PART III.

PREPARATIONS AND COMPOUNDS.

ACIDS.

THESE are substances which have a sour taste: and are capable of combining with alkalies, earths, and metallic oxides, while at the same time they lose their acidity, and form compounds named neutral salts, in which the properties of the acid, the alkali, the earth, or the oxide employed, are lost. They change to red, the blue, purple, and green colours of vegetables; and unite with water in almost every proportion. These circumstances, therefore, may be regarded as characteristic of this class of substances.

Acids were supposed by Lavoisier to be combustible bodies combined with oxygen, which he regarded as the principle of acidity; and this opinion was almost generally adopted until lately, when the discovery of *chlorine*, and the promulgation of Sir H. Davy's theory of the nature of muriatic acid, led to the revival of Berthollet's doctrine, "that no substance as an acidifying principle exists; but that the nature of a compound depends upon the way in which the constituents unite together." It is now, therefore, no longer questionable, whether there is any acid that does not contain oxygen as an essential component; and it is by no means true that the combination of every combustible with oxygen will constitute an acid.[1] Thus the combination of hydrogen with oxygen forms water which is not acid, and that of sulphur with hydrogen forms a body, which really possesses acid properties, but nevertheless contains no oxygen; and it is now known that the alkalis owe their alkaline properties to the presence of oxygen, as much as the acids owe to it their acid properties.[2] For the formation of an acid, however, although the union of the body with oxygen be not essential, yet it is not improbable, that some principle must be present in the body, common, in a greater or less degree, to all bodies capable of being formed into acids, which may be regarded as the principle of acidity, although it be yet unknown.

On the supposition that all acids are compounds of oxygen

[1] Acids containing no oxygen—Muriatic, Prussic.
[2] See Davy's Discoveries, *Phil. Trans.* 1808.

with certain bases, the name of each has been derived from the base of which it is formed; from *sulphur*, for instance, comes *sulphuric acid:* but the same base being supposed capable of uniting with different proportions of oxygen, the terminations *ous* and *ic* were added to indicate the degree of acidification: thus, when sulphur is united with the smaller proportion of oxygen, the acid produced is named *sulphurous acid;* when with the full proportion *sulphuric acid.* One or two acids were moreover supposed to combine with a still larger proportion of oxygen, to denote which the syllable *oxy* (for oxygenized) was prefixed: thus muriatic (*hydrochloric*) acid, which was supposed to be combined with an excess of oxygen, became oxymuriatic acid.

It is unnecessary to enter into the consideration of the impropriety of these terms in a chemical point of view; they are those employed in the British Pharmacopœias, and are applied to well known substances, in daily use in the practice of medicine.

The stronger acids require to be kept in glass bottles, furnished with well ground glass stoppers, and having the name of the acid which each contains engraved on the glass. They should be dispensed also in glass stopped phials. The acids known to chemists are very numerous: but of these a small proportion only is employed for medical and pharmaceutical purposes. In the London Pharmacopœia, the arrangement of which we have adopted, they are placed in alphabetical order; but in this place it may be proper first to exhibit them according to the nature of their radicals or bases.

I. ACIDS COMPOSED OF A SIMPLE RADICAL AND OXYGEN.

SULPHUR	1. SULPHURIC ACID.
AZOTE	2. NITROUS ACID.
	3. NITRIC ACID.

II. ACIDS COMPOSED OF A COMPOUND RADICAL AND OXYGEN.

CARBON AND HYDROGEN	1. ACETIC ACID.
	2. CITRIC ACID.
	3. BENZOIC ACID.
	4. SUCCINIC ACID.

III. ACIDS COMPOSED OF A SIMPLE RADICAL AND CHLORINE.

HYDROGEN	1. MURIATIC ACID.

ACIDUM ACETICUM DILUTUM, Lond. *Diluted Acetic Acid.*

"Distil the dilute Acetic acid from a glass retort, placed in a sand bath, into a glass receiver kept cool: throw away

the first pint, and preserve the six succeeding pints which are distilled."

ACIDUM ACETICUM TENUE, Edin. *Weak Acetic Acid.*

"Distil eight pounds of Vinegar in glass vessels, with a gentle heat. The pound which first comes over, being too watery, is to be rejected; the five pounds that follow, will be the weak acetic acid. The distillation may be continued as long as a colourless acid comes over; but this, being too much burnt, and unfit for internal use, may be mixed with the pound which first came over, and preserved for various chemical purposes."

ACETUM DISTILLATUM, Dub. *Distilled Vinegar.*

"Take of Wine Vinegar, *ten pints;* distil with a gentle heat *six pints.* The distillation must be performed in a glass vessel, and the first pound which comes over rejected."

The specific gravity of this acid is to that of water as 1006 to 1000.

Syn. Vinaigre distillé (*F.*), Distillirter Essig (*G.*), Azynagtige zuur (*Dutch*), Aceto distillato (*I.*), Vinaigre distilado (*S.*).

Of the three appellations given to this preparation in the British Pharmacopœias, that of the Edinburgh College only is unobjectionable. It is the acetic acid in a more diluted state than that in which it exists in vinegar, but purer; being freed in a great degree from the mucilage, extractive, supertartrate of potass, and other extraneous matters which vinegar contains.[1] The distillation on a large scale is often conducted in the common copper still, or in a tinned still with a pewter worm; but both these practices, as they are apt to give dangerous metallic impregnations to the product, are highly reprehensible, when the distilled vinegar is to be employed for medicinal purposes.

In performing the process, it is more important to avoid carrying the distillation too far than to reject the first eighth part which comes over; for although this is undoubtedly weaker, and contains a small portion of alcohol, yet it retains about one-twelfth[2] of the whole quantity of the real acid obtained: but by continuing the process a little too long, the whole product acquires an unpleasant empyreumatic flavour. This is avoided by changing the receiver rather before the quantity ordered has been obtained; and, if to the residue be added an equal quantity of hot water and half an ounce of recently burnt animal charcoal[3], for every pint of fluid in the

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[1] See *Acetum*, Part II. [2] *London Medical Review*, No. x. 125.

[3] Animal charcoal is made by calcining bones in a crucible, to which is luted a perforated cover. When no more flame issues from the aperture, it must be closed, and the heat raised for half an hour.

retort, the distillation may be recommenced, and an additional portion of the diluted acid obtained, equally pure and strong as the former. At the end of the operation, when dilution has not been employed, the residue is a deep-red coloured liquor, strongly acid, very empyreumatic, and which deposits supertartrate of potass. Mr. Brande justly regards as an improvement in the distillation of vinegar, the employment of the heat of high pressure steam, instead of that of an open fire; as both the risk of empyreuma is prevented, and "a larger portion may usually be distilled off, before any foreign flavour is perceptible."[1]

Qualities. — Distilled vinegar has a fainter and less agreeable odour than common vinegar; a grateful, not strong, acid taste: is limpid and colourless; and of a specific gravity varying from 1·007 to 1·0095. One fluid ounce of spec. grav. 1·007 should dissolve 13·8 grains of marble; or 1000 grains should dissolve 145 grains of crystallized subcarbonate of soda, for their saturation. It dissolves the gum resins and the active principles of plants, such as those of the squill and the meadow-saffron; and forms acetates with the alkalies and several of the metallic oxides. Darracq[2] ascertained that it differs from acetic acid in containing some uncombined mucilage and extractive matter, but that the acids are otherwise the same. According to Mr. Phillips, the acid of sp. gr. 1·007 contains of acetic acid 3·42, water 96·58, in 100 parts; and that of sp. gr. 1·009, acetic acid 4·73, water 95·27. It is owing to the extractive that, when distilled vinegar is boiled with potass, the solution has a deep reddish-brown colour, and, during evaporation, carbonaceous matter is deposited. It is sometimes adulterated. Sulphuric acid is detected by a precipitate being produced on the addition of a solution of acetate of barytes; lead and tin, by a solution of sulphuretted hydrogen, forming a dark-coloured precipitate; and copper, by the acid assuming a blue colour, when supersaturated with ammonia.

