79.4
30 hydrogen	= 3.75	— —	9.9
4 oxygen	= 4	— —	10.7

37.75 100

(2.) *Venice turpentine* comes from Styria, Hungary, and the Tyrol, and is extracted from the *pinus larix*, or *common larch*. It is limpid, transparent, and has a light-yellow colour, and the consistence of honey. Its smell is disagreeable, and its taste bitter and hot. It must be many years exposed to the air before it becomes hard and brittle. It contains from 18 to 25 per cent. of oil of turpentine, which is extracted by distilling it with water. What remains is *colophan*, or common *rosin*.

Venice turpentine dissolves slowly in alcohol, without leaving any residue. The caustic alkalies dissolve it easily, and no doubt combine with its acid resins. If Venice turpentine be mixed with caustic potash ley it dissolves, while a white flocky matter precipitates. The solution is limpid and yellowish-brown. Its taste is not alkaline, and it may be evaporated in a gentle heat without any oil being disengaged. When evaporated till it becomes solid it is opaque and wrinkled. It dissolves readily in water, but separates when we pour into the solution a certain quantity of carbonate or hydrate of potash. Soda acts precisely in the same manner with this turpentine as potash.

Very concentrated ammonia has little action on Venice turpentine, but when diluted it dissolves the greater part of the turpentine by the assistance of heat. The undissolved portion assumes the appearance of a gelatinous mass, and the solution has a yellow-

^{*} Poggendorf's Annalen, xxxiii. 42.

† Ann. der Pharmacie, xiii. 171.

ish-brown colour. On cooling the whole concretes into a gelatinous solid, while a brown liquid separates, which may be decanted off. When this mass is mixed with water it becomes white. When agitated in from 40 to 50 times its weight of water it forms a milky liquid, which in about 12 hours concretes into a white soft jelly. The turpentine thus treated is divided into two substances, which have distinct properties.

a. The limpid, yellow liquid which separates from the jelly before and after the dilution, and which passes through the filter, is a combination of ammonia with a resin, which contains no volatile oil. If we saturate it with an acid the resin precipitates in powder, and may be collected and washed on a filter. It is a white, light, friable matter, with an earthy fracture. It melts at the temperature of boiling water, or a little higher, and then has the appearance of common rosin. When assisted by a boiling temperature, naphtha dissolves a portion of this resin, and assumes a brown colour; but during the cooling the resin precipitates, and the naphtha becomes colourless as at first.

b. The gelatinous part of the combination of ammonia and Venice turpentine, when dried in the open air, has a yellow colour, is transparent and adhesive like the turpentine itself. It consists of the ammonia combined with a resin, and with oil of turpentine. In proportion as the ammonia is driven off, the turpentine is regenerated, but it is softer than before, because it contains less resin. By mixing it with acidulated water and distilling, the oil is removed, and a resin remains, which differs from the resin in the liquid portion in being soluble in naphtha.

A solution of turpentine in potash precipitates the salts which have the alkaline earths, and the metallic oxides for bases. These precipitates are insoluble in water, and when distilled with water after having been dried, they give off oil of turpentine. They have no smell, and seem at first destitute of taste, but by degrees the acrid taste of oil of turpentine becomes perceptible.

Unverdorben analyzed fresh Venice turpentine, and obtained :
1. A volatile oil easily distilled off. 2. An oil not so easily distilled, and having a great tendency to be converted into a resin. 3. Succinic acid, which is found dissolved in the water with which the turpentine is boiled, in order to drive off the volatile oil. 4. Three different resins, which were separated in the following manner:—The turpentine freed from its oils was dissolved in alcohol of 0·873, and the solution was precipitated by an alcoholic solution of acetate of copper. This precipitate consisted chiefly of pinate of copper mixed with a very small quantity of silvate of copper. These two acid resins were separated in the way already stated. The solution, which had been precipitated by acetate of copper, was evaporated to dryness, the acetate of copper which it contained was dissolved out by water, and the resin taken up by alcohol of 0·873, which left, without dissolving it, a small quantity of pinate of copper. When the alcoholic solution is evaporated to dryness,

the third resin remains. It is colourless, and has a strong resinous lustre. It is insoluble in alcohol and naphtha, and belongs to the class of neutral resins.

(3.) French turpentine is obtained from the *pinus maritima*, which grows in the south of France. It resembles Venice turpentine, and is considered as possessed of nearly the same qualities.