Medical properties and uses. — The same as those of common vinegar; but, as it is purer, and not liable to spontaneous decomposition, it is fitter for pharmaceutical purposes.

Officinal preparations. *Liquor Ammoniæ Acetatis*, L. E. D. *Acetas Ferri*, D. *Liquor Plumbi Subacetatis*, L. D. *Acetum Colchici*, L. *Acetum Scillæ*, L. E. D. *Oxymel*, L. D. *Emplastrum Ammoniaci*, L. *Oxymel Colchici*, D.

ACIDUM ACETICUM, Dub. *Acetic Acid.*

"Take of Acetate of Kali (Potash), *six ounces*; Sulphuric acid, *three ounces by weight*. Pour the acid into a tubulated

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[1] *Manual of Pharmacy*, p. 192. [2] *Annales de Chimie*, xli. 264.

retort: then add to it in small portions and at different times, the Acetate of Potass, allowing the mixture to cool after each addition; finally, with a moderate heat, distil the acid until the residue be dry.

"The specific gravity of this acid is to that of distilled water, as 1070 to 1000."

ACIDUM ACETICUM FORTE, Edin. *Strong Acetic Acid.*

"Take of dried Sulphate of Iron, *one pound*; Acetate (*superacetate*) of lead, *ten ounces*. Rub them together; then put them into a retort, and distil in a sand bath with a moderate heat, as long as any acid comes over."

Syn. Acide Acetique (*F.*), Essigsäure (*G.*), Azynzuur (*Dutch*), Acido acetico (*I.*).

These processes furnish the same acid as that which is contained in distilled vinegar, but completely free from extractive and mucilage, and much stronger. In the process of the Dublin College, the sulphuric acid, by reason of its superior affinity for potass, decomposes the acetate of potass, and sets free the acetic acid; which must necessarily come over in a concentrated form, as the acetate does not contain much water, and the greater part of the water of the sulphuric acid is retained by the sulphate of potass which is formed in the retort. The Edinburgh process is that of Badollier, an apothecary of Chartres[1], with the substitution of sulphate of iron for sulphate of copper. The affinity of the sulphuric acid of the sulphate of iron to the oxide of the acetate of lead, assisted by the heat, decomposes the acetate, and the sulphuric acid, uniting with the lead, the acetic acid is disengaged, and distils over. The dried state of the salts enables the acid to be obtained in a concentrated form.[2] The process of the Dublin College is the best; the acid obtained being stronger, not contaminated with any metallic impregnation, and free from sulphurous acid, a small portion of which the other generally contains.[3]

Qualities. — Acetic acid has a grateful, fragrant, pungent odour, a very sour, and acrid taste; and when applied to the skin, inflames it and raises a blister. It is limpid, colourless, highly volatile, and if much concentrated, takes fire when

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[1] *Annales de Chimie*, xxxvii. 2.

[2] The process of the edition of the London Pharmacopœia of 1787, for obtaining this acid by the simple distillation of dried, subacetate of copper, afforded a much stronger acid than either of these processes. An excellent acetic acid is obtained by decomposing the acetate of lead at once, by means of sulphuric acid; putting into the retort, before distilling, a small portion of oxide of manganese, as directed by M. Baup. Vide *Journ. de Pharm.* Dec. 1816.

[3] It may be completely freed from this acid by re-distilling it from black oxide of manganese mixed with a small portion of carbonate of potass. *Nicholson's Journal*, xiii. 42.

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heated in the open air. The sp. grav. of the strongest that can be procured is 1·063; in which state it contains 100 parts by weight of real acid and 14·78 of water.[1] It becomes solid and crystallizes at 28° of Fahrenheit, liquefying again at 40°; is capable of oxidizing iron, zinc, copper, nickel, and tin; combines with alkalies, earths, and metallic oxides, forming acetates; dissolves resins, gum-resins, camphor[2], and volatile oils; and combines with alcohol, which, when aided by heat, it converts into a species of ether. The dry acid saturates its own weight of carbonate of lime, so that the strength of any sample of this acid may be readily determined.[3] With water it unites in any proportion, and, during the mixture, heat is evolved. From the experiments of Gay Lussac 100 parts of pure Acetic acid appear to consist of 50·224 of carbon, 5·629 of hydrogen, and 44·147 of oxygen.

Medical properties and uses. — Acetic acid is stimulant and rubefacient. It is principally employed as a refreshing scent, in syncope, asphyxia, and nervous head-achs; and for obviating the unpleasant smell of the confined air of crowded assemblies and of the sick-room. It may be used as a counter-irritant, when applied to the skin, in cynanche tonsillaris, croup, and other internal inflammations. It is, also, an excellent application to warts and corns, which it seldom fails to remove; but, in applying it, care must be taken to avoid eroding the surrounding skin. It is a useful and powerful substitute for a blister, when the effect of such an application is required to be rapidly obtained.

Officinal preparation. *Acidum aceticum camphoratum*, E. D.

ACIDUM BENZOICUM, Lond. *Benzoic Acid.*

"Take of Benzoin, *one pound.* Put the Benzoin into a glass vessel placed in a sand bath, and exposed to a heat of 300° gradually increased, and sublime until nothing more ascends; press the sublimed matter between bibulous paper, in order to separate it from the oil: then sublime it again with a heat not exceeding 400.°

Edinburgh.

" Take of Benzoin, *twenty-four ounces;* Subcarbonate of Soda, *eight ounces;* Water, *sixteen pounds.* Triturate the balsam with the subcarbonate; then boil them in the water for half an hour, stirring them constantly, and strain. Boil the residue of the balsam in other six pounds of water, and strain.

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1 *Ann. de Chim.* lxviii. 88.

2 *Henry's Aromatic Vinegar* is a solution of camphor, and some essential oil, in acetic acid.

3 *Brande's Manual of Pharm.* p. 7.

Mix the strained liquors, and evaporate to two pounds: filter again, and drop in diluted sulphuric acid as long as any precipitation is produced.

Dissolve the precipitated Benzoic acid in boiling water: strain the liquor whilst it is hot through linen, and set it aside to crystallize. Wash the collected crystals with cold water; then dry, and preserve them for use."

Dublin.

"Take of Benzoin, *any quantity*. Liquefy it in a wide-necked retort, to which a receiver is adapted but not luted, and sublime. The sublimed matter must be now and then removed from the tube of the retort, lest it accumulate in too great quantity. If it be soiled with oil, press it between folds of blotting paper to separate the oil, and repeat the sublimation."

Syn. Acide Benzoïque (*F.*), Benzoesäure (*G.*), Benzoin zuur (*Dutch*), Acido Benzoico (*I.*).

The processes of the London and Dublin Colleges are nearly the same as the method recommended by Chaptal of separating the acid which the Benzoin contains: but although the quantity contained be greater, yet if the fire be not very nicely regulated, so large a portion of empyreumatic oil is also volatilized that it gives the acid a brown tinge, which cannot easily be entirely separated from it.[2] The Edinburgh process is that of Gren, which is a modification of that of Scheele published in 1775.[2] Subcarbonate of Soda separates the Benzoic acid from the resin with which it is united in the Balsam, combines with it, and forms a Benzoate which is dissolved in the water; whilst at the same time a small portion of resin is also dissolved, and gives the solution a yellow colour. This Benzoate is decomposed in its turn by the sulphuric acid, which combines with the alkali, and forms a sulphate; whilst the Benzoic acid that is set free, being insoluble in cold water, precipitates in the form of a brownish powder. The subsequent sublimation frees the acid of this colour, and gives it the crystallized form and brilliant appearance of the acid originally obtained by sublimation, without any adhering oil. The following are the quantities of acid obtained from one pound of Benzoin by these processes, according to Mr. Brande's experiments.[3]

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[1] This acid was originally obtained by sublimation. It was described under the name of *flowers of benzoin* by Blaise de Vigeneve, in 1608. *Thomson's Chemistry*, 4th edit. 289.

[2] *Scheele*, i. 124.

[3] *Nicholson's Journal*, x. 88.

	℥.	ʒ.	℈.	grs.
By Chaptal's (*that of the London College*)	2	0	0	0
Gren's (*the Edinburgh*) - -	1	6	2	19[1]

Benzoic acid may also be extracted from the other balsams.

Qualities. — Benzoic acid is, when perfectly pure, inodorous; but as it is usually found in the shops, it has a slight aromatic odour[2]: its taste is pungent, sweetish, acrid, and acidulous. It is in feathery or flocculent crystals, soft to the touch and not pulverulent, of a beautiful whiteness, and a silky lustre. The crystals contain no water. Its specific gravity is 0·657. When heated, it melts, emits a suffocating, acrid vapour, and in a strong heat burns with a white flame. Benzoic acid is soluble in twenty-four times its weight of boiling water; but the water lets fall nineteen twentieths in cooling. Cold alcohol takes about one half its weight; boiling alcohol its own weight of this acid. With the alkalies, earths, and metallic oxides, it forms benzoates, which are not used in medicine. According to Berzelius it is a triple compound of 74·41 of carbon, 5·16 of hydrogen, and 20·43 of oxygen.

Medical properties and uses. — This acid is stimulant; but, although it is retained by all the Pharmacopœias, it is of little value as a remedy.

Officinal preparation. *Tinctura Camphoræ composita*, L. D. *Tinctura Opii ammoniata*, E.

ACIDUM CITRICUM, Lond. *Citric Acid.*

"Take of Lemon Juice, *a pint*; prepared Chalk, *an ounce*; or a quantity sufficient to saturate the juice; Diluted Sulphuric Acid, *nine fluid ounces*. Add the Chalk by degrees to the Lemon Juice heated, and mix them; then pour off the liquor. Wash the Citrate of Lime which remains, in repeated portions of warm water, and then dry it. On the dried powder pour the Diluted Sulphuric Acid, and boil for ten minutes; express the liquor strongly through a linen cloth, and filter it through paper. Evaporate the filtered liquor with a gentle heat, so that crystals may form as it cools. To obtain the crystals pure, dissolve them in water a second and a third time; filter each solution, boil it down, and put it apart to crystallize."

Syn. Acide Citrique (*F.*), Acido Citrico (*I.*).

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[1] M. Stoltze has obtained 180 parts of pure acid from 1000 of Benzoin by the following process. He dissolves the Benzoin in 3 parts of alcohol at 76°, filters the solution, introduces the liquor into a retort, and saturates it with neutral carbonate of soda, dissolved in 8 parts of water and 3 of alcohol. He then distils to obtain the alcohol; and to the decanted, remaining liquor, adds sulphuric acid to separate the Benzoic acid; which is afterwards purified by dissolving it in boiling water and crystallizing. *Berl. Jahsbuch*, 1823. Part II. p. 75.

[2] To free it from the oil on which its odour depends, dissolve it in alcohol, and precipitate by water. *Phil. Mag.* xiv. 331.

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This process, which was contrived by Scheele, will seldom require to be performed by the apothecary, as the crystallized acid is now manufactured very pure, and sufficiently reasonable on the great scale.[1] The theory of the process is very simple. The lime of the chalk unites with the citric acid which exists ready formed in the lemon juice, and produces an insoluble citrate of lime, which precipitates united with some of the mucilaginous and extractive matter of the juice. These are separated by repeated washings; and the sulphuric acid, which is added to the dried citrate, decomposing it, owing to the superior affinity of the sulphuric acid for lime, an insoluble sulphate of lime forms, and is precipitated, while the citric acid is disengaged, remains in solution, and is crystallized by evaporation. The crystals of the first crystallization are dark coloured; which is partly owing to a portion of mucilage that still adheres to the citric acid, and partly to the excess of sulphuric acid acting on the citric acid and decomposing a portion of it. The repeated crystallizations free the crystals from this dark colour; but as it is of some importance to avoid any hurtful excess of sulphuric acid, and as the strength of lemon juice is variable and uncertain, it is better to determine the quantity of acid required by the quantity of chalk employed. For this purpose a portion of the sulphuric acid intended to be used must be previously saturated with the chalk, and the weight of the portion employed accurately ascertained; by the knowledge of which the exact quantity of sulphuric acid required to decompose the citrate may be found. According to the experiments of Proust[2], 94 ounces of lemon juice saturate 4 ounces of chalk with citric acid, and produce 7½ ounces of dry citrate, which require for their decomposition, and the complete saturation of the lime they contain, 20 ounces of diluted sulphuric acid, composed of one part of the common acid, and three parts of water, or of a specific gravity of 1·15. To ascertain, however, the exact point of saturation of the lime with the sulphuric acid, take a little of the clear supernatant fluid, filter it, and add to it a few drops of acetate of lead; if no sulphuric acid be present, citrate of lead only will be formed, soluble in nitric acid, which does not dissolve sulphate of lead.[3]

Qualities. — Pure citric acid is in white, transparent, persistent, right rhomboic prisms; in general, however, variously

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[1] The principal manufacturer in London, is Mr. Coxwell, of Fleet Street.

[2] *Journal de Physique*, lii. 366.

[3] Citric acid may be also obtained from the juice of the Craberry, Vaccinium *oxycoccus:* Bird cherry, Prunus *padus;* Bitter-sweet, Solanum *dulcamara;* and Dog-rose, Rosa *canina.*

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modified. It is inodorous; has an extremely acid, almost caustic taste; and reddens strongly the vegetable blues. In a damp air, the crystals absorb moisture. One ounce of water at 60° Fahrenheit dissolves one ounce and a quarter of this acid; and at 212° twice its weight. The solution, when long kept, is liable to become mouldy and undergo spontaneous decomposition. Citric acid combines with the alkalies, earths, and metallic oxides, and forms citrates. The sulphuric and nitric acids decompose it. Its components, according to Berzelius, are 41·369 carbon, 3·800 hydrogen, and 54·831 of oxygen: and in its crystallized state contains Citric Acid 76·32, water 23·68 in 100 parts.[1] Citric acid may be adulterated with tartaric acid; or with citrate of lime. The first is discovered by adding to the solution of the acid to be tested a solution of nitrate, sulphate or muriate of potass, or saturating it with carbonate of potass, when an insoluble supertartrate, in small brilliant crystals, will be formed if the tartaric acid be present; the second is detected by dissolving the crystals in water, saturating the solution with ammonia, and adding to it some oxalate of ammonia, which will instantly precipitate the lime, if present. If it be mixed with sulphate of potass, the solution will yield a precipitate with muriate of barytes, which is insoluble in muriatic acid.

Medical properties and uses. — The solution of this acid in water, in the proportion of nine drachms and a half of the crystals to Oj. of water, answers nearly all the purposes of recent lemon juice; and is even preferable for forming the common effervescing draught with Carbonate of Potass. The following table shows the quantity of Citric Acid required to decompose one scruple of the alkaline salts mentioned in it.

Alkaline salts.	*Citric Acid.*
Carbonate of Soda.	gr. x.
Subcarbonate of Soda.	gr. xij.
Carbonate of Potass.	gr. xv.
Subcarbonate of Potass.	gr. xviij.
Subcarbonate of Ammonia	gr. xxvj.

A solution of ℈j. in Oj. of water, sweetened with sugar that has been rubbed on fresh lemon peel, forms a grateful refrigerant beverage, resembling lemonade; and which is equally useful in febrile and inflammatory complaints. It is said that

[1] *Phillips' Translation of Pharm.* p. 23.

the crystallized acid is not so useful in scurvy as the juice of the fresh fruit. Citric acid is incompatible in formulæ with the alkaline and earthy carbonates and acetates; the earthy and alkaline sulphurets; and tartrate of potass.

ACIDUM MURIATICUM, Lond.[1] *Muriatic Acid.*

"Take of dried Muriate of Soda, *two pounds;* Sulphuric Acid, (by weight,) *twenty ounces;* Distilled Water, *a pint and a half.* First mix the Acid with half a pint of the water, in a glass retort; and when the mixture is cold, add to it the Muriate of Soda. Pour the remainder of the water into the receiver; and having fitted it to the retort placed in a sand bath, distil over the Muriatic Acid into this water, with a heat gradually raised until the retort become red hot.