When turpentine is kneaded with $\frac{1}{12}$ th of its weight of *magnesia alba*, a combination takes place gradually, and after six or seven days the mixture becomes firm. Fauré, who first observed this effect, has recommended this combination as a convenient mode of administering turpentine internally as a medicine.* This properly belongs to the turpentine from the *pinus maritima*, but not to that from the *pinus picea*.†

(4.) *Strasburg turpentine* is extracted from the *pinus picea*. It is pale yellow, transparent, and more liquid than Venice turpentine, and has a smell which is rather agreeable. It has been subjected to an interesting examination by M. Caillot. According to him it is obtained not only from the *pinus picea*, but also from the *pinus abies*.‡

When he distilled off the volatile oil along with water, he found that the water contained in solution a quantity of succinic acid. He digested it in boiling water till every thing soluble in that liquid was taken up. He then treated it with cold absolute alcohol, which left undissolved a neutral resin. It is colourless, and is insoluble in cold alcohol, in naphtha, and in caustic potash. It differs by its insolubility in alcohol from the neutral resin in Venice turpentine.

The alcoholic solution being evaporated, left a resinous mass, which was boiled in a solution consisting of twice its weight of carbonate of potash. The mixture was concentrated by evaporation, and the alkaline liquor decanted off. The residual compound of resin and potash was mixed with from 25 to 30 times its weight of water, and the whole left at rest. There was deposited at the bottom of the vessel a mass of crystals. This mass, freed from the liquid in which it was deposited, was dissolved in alcohol, and the solution was left to spontaneous evaporation. The resin was deposited in pyramidal crystals, to which Caillot gave the name of *abietin*. It is destitute of smell, and has little taste. It is very fusible, and becomes soft when exposed to the direct rays of the sun. When in a state of fusion, it is colourless and limpid, and looks like melted tallow. On cooling it concretes into a white, opaque, crystalline mass. It is insoluble in water; but dissolves readily in alcohol of 0·833, and in every proportion at a boiling heat. It is soluble in ether, in naphtha, and in concentrated acetic acid, and crystallizes when these liquids are volatilized. It is insoluble in potash.

The resin dissolved by the alkaline carbonate appears to be a mixture of pinic and silvic acids. Caillot has given it the name of

* Jour. de Pharmacie, xvii. 102.

† Ibid. p. 106

‡ *Abies excelsa* of Decandolle.

abietic acid. The following table exhibits the result of Caillot's analysis of two different varieties of turpentine :—

	Turpentine from <i>abies pectinata</i> .	Do. from <i>abies excelsa</i> .
Volatile oil	33.50	32.00
Pinic and silvic acids .	46.39	45.37
Abietin	10.85	11.47
Abietic acid	6.20	7.42
Succinic acid and extract	0.85	1.22
	97.79	97.48

Blanchet and Sell analyzed turpentine from the Vosges which exudes from the *pinus picea*, and obtained

Volatile oil	33.5
Resins	63.44
Extractive and succinic acid .	0.85

97.79*

Caillot is of opinion that the *abietic acid* belongs particularly to Decandolle's genus *abies*; that is, to the species of *pinus* which have the summit of the cones pointing upwards.

(5.) *Turpentine from the Carpathian mountains and from Hungary*. The first of these is obtained from the *pinus cembra*, the second from the *pinus mugos*. They resemble Strasburg turpentine very closely.

(6.) *Canada balsam*. Obtained from the *pinus canadensis* and *balsamea*. It has a pale-yellow colour, is transparent, fluid, but adhesive and capable of being drawn out into threads. Its smell is much more agreeable than that of turpentine in general.

(7.) *Turpentine of Cyprus and Chio*. It is extracted from the *pistacea terebinthus*. It is yellow, greenish or bluish green, translucent, viscid, and of the consistence of honey. Its smell is agreeable, and its taste is less acrid than that of any of the preceding varieties. It is often adulterated by being mixed with the cheaper turpentines.

SECTION II.—OF COPAIVA. †

This balsam, which is a good deal used in medicine, comes from Brazil, and from the Antilles. It is obtained not only from the *copaifera officinalis*; but from the *copaifera coriacea*, *Langsdorfii* and *multijuga*, which grow in the same tract of country with the *officinalis*. It exudes from incisions made in the trunk of the tree. The juice thus obtained is transparent, of a yellowish colour, an agreeable smell, a pungent taste, at first of the consistence of oil, but it gradually becomes as thick as honey. Its specific gravity is 0.950.‡ When mixed with water and distilled, there comes over with the water a very large portion of volatile oil. Lewis obtained

* Jour. de Pharmacie, xx. 224. † *Copahu* of the French.