"The specific gravity of Muriatic Acid is, to that of Distilled Water, as 1·160 to 1·000.

"One hundred grains of this acid are saturated by one hundred and twenty-four grains of the crystals of Subcarbonate of Soda."

Edinburgh.

"Take of Muriate of Soda, which has been previously exposed to a red heat, Sulphuric Acid, Water, of each *two pounds.* Pour the Acid, mixed with eight ounces of the Water and cooled, upon the Muriate of Soda, in a glass retort; to which adapt a receiver, containing the remainder of the Water, and distil from a sand bath with a moderate fire. In a short time the vessels may be luted together, and the distillation continued to dryness.

"The specific gravity of this acid is, to that of distilled water, as 1·170 to 1·000."

Dublin.

"Take of Muriate of Soda dried, Sulphuric Acid, Water, of each *six pounds.* Dilute the Acid with the Water, and after it is cold add it gradually to the Muriate put into a glass retort: then distil the liquor until the residuum become dry.

"The specific gravity of this acid is, to that of distilled water, as 1·170 to 1·000."

Syn. Acide Muriatique (*F.*), Kochsalzäure (*G.*), Zoutzuur (*Dutch*), Acido Muriatico (*I.*), Ooppoo trāvagum (*Tam.*).

The principal difference in these formulæ is in the quantity of Sulphuric Acid ordered for decomposing the Muriate.[2] The Sulphuric Acid is properly ordered to be diluted, to moderate the strong effervescence, and to prevent the too rapid disengagement of the muriatic acid gas, which would both endanger the bursting of the apparatus, and render the

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[1] Spiritus Salis, P. L. 1720. Spiritus Salis Marini Glauberi, P. L. 1745.

[2] We use the word *muriate*, because it is the term employed by the Colleges, although *Chloride of Sodium* be that now generally and properly adopted.

process otherwise very unmanageable. The directions of the London and Edinburgh Colleges, to put part of the water into the receiver, is preferable to mixing the whole with the acid, and pouring it on the Muriate, as it facilitates very much the condensation: but Mr. Phillips justly remarks, that it would be better to put less water into the receiver and more into the retort. In the manufacturing laboratories, although the process is in principle the same as the above, yet the retort is generally of earthenware or of iron, which communicates the yellow colour that characterizes the common Muriatic acid, and which depends on a small portion of iron being raised, and brought over with the acid. Even when iron vessels are not employed the acid often assumes a yellowish colour, which depends either on a small portion of iron in the salt, or from the presence of some chlorine.

These processes were formerly explained, by saying that the decomposition of the muriate of soda is effected by the superior affinity of sulphuric acid for soda; aided by the affinity of the muriatic acid for the soda being weakened by the heat, which favours its tendency to assume the elastic form, in which state it passes over into the receiver, and is there condensed by the water. But as the doctrine of chlorine is now admitted, we must adopt the following explanation of Sir H. Davy, who regards dry common salt as a compound of 36 parts of chlorine and 24 of sodium, and consequently containing neither muriatic acid nor soda. In the processes of the Pharmacopœias, therefore, for obtaining muriatic acid, the water of the sulphuric acid is decomposed, its oxygen unites to the sodium, and forms soda, which combining with the sulphuric acid produces a sulphate of soda; while the hydrogen of the decomposed water combines with the chlorine and forms hydrochloric acid, or muriatic acid gas, a gaseous fluid consisting of equal volumes of hydrogen and chlorine, or by weight of hydrogen 2·7, chlorine 97·3, in 100 parts, which dissolving in the water contained in the receiver constitutes the liquid acid. The residue of the process is sulphate of soda with an excess of acid; to separate which, without breaking the retort, boiling water may be poured into the retort, after its contents have cooled down to 212°.

Qualities. — Liquid Muriatic Acid, thus obtained, is a colourless or very pale straw-coloured fluid: it has a strong pungent odour, an intensely sour, caustic taste; it reddens strongly the vegetable blues, emits white, suffocating fumes when exposed to the air, and erodes animal and vegetable substances. It unites with the alkalies, earths, and metallic oxides, forming muriates. According to Phillips, the statement of the London College as to the quantity of subcarbonate

of soda required to saturate 100 grains of the acid, is not quite correct.[1] The acid obtained by the process of the London College of the sp. gr. 1·160, consists of nearly 32·4 of muriatic acid, and 67·6 of water. The following part of a table, constructed by Mr. E. Davy, shows the quantity of real muriatic acid gas contained in 100 parts of fluid acid, of different densities, at the temperature of 60°:

Spec. Grav.	Real Acid Gas.	Spec. Grav.	Real Acid Gas.	Spec. Grav.	Real Acid Gas.
1·21	42·43	1·14	28·28	1·07	14·14
1·20	40·80	1·13	26·26	1·06	12 12
1·19	38·38	1·12	24·24	1·05	10·10
1·18	36·36	1·11	22·30	1·04	8·08
1·17	34·34	1·10	20·20	1·03	6·06
1·16	32·32	1·09	18·18	1·02	4·04
1·15	30·30	1·08	16.16	1·01	2·02

According to the new nomenclature, the muriatic acid of the shops is *Hydro-chloric acid*, or, to retain the common name, *Hydro-muriatic acid.* The real acid contained in the liquid acid, is a compound of equal volumes of chlorine and of hydrogen. The fluid muriatic acid found in the shops often contains sulphuric acid with small portions of iron, and sometimes copper; the first is detected by diluting the acid with 5 or 6 parts of distilled water, and adding a few drops of muriate of barytes[2], which is precipitated white if sulphuric acid be present; iron is discovered by saturating the diluted acid with carbonate of soda, and adding prussiate of potass; if a blue precipitate be formed, it may be concluded that iron is present. A blue colour being produced by supersaturating the acid with ammonia detects copper.

Medical properties and uses. — This acid is tonic, and antiseptic. It has been efficaciously used in typhus fevers, and in some cutaneous eruptions. It is a common and useful adjunct to gargles, in the proportion of from ʒss. to ʒij. in fʒvj. of any fluid, in ulcerated sore throats, and scarlatina maligna; and, in a very highly diluted state, viz. ♏viij. in fʒiv. of water, it has been recommended as an injection in gonorrhœa.

This acid has even been regarded as an antidote in general syphilitic affections; but the observations of Mr. Pearson have showed this opinion to be erroneous; yet, by its salutary

[1] *Philip's Trans. Pharm.* p. 27.

[2] Mr. Hume discovered that muriatic acid precipitates muriate of barytes when no sulphuric acid is present: but this does not happen when the acid is much diluted.

effects on the stomach and general health, "it is a medicine capable of ameliorating the appearance of venereal ulcers, and of restraining for a time the progress of the disease," where it is desirable "to gain a little time, previously to the entering on a mercurial course."[1] The dose is from ♏x. to ♏xx. in a sufficient quantity of water, or in any bland fluid. It is incompatible in prescriptions with alkalies, most of the earths, oxides and their carbonates; sulphuret and tartrate of potass, tartarized antimony and iron, nitrate of silver and acetate of lead. In typhus, and fevers of a typhoid type, I have generally given it in the infusion of cinchona or cusparia bark. Dr. Paris states that he has found it a preventive of the generation of worms, when given after copious evacuations of the bowels.[2] Largely diluted in any mucilaginous fluid, and sweetened, it is a useful remedy in calculous cases depending on an excess of the phosphates.

When Muriatic Acid is taken as a poison, it may be detected by its sensible qualities; but if mixed with wine or other fluids, let a portion of it be distilled from a small retort over a candle, into a phial containing a solution of nitrate of silver. The precipitation of muriate of silver, which is soluble in ammonia, but not in nitric acid, will take place if the poison contain muriatic acid. The best antidotes, if exhibited in time, are soap and calcined magnesia suspended in water.

A very important property of muriatic acid, in the state of gas, is the power it possesses of neutralizing putrid miasmata, discovered by Morveau in 1773. It is therefore used as an agent for destroying infection in sick-rooms and hospitals, disengaged by pouring sulphuric acid on common salt.