‡ Schonberg, Gehlen's Jour. vi. 494.

half the original weight of this oil.* Schonberg, from 8 ounces of copaiva, obtained $3\frac{1}{4}$ of oil by this process.† It was colourless, very limpid, of the specific gravity 0.900; had the taste and smell of copaiva, but rather stronger. It dissolved in 8 parts of alcohol; but the copaiva itself is a good deal more soluble.‡ The oil ceases to come over before all the water has passed into the receiver. The residuum, of course, consists of two substances; namely the watery portion, and a greyish-yellow substance, lying at the bottom of the vessel, which, on exposure to the air, dries, and becomes brittle and transparent. When heated it melts, and possesses the characters of a resin. When distilled it yielded a yellowish thick oil, some acidulous water, and a gas; $\frac{1}{10}$ th of which was carbonic acid, and the remainder seemed to possess the characters of olefiant gas.§ From these facts, which have been long known, it was concluded, that copaiva is a compound of a resin and a volatile oil, which passes over at a heat inferior to that of boiling water; but the experiments of Schonberg have rendered it much more probable, that the balsam is decomposed when distilled along with water, and that both the oil and resin are new products.

When distilled on a water-bath, nothing comes over but a few drops of water, and 1 or 2 drops of oil.|| If the vessel be kept at a temperature between 234° and 257° , scarcely any thing more is obtained than when the distillation is conducted over a water-bath. At the temperature of 504° the balsam begins to boil gently, a gas is extricated, and drops begin to pass more rapidly into the receiver. At 550° it boils briskly, and the distillation goes on rapidly. There passes into the receiver a limpid yellowish oil, occasionally mixed with a drop or two of water. As the distillation proceeds the oil becomes more and more yellow. At this period the balsam is as liquid as water, and boils without any frothing or swelling. After this period the oil becomes yellow, and then brownish-red; but still continues pretty thin. The first oil obtained by Schonberg from 8 ounces of copaiva, by this process, was $3\frac{1}{16}$ ounces. The water had a sour taste, and reddened litmus paper. The gas amounted to 81 ounce measures; $\frac{1}{3}$ th of it was carbonic acid, the rest resembled olefiant gas.¶

More lately it has been subjected to a new examination by Stoltze,** who has ascertained the following facts:—

It is insoluble in water, yet it communicates to that liquid the peculiar taste and smell by which it is characterized. It dissolves in all proportions in absolute alcohol. Alcohol of 0.812 dissolves a great proportion of it, while alcohol of 0.848 dissolves only the tenth or ninth of its weight of it. It dissolves in all proportions in ether, fixed and volatile oils.

When a small quantity of alcohol, not weaker than 0.812, is poured upon balsam of copaiva, mixed with a fixed oil, the oil does

* Neumann's Chem. p. 285.

† Gehlen's Jour. vi. 494.

‡ Schonberg, Gehlen's Jour. vi. 494. § Ibid. 497. || Ibid. 495. ¶ Id. Ibid.

** Berlin Jahrb. xxvii. 2, 179.

not separate, but it is disengaged when a considerable portion is added. Schweitzer has shown that the presence of a fixed oil in this balsam may be detected by agitating it with caustic ammonia. The ammonia becomes milky only if the oil be present.*

Balsam of copaiva unites when heated with sulphur and phosphorus. Sometimes it dissolves as much as half its weight of sulphur. Both of these bodies are thrown down by absolute alcohol. Balsam of copaiva absorbs chlorine gas, becomes muddy, and muriatic acid is formed. Iodine is dissolved in it by the assistance of heat, giving it a dark red colour. It combines with sulphuric acid, assuming a red or brown colour, while sulphurous acid is disengaged.† The balsam becomes viscid.

Concentrated nitric acid attacks it violently. Dilute acid has less action; but transforms it into a hard yellow resin, a portion of which dissolves in the acid at the same time, with a yellow bitter substance soluble in water and in alcohol. Muriatic acid gives copaiva a red colour, but scarcely dissolves it. It may be mixed with concentrated acetic acid, but it becomes muddy, and allows an aqueous liquid to fall to the bottom, while the balsam, dissolved in anhydrous acid, swims on the surface. Boracic, succinic, and benzoic acids are dissolved in small quantities by this balsam. The best way is to dissolve them in absolute alcohol, mix the solution with the balsam, and then evaporate the liquid to drive off the alcohol. Aqueous solutions of oxalic and tartaric acids dissolve a little of this balsam.