Officinal preparations. *Murias Barytæ*, E. *Solutio Muriatis Calcis*, E. D. *Tinctura Ferri Muriatis*, L. E. D.

ACIDUM MURIATICUM DILUTUM, Dub. *Diluted Muriatic Acid.*

"Take of Muriatic Acid, and of Distilled Water, each *one pound by weight.* Mix them. The specific gravity of this acid is, to that of water, as 1·080 to 1·000."

This formula is intended to render the dose of Muriatic Acid more easily apportioned: 100 parts contain about 14 of real acid.

AQUA OXYMURIATICA, Dub. *Oxymuriatic Water.*

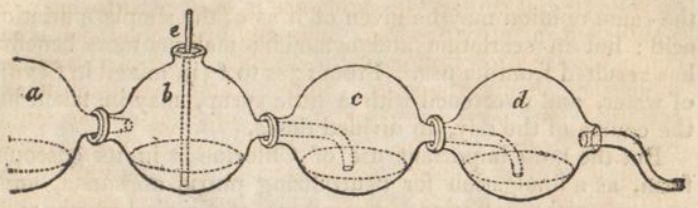
"This is prepared by transmitting the superfluous gas of the process for making the solution of Oxymuriate of Soda, *Aqua Alcalina Oxymuriatica*, by means of a proper apparatus, through a pint of distilled water.

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[1] *Pearson on Remedies for Lues Venerea*, 194.
[2] *Pharmacologia.*

"The specific gravity of this solution is, to that of water, as 1·003 to 1·000."

Syn. Acide muriatique oxigéné (*F.*), Vollkomme Salzsäure (*G.*), Orerzuures Zoutzuur (*Dutch*), Acido muriatico ossigenato (*I.*). [1]



In the process by which this solution is prepared, Chlorine comes over in the gaseous form, and is condensed in the distilled water, which is placed in a Woolfe's bottle, or a globular vessel *b*, furnished with a safety tube *e*, and connected by a tube with a receiver *a*, that contains a solution of subcarbonate of potass. The gas first passes through the alkaline solution, part of it condenses and combines with the potass, forming a chlorate of potass, while the superfluous uncondensed portion passes on to the other vessels *c*, *d*, and there combines with the water, forming this solution, which is erroneously termed oxymuriatic acid.

The substance contained in this solution was discovered by Scheele in 1774, while making his experiments on manganese; and termed by him *Dephlogisticated Muriatic Acid*: but its nature was not perfectly understood until it was investigated by Sir H. Davy, who determined it to be an elementary substance, and named it *Chlorine*, from its colour, which is yellowish.

Qualities.—The saturated solution of Chlorine, or Oxymuriatic acid as it is still termed by the Dublin College, has a very offensive suffocating odour; and a harsh, styptic, but not acid taste. Its colour is a very pale-yellowish green; it destroys all the vegetable colours, rendering them white. It must be kept in opaque bottles or in a dark place; for by the action of the solar rays, part of the water is decomposed; the hydrogen of which, uniting with the Chlorine, forms muriatic acid, which remains in solution in the water, while the oxygen is set free. At a temperature of 50° this solution contains about twice its volume of Chlorine. The aqueous solution of *Chlorine* acts on almost all the metals, forming Muriates or Chlorides.

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[1] All these terms are now generally admitted to be erroneous, there being really no such substance as they imply: the composition alluded to is the solution of a simple elementary body, *Chlorine*, in water.

Medical properties and uses. — Fluid Oxymuriatic-acid (*Aqueous solution of Chlorine*) is stimulant and antiseptic. It has been strongly recommended in scarlatina and malignant sore throat; and as an antisyphilitic remedy. In the latter disease the same opinion may be given of it as of the simple muriatic acid; but in scarlatina and cynanche maligna more benefit has resulted from its use. From f℥ss to f℥ij, mixed in f℥viij of water, and sweetened with a little syrup, may be taken in the course of the day, in divided doses.

But the most important use of Chlorine is in its gaseous form, as a fumigation for neutralizing putrid miasmata, and correcting the infectious atmosphere of hospital wards and rooms in which have been cases of contagious fevers. For these purposes it is better adapted than the common muriatic acid gas; but as both of them are highly deleterious to animal life, they should be employed in such apartments only as the sick can be removed from while the gas is extricated. The Chlorine is easily procured by pouring f℥vj of strong sulphuric acid on a mixture of ℥iv of pulverized manganese, and ℥viij of dried common salt, in a china cup, which should be placed in a pipkin of hot sand. The doors of the room which is to be fumigated, must be kept shut for two hours after the cup or cups with this charge are placed in it; then be thrown open, and a free current of air permitted to pass through the apartment. By this process the offensive odour of the sick room is destroyed, the chemical constitution of the deleterious atmosphere altered, and its freshness completely restored.

For the more convenient application of this powerful agent, Morveau has invented what he terms disinfecting or preservative bottles. The apparatus consists of a strong glass bottle or phial, covered with a plate of glass, which is fitted by grinding so as to shut, accurately, the orifice of the vessel. The bottle is fixed in a wooden frame; and the plate of glass kept in its place, and closely applied by means of a screw. If the bottle be of 25 cubic inches of capacity, the charge to be put into it may consist of 372 grs. of black oxide of manganese in coarse powder, 3·5 cubic inches of nitric acid of 1·4 specific gravity, and an equal bulk of muriatic acid of 1·134 specific gravity. As soon as the charge is introduced, the glass plate must be firmly screwed down in its place. When the apparatus is to be used, the screw is to be turned so as to allow the gas which is extricated to escape from under the plate of glass; and this must be again screwed down, as soon as the smell of the Chlorine is perceptible in the distant corners of the apartment. Bottles of any dimensions may be used, but the charge must in no case occupy more than one-third part of the capacity of the vessel.

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ACIDUM NITRICUM, Lond. [1] *Nitric Acid.*

"Take of Nitrate of Potass dried, and Sulphuric Acid, each by weight *two pounds;* mix them in a glass retort: and distil the Nitric acid from a sand-bath, until red vapours are produced. Then, having added an ounce of dry Nitrate of Potass, re-distil the acid in a similar manner.

"The specific gravity of this acid is, to that of distilled water, as 1·500 to 1·000. One hundred grains of this acid are saturated by two hundred and twelve grains of crystals of Subcarbonate of Soda."

Edinburgh.

"Take of Nitrous Acid, *any quantity.* Put it into a retort, and having fitted a receiver, which must be kept cold, apply a very gentle heat until the reddest part shall have passed over, and the acid which remains in the retort, already almost free from colour, have become Nitric acid."

ACIDUM NITROSUM, Edin. *Nitrous Acid.*

"Take of Nitrate of Potass bruised, *two pounds;* Sulphuric Acid *sixteen ounces.* Pour the acid upon the Nitrate of Potass in a glass retort, and distil from a sand-bath with a gradually augmented heat, until the iron pot becomes obscurely red hot.

"The specific gravity of this acid is, to that of distilled water, as 1·520 to 1·000."

Dublin.

"Take of Nitrate of Kali, *six pounds;* Sulphuric Acid, *four pounds* by weight. Mix and distil until the residue becomes dry.

"The specific gravity of this acid is, to that of distilled water, as 1·500 to 1·000." [2]

Syn. Acide nitrique (*F.*), Salpeter säure (*G.*), Zalpeterzuur Skerkwater (*Dutch*), Skedwatter (*Swed.*), Acido Nitrico (*I.*), Pottle Ooppoo trāvágum (*Tam.*), Areki Shora (*Pers.*), Maulabker (*Arab.*).

In performing these processes it is advisable to use a Woolfe's apparatus, or a range of two or three globular receivers, the last of which should contain a small portion of water. The Nitric Acid is separated from its combination with potass in the nitrate by the superior affinity of the sulphuric acid for the potass, which, however, requires to be aided by quantity, a larger portion of sulphuric acid than is

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[1] Acidum Nitrosum, P. L. 1787. Spiritus Nitri Glauberi. Aquafortis, P. L. 1745. Aquafortis simplex et duplex, P. L. 1720.