Balsam of copaiva combines readily with the salifiable bases. When we mix 3 parts of balsam with a solution containing $\frac{1}{8}$ th of its weight of hydrate of potash, a complete combination takes place with the disengagement of heat, and we obtain a limpid liquid. If we add an additional dose of potash, the liquid becomes muddy, and a still greater quantity causes the combination of the balsam and potash to separate and swim on the surface. This compound dissolves in water, and when left to itself a small quantity of neutral resin precipitates. In spirit of wine this compound forms a limpid solution; but the solution of it in absolute alcohol is muddy. It is soluble in ether, and also in a great measure in naphtha.‡ It cannot be dried completely without undergoing decomposition.

With soda it exhibits the same phenomena as with potash.

The same remark applies to ammonia. 1 part of liquid ammonia, of specific gravity 0.96, mixed with 8 parts of balsam, forms a limpid liquid.§ When we double the quantity of ammonia, the liquid

* Poggendorf's *Annalen*, xvii. 487.

† In France copaiva is often adulterated with castor oil. This adulteration M. Planche has shown may be detected by means of sulphuric acid. A few drops of pure copaiva, mixed with the same quantity of acid, assume a yellow colour, which persists for some time. But if castor oil be present, the yellow colour becomes immediately weak, and speedily disappears. See *Jour. de Pharmacie*, xi. 231.

‡ See Gerber, *Jour. de Pharmacie*, xvi. 74.

§ The solubility of copaiva in ammonia seems to have been first noticed by M. Planche. See *Jour. de Pharmacie*, xi. 228.

begins to get muddy, and if we increase the quantity of ammonia still farther, a separation of the liquid takes place into two portions.* It is then unctuous, soluble in weak alcohol and in ether; but almost insoluble in absolute alcohol, and in the fixed oils. Schweitzer found that when 9 parts of copaiva are agitated in 2 parts of liquid ammonia, of the specific gravity 0.95, and then left at the temperature of 50°, crystals of a neutral resin are gradually deposited. If we wash these crystals in ether, and dissolve them in alcohol, we obtain larger, but less regular crystals. They are white and translucent. They are four-sided prisms, very nearly rectangular, the angles being 90° 30' and 89° 30'. The acute edge of the prism is usually replaced by a tangent plane.† They are at first soft, but by exposure to the air become hard and brittle, without losing their transparency. They contain no ammonia.‡

With the other salifiable bases balsam of copaiva forms insoluble compounds, which may be obtained by double decomposition. They have the consistence of plaster; their smell is analagous to that of the balsam; they are little soluble in absolute alcohol; but they dissolve in ether, naphtha, and the volatile oils. They are soluble also in balsam of copaiva, and increase its consistence.

The affinity of magnesia for this balsam is remarkable. 1 part of magnesia dissolves in 30 parts of balsam, into a transparent liquid. When we agitate balsam of copaiva with a solution of a metallic subsalt, it combines with the excess of base, and the salt, held in solution by water, becomes neutral. The following table shows the composition of this balsam, as determined by Stoltze and Gerber:§—

	STOLTZE.	GERBER.	
		Fresh Balsam.	Old Balsam.
Volatile oil . . .	45.59	41	31.70
Yellow hard resin .	52.75	51.38	53.68
Brown soft resin . .	1.66	2.18	11.15
Water	— —	5.44	4.10
	100.00	100	100.63

According to Durand, the balsam contains besides a fatty substance, which remains when we dissolve it in a sufficient quantity of alcohol of 0.842. It is insoluble in ether and in absolute alcohol.

1. The volatile oil is not easily obtained from the balsam by distillation. When we distil with water, we must repeat the process seven or eight times, in order to procure all the oil. If we distil the oil alone, it does not come over till the balsam is heated to 500°. But, according to Ader, we may separate the oil without having recourse to distillation. If we agitate 100 parts of alcohol, of 0.836, with

* See Gerber, Jour. de Pharmacie, xvi. 75.

† Poggendorf, xvii. 489.

‡ Ibid. xxi. 172.

§ Jour. de Pharmacie, xvi. 79 and 367.