[2] For the preparation of this acid on a large scale in this country, rough nitre, with half the weight of sulphuric acid, is employed. These are put into a large glass or earthenware *body*, to which a glass pipe is luted communicating with an empty receiver, which is connected by means of pipes also, with several other receivers half filled with water.

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necessary for saturating the potass of the nitrate being used: and also by heat, which volatilizes the Nitric Acid as it is disengaged. As soon as the materials are heated, orange-yellow vapours are disengaged, which in a short time, as the heat increases, become paler, and continue so until the ingredients in the retort are nearly dry, and the heat is augmented to 500°; when, owing to a partial decomposition of the acid next disengaged, nitrous gas comes over in deep red fumes, with a quantity of permanently elastic pure oxygen, which may be collected in an inverted receiver filled with water, placed in a pneumatic trough, and connected with the last of the receivers by means of a bent tube. The nitrous gas combines with the condensed acid in the receiver, deepens its colour, and gives it that form which constitutes nitrous acid. It is with the view of preventing this, that the London College has ordered so large a portion of sulphuric acid to be employed, the principal use of which appears to be to contribute a sufficient portion of water to preserve the constitution of the Nitric Acid. The Edinburgh College orders the acid to be kept in its coloured state; and as a medical agent it answers the same purposes as the colourless acid; for, when both are diluted with water, they have the same appearance, and are brought to the same state, the addition of the water expelling completely the nitrous gas, which is only loosely united with the Nitric Acid to form the nitrous. The quantity of acid obtained by the Edinburgh process is about half the weight of the nitrate employed; and the residue is a white spongy saline cake of sulphate of potass with an excess of sulphuric acid, or a bisulphate of potass, which may be dissolved out of the retort by hot water.

By the London process the Nitric Acid is at first obtained tolerably free from nitrous gas; but in general the re-distillation, as directed, will be found necessary. In the expulsion of the nitrous gas, to change the nitrous acid into Nitric Acid, according to the directions of the Edinburgh College, a portion of the acid is carried over with the gas, as nitrous acid vapour; which should not be wasted, but be condensed by a small portion of water being put into the receiver, and thus form a diluted acid. Mr. Murray [1] justly observes, that the heat of a water-bath is best adapted for this operation, being sufficient for the purpose, and not too great to produce the decomposition of the acid. A completely colourless acid, however, is not obtained, unless the acid be re-distilled from

[1] *System of Materia Medica*, ii. 184.

a small portion of black oxide of manganese; but this is not at all necessary for medical purposes.[1]

As nitre sometimes contains a small portion of muriate of soda, Nitric Acid, in whatever method it has been procured, may be contaminated with a minute portion of muriatic acid, or of sulphuric acid, if a large proportion of this have been used for decomposing the nitre: the presence of the first is detected by dropping in nitrate of silver, which forms an insoluble muriate of silver; while the formation of a precipitate on the addition of nitrate of barytes discovers the second; but both the acid to be tested and the nitrate of barytes should be previously diluted with distilled water: if any undecomposed nitre be present, it will be detected by evaporating a portion of the acid, when, if it contain no nitre, it will have no residue. These contaminations do not affect the medicinal virtues of the acid.

Qualities. — *Nitrous* Acid, as the term is understood in the Edinburgh Pharmacopœia, is a yellow or orange-coloured fluid, emitting, when exposed to the air, deep orange-coloured, extremely suffocating fumes. In its chemical affinities and other qualities it agrees in many respects with Nitric Acid. It consists of nitrous gas loosely combined with Nitric Acid and water; and the colour varies according to the proportion of nitrous gas which is present. From experiments made by Sir H. Davy[2] on this subject, the following appear to be the proportions in the three states in which nitrous acid is usually procured for pharmaceutical purposes.

100 Parts of Acid.	Spec. Gravity.	Real Nitric Acid.	Water.	Nitrous Gas.
Pale yellow	1·502	90·5	8·3	2·00
Bright yellow	1·500	88·94	8·10	2·96
Dark orange	1·480	86·84	7·6	5·56

The Edinburgh College states the specific gravity too high, for it seldom exceeds 1·502, and scarcely ever 1·52.[3] When one part by weight of water is added to four parts of yellow nitrous acid, the colour is altered to a fine green; when equal parts of both are mixed, it becomes blue; and by another addition of water, or by allowing it to stand exposed to the air, it changes to a very pale straw-colour, or becomes nearly colourless.

[1] Nitric acid was first obtained by Raymond Lully, in the 13th century, by distilling a mixture of nitre and clay: a process still employed on the continent. The name *Nitric acid* was imposed in 1787, by the French chemists.

[2] *Researches*, 37.

[3] Rouelle states the specific gravity of the strongest nitric acid that can be procured to be 1·583; Kirwan makes it 1·5545 only, at 60° Fahrenheit.

Liquid Nitric Acid is a colourless, or very pale-yellow, limpid fluid, emitting, when exposed to the air, white suffocating vapours, and possessing strong acid properties. It is highly corrosive, and tinges the skin yellow, the tint remaining till the epidermis peel off. When exposed to the air, it attracts moisture and becomes weaker. It unites with water in every proportion, and while mixing, heat is evolved. One fluid ounce of the acid, prepared according to the formula of the London College, should weigh 11 drachms 1 scruple. The following table, constructed by Sir H. Davy [1], shows the quantity of real acid and water contained in 100 parts of fluid acid of different densities.

100 Parts Nitric Acid of specific gravity.	Contain of		100 Parts Nitric Acid of specific gravity.	Contain of	
	True Acid.	Water.		True Acid.	Water.
1·5040	91·55	8·45	1·3186	52·03	47·97
1·4475	80·39	19·61	1·3042	49·04	50·96
1·4285	71·95	28·35	1·2831	46·03	53·97
1·3906	62·96	37·04	1·2090	45·27	54·73
1·3551	56·80	43·12			

Nitric Acid is volatilized by heat, and decomposed by light. It is also decomposed by all the simple combustibles, with great violence of action, which is accompanied with the evolution of copious red fumes. When poured on oils, particularly if these contain any essential oil, it sets them on fire; is capable of oxidizing all the metals; and combines with the earths, alkalies, and metallic oxides [2], forming nitrates; one fluid ounce of specific gravity 1·500 should dissolve 476 grains of white marble. The constituents of Nitric Acid, independent of the water, which gives it the fluid form, are 25·93 azote, and 74·07 oxygen in 100 parts: or 1 volume of azotic gas and $2\frac{1}{2}$ volumes of oxygen gas. The strongest fluid acid contains 25 per cent. of water, and 75 of dry acid.

Use. — Strong fluid Nitric Acid is seldom employed except for pharmaceutical purposes; but it has been lately recommended as an escharotic in sloughing phagedœnic ulcers by Mr. Welbank. To employ it properly, the surface of the ulcer must be well cleaned and dried, and, after applying a thick coating of lard to protect the surrounding sound skin,

[1] *Researches*, p. 41.

[2] In its concentrated state, it does not act upon the metals at ordinary temperatures; but when slightly diluted it quickly oxidizes them and dissolves the oxides. This is owing to the decomposition of the water, which yields up its oxygen to the metal, which in a state of oxide is readily soluble in the acid. It does not act on platina or gold.

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a pledgit, moistened with the undiluted acid, must be pressed steadily on every point of the diseased surface, which, by this treatment, soon throws off a slough: and assumes a healthy aspect.[1] When extricated in the form of vapour, it is employed for destroying contagion. It is less powerful than the oxymuriatic acid, but is more generally useful, as it can be extricated in the chambers of the sick without proving deleterious to animal life.[2] For this purpose f℥ij. of sulphuric acid may be poured over ℥iv. of coarsely powdered nitre in a china cup, and placed in a pipkin of hot sand. This quantity is sufficient for fumigating a room of ten feet square; and, where a larger portion is required, it is more advisable to multiply the number of pipkins, than to put a larger quantity of the materials into one vessel.

Officinal preparations. *Acidum Nitricum Dilutum*, L. E. D. *Argenti Nitras*, L. E. D. *Ung. Hydrargyri Nitratis*, L. E. D. *Hydrargyri Nitrico-oxydum*, L. *Spiritus Ætheris nitrici*, L. E. D. *Unguentum Acidi nitrosi*, E. D.

ACIDUM NITRICUM DILUTUM, Lond. *Diluted Nitric Acid.*

"Take of Nitric Acid, *a fluid ounce*; Distilled Water, *nine fluid ounces.* Mix."

ACIDUM NITROSUM DILUTUM, Edin. *Diluted Nitrous Acid.*

"Take of Nitrous Acid, and of Water, *equal weights.* Mix, avoiding the noxious vapours."

Dublin.

"Take of Nitrous Acid, and of Distilled Water, each *one pound.* The specific gravity of this mixture is, to that of distilled water, as 1280 to 1000."

These processes are intended for the more convenient apportionment of the dose in the exhibition of this acid. In the former edition of the London Pharmacopœia the proportions of acid and water were equal by weight; but the alteration in the present edition makes a very important difference of strength, in a given measure of the diluted acid, prepared after the first, and the last of the above formulæ.

When prepared according to the directions of the London College, f℥i. contains about grs. 68 of Nitric Acid, of 1·500 specific gravity, and will saturate 144 grains of crystallized Subcarbonate of Soda; while the same measure of the same acid, prepared after the Edinburgh and Dublin, and the former London formulæ, contains grs. 390·5 of the same acid; a difference which may lead to errors in practice; and is

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[1] *Medico Chirurg. Trans.* vol. xi. p. 69.

[2] *The effects of Nitrous Vapour, &c. by J. C. Smyth, M. D.*

therefore to be regretted, particularly as no reason is assigned for the change.

Medical properties and uses. — Nitric acid is tonic and antiseptic. When very largely diluted with water, it forms an agreeable and very useful beverage in fevers, particularly of the typhoid type. In larger doses, less diluted, it has been efficaciously administered in chronic hepatitis, even when dropsy has supervened; and has also been found serviceable in restraining violent sickness, in dyspepsia, asthma, and the majority of the cachexiæ. From some observations of Dr. Scott, published at Bombay, in 1796, this acid excited considerable attention as a remedy for syphilis; but after the most ample trials, by almost every practitioner of any eminence in the country, its antisyphilitic powers have not been found by any means to answer the accounts of them transmitted from India. The subsequent publications of Dr. Scott, however, have shown, that he did not employ Nitric Acid, but a mixture of three parts of muriatic acid, and two of nitric. It checks for a time the progress of the disease, but does not permanently remove the symptoms; and, as Mr. Pearson justly observes, "it would by no means be warrantable to substitute the Nitrous (or Nitric) Acid in the place of mercury, for the cure of venereal [1] complaints." It is, however, in many cases of much benefit during a mercurial course, or prior to its commencement, when the constitution is impaired, and inadequate to support the effects of mercury; as by its tonic powers it promotes the general health, and lessens the action of the mercurial remedy on the mouth and fauces; yet, when it is pushed far, it affects the mouth, and produces ptyalism. [2] When dropsy supervenes on reiterated courses of mercury, which is not unfrequent in broken-down constitutions, this acid, Mr. Carmichael observes, given in as large doses as the stomach will permit, conjoined with digitalis, is productive of the utmost benefit. We have found it of considerable service, given at the same time with mercury, in old obstinate ulcerations of the legs, although no venereal taint could be suspected: and it is employed with benefit as a local stimulant, in the form of lotion, in the proportion of ƒʒij. of the diluted acid, to Oj of water, to fœtid ulcers, attended with a thin ichorous discharge, and in caries of the bones. In India, and in this country for some years past, Nitric Acid has been used combined with muriatic acid, in the form of a bath [3], and

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[1] *Pearson on Remedies for Lues Venerea*, 188.

[2] Blood drawn from the arm, after the daily use of this acid for some weeks, exhibits the buffy coat.

[3] The proportions are two parts of muriatic acid and one of nitric, so diluted with water as to taste as sour as vinegar. Experience has not justified the high encomiums bestowed upon them.

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in this state produces a slight excitement of the skin, a peculiar taste in the mouth, and, in other respects, nearly the same effects as when it is taken internally; but the chief perceptible effect of the mixed acid is on the bowels, which it keeps moderately open. Diluted Nitric Acid has often been employed as a poison. It is detected by the orange-coloured spots, which are observed on the lips, chin, and hands of the patients; and, if death be the result, by the same colour being found in a large portion of the alimentary canal, the mucous membrane of which is converted into a fatty substance, and the stomach often perforated. If any of the fluid can be obtained, the extrication of orange-coloured fumes on boiling it over copper-filings, is a certain test of aquafortis. Soap, and calcined magnesia suspended in water, are the best antidotes.

The dose of the diluted acid is from ♏x. to ♏xxx. in f℥iij. of water, given three or four times a day. When used as a bath, the mixed acid should be added to the water, until it is about as sour as weak vinegar. Nitric acid, even when diluted, is incompatible in prescriptions with oxides, earths, alkalies, the sulphurets, and the acetates of potass and of lead. It decomposes the two last named salts, and forms nitrates of lead and of potass.

ACIDUM SUCCINICUM, Edin. *Succinic Acid.*

"Take of Amber in powder, and pure Sand, *equal parts*; mix and put them into a glass retort, of which they may fill one half. Having adapted a large receiver, distil from a sand-bath, with a gradually raised fire. A watery liquor with a little yellow oil will first distil over: then a yellow oil with an acid salt: and lastly, a reddish and black oil. Pour the liquor out of the receiver, and let the oil be separated from the water. Press the acid salt, collected in the neck of the retort and on the sides of the receiver, between folds of bibulous paper, that it may be freed from the adhering oil; then purify it by solution, in hot water and crystallization."

ACIDUM SUCCINICUM, Dub. *Succinic Acid.*

"Take of Amber, and pure Sand, each *a pound*. Distil, with a gradually increased heat, an acid liquor, an oil, and a salt discoloured with oil. Wrap up this salt in bibulous paper, and subject it to the press to separate the oil; then let it be again sublimed."

Syn. Acide Succinique (*F.*), Bernsteinsäure (*G.*), Acido Succinico (*I.*).

The use of the Sand in these processes is to prevent the Amber, which swells very much, from passing over into the receiver. The heat which is necessary for the complete decomposition of the amber is very considerable; and therefore by following exactly the formulæ of the Colleges, this is

scarcely ever accomplished. The Succinic Acid is partly dissolved in the water which condenses in the receiver, but the greater part is sublimed in the neck of the retort, and is so much contaminated with the oil, that after repeated solution and crystallization, and even resublimation, it still retains a portion of it. According to Guyton Morveau [1], it may be obtained perfectly pure by distilling from it a small portion of Nitric Acid, with a heat not strong enough to sublime the Succinic Acid.

Qualities. — The crystals of Succinic acid are minute triangular prisms. When pure, they are white, translucent, and shining; have a slight penetrating sour taste; redden infusion of litmus; and are volatile and inflammable, burning away without leaving any odour. They are soluble in twenty-four parts of water at 60°, and two parts at 212°; the greater part, however, crystallizing as the water cools. They are also soluble in alcohol, and in sulphuric and nitric acid, without suffering decomposition. With the alkalies, earth, and metallic oxides, succinic acid combines and forms succinates. It is a triple compound of 47·600 parts of carbon, 4·512 of hydrogen, and 47·888 of oxygen. [2]

This acid is often adulterated with tartaric acid, muriate of ammonia, and sulphate of potass. The first is detected by carbonate of potass; the second, by nitrate of silver; and the sulphate by barytic water. It is altogether discarded from practice.

ACIDUM SULPHURICUM DILUTUM, Lond. *Diluted Sulphuric Acid.*

"Take of Sulphuric acid, *a fluid ounce and a half*; Distilled Water, *fourteen fluid ounces and a half.* Add the acid gradually to the water, and mix."

Edinburgh.

"Take of Sulphuric acid, *one part*; Water, *seven parts*; mix them."

Dublin.

"Take of Sulphuric acid, *two ounces by weight*; Distilled Water, *fourteen ounces by weight.* Mix them gradually, and set the mixture aside to cool; then pour off the clear liquor. The specific gravity of this acid is, to that of water, as 1090 to 1000."

Syn. Acidum Vitriolicum dilutum, P. L. 1787. Acide sulphurique étendu d'eau (*F.*), Verdüunte Schwefelsäure (*G.*), Verduuntes Zwavelzuur (*Dutch*), Acido solforico diluito (*I.*), Zakab (*Arab.*).

It is very much to be regretted, that the London College, when it altered the proportions of acid and water in this mix-

[1] *Annales de Chimie*, xxix. 165.
[2] *Annals of Philosophy*, vol. v. p. 99.

ture, from those in the last edition of its Pharmacopœia, did not adopt the proportions ordered by the two other Colleges, so that, in this preparation at least, a standard strength might have been fixed for the whole kingdom. The reasons which induced it to adopt the present proportions are not easy to be conceived; for the puerile reason stated by Dr. Powell that "this mixture will be more conveniently made, and its dose more easily apportioned than the former one," cannot surely have operated in causing the alteration. One fluid ounce of this diluted acid of the London Pharmacopœia, contains 80 grains of the strong acid; in the Edinburgh and Dublin pharmacopœias it constitutes an eighth part.

Owing to the great affinity of Sulphuric Acid for water, and the density of the mixture being much greater than the mean of the separated acid and water [1], a very considerable increase of temperature is produced during their combination, sufficient to crack the glass vessels in which it is made, if the two ingredients be at once mixed together.[2] To prevent such an accident, the acid must be gradually added in small portions to the whole of the water, and the mixture agitated after every addition. It is of importance always to ascertain the specific gravity of the acid before the mixture be made. The mixture, when it has cooled down to the temperature of the atmosphere, lets fall a white precipitate, consisting of a small portion of sulphate of potass, and of sulphate of lead, which the strong acid always contains, but which the diluted acid is incapable of holding in solution. The diluted acid is thus purer than the strong acid, which suffers no other alteration except in point of strength: and hence the Dublin College properly directs the clear liquor to be poured off when the mixture has cooled.

Medical properties and uses. — Diluted Sulphuric Acid is tonic, antiseptic, and refrigerant. Its tonic and antiseptic powers render it extremely serviceable in low typhoid fevers, dyspeptic affections, diabetes, convalescencies, and in cutaneous eruptions. It restrains the colliquative sweats which attend hectic: locally applied, it is a common and useful adjunct to gargles in cynanche, and to check salivation; and as a refrigerant, it is given with certain benefit in passive hæmorrhages, from whatever part they may arise. Combined with mucilages, it has been beneficially given in passive diarrhœas,

[1] It is a curious fact that, after the mixture has cooled down to the temperature of the atmosphere, a considerable time elapses before it acquires its real density.

[2] If one part by weight of sulphuric acid of 1·845 specific gravity be mixed with one-fourth its weight of water, both being at the temperature of 50° Fah., the caloric instantly evolved is sufficient to raise the thermometer from 50° to 300°, and a still greater heat is produced by mixing 73 parts of the acid with 27 of water.

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operating on the relaxed mucous coat of the intestine as an astringent. In the first-mentioned cases, the diluted acid may be combined with infusions of cinchona or other vegetable bitters, and aromatics; and in the latter with infusion of roses, mucilage, or simple water sweetened with syrup. It is certainly injurious to the teeth; and, therefore, should be sucked through a quill, when taken as an internal remedy. The usual dose is from ♏x. to ♏xxx., but in malignant erysipelas, with a tendency to hæmorrhage, it has been given to the amount of f℥j. in twenty-four hours; and we have given it, with evident advantage, to the same amount, in violent uterine hæmorrhages.

Officinal preparations. *Acidum sulphuricum aromaticum*, E. *Infusum Rosæ compositum*, L.

ACIDUM SULPHURICUM AROMATICUM, Edin. *Aromatic Sulphuric Acid.*

"Take of Alcohol, *two pounds*; Sulphuric Acid, *six ounces*. Drop the acid gradually into the alcohol. Digest the mixture in a covered vessel with a very gentle heat for three days; then add of Cinnamon-bark, bruised, *one ounce and a half*; Ginger-root, bruised, *one ounce*. Digest again in a closed vessel for six days; then filter through paper placed in a glass funnel."

This preparation is generally regarded as an imperfect ether; but we are of opinion that the reciprocal action of the acid and alcohol during the digestion is scarcely sufficient to produce such a result; and the acid, undoubtedly, very much predominates. It is, therefore, a simple alcoholic solution of sulphuric acid, holding the essential oils of cinnamon and of ginger in solution.

Qualities.—The odour is peculiar and aromatic; the taste gratefully acid. It is limpid, and of a brownish colour.

Medical properties and uses.—This is an agreeable mode of exhibiting Sulphuric Acid in dyspepsia, chronic asthma, and most of the complaints for which the diluted acid has been found serviceable. The dose is from ♏x. to ♏xxx. in any convenient fluid vehicle; and may be given three or four times a day.

ACIDUM TARTARICUM, Lond. *Tartaric Acid.*

"Take of Supertartrate of Potass, *two pounds and a half*; boiling Distilled Water, *three gallons*; prepared Chalk, *one pound*; Sulphuric Acid *one pound*. Boil the Supertartrate of Potass with two gallons of the Distilled Water, and gradually add the prepared Chalk, until no more bubbles are produced: set the mixture apart that the Tartrate of Lime may subside; pour off the fluid, and wash repeatedly the Tartrate of Lime with distilled water, until it come off tasteless. Then pour upon the Tartrate the Sulphuric Acid diluted with a gallon

of the boiling distilled water, and set the whole apart for twenty-four hours, occasionally stirring it. Filter the liquor, and evaporate it in a water-bath to obtain the crystals."

In this process, which is nearly the same as that of Scheele, the lime of the chalk separates the tartaric acid from the potass with which it was previously combined [1]; and again yields it up, in order to combine with the sulphuric acid, which is used in the second part of the process. It is quite unnecessary to boil the distilled water for diluting the sulphuric acid, as the degree of heat produced by the mixing the acid and water, even were both at the freezing point, is sufficient for every purpose of the process, and is not increased by using the distilled water in a boiling state. Before crystallizing, it is proper to test the liquor by dropping a little acetate of lead into a small portion of it, which throws down a precipitate insoluble in acetic acid, if any sulphuric acid be present. In which case a little more tartrate of lime should be added. The crystals are obtained in groups, and cannot be always procured of the same form under the most careful management: but their most frequent form is an oblique rhombic prism.

Qualities.—Tartaric acid in its crystallized state is white, imperfectly transparent, persistent in the air, inodorous, and very acid to the taste. The primary form of its crystal is an oblique rhombic prism. [2] It melts when heated a little above 212°, and boils at 250°, without losing its whiteness, and, unless the boiling be long continued, it loses little more than 4 *per cent.* of its weight; but the nature of the acid is changed; for on cooling, the semi-transparent mass into which it concretes is deliquescent. Tartaric acid is readily soluble in water, which dissolves one fifth of its weight, and the saturated solution is not liable to spontaneous decomposition. It is decomposed by a high temperature, and also by sulphuric and nitric acids, the latter of which converts it into oxalic acid. It combines with alkalies, earths, and metallic oxides, forming *tartrates;* and in its power of saturating alkalies closely resembles citric acid. According to the analysis of Berzelius, 100 parts of this acid, as it exists in tartrate of potass, are composed of 3·951 of hydrogen, 36·167 of carbon, and 59·882 of oxygen: but, in its ordinary crystallized state, or as a hydrate, it is composed of 88·16 parts of real acid, and 11·84 of water, in 100 parts. When carelessly made, it may contain sul-

[1] The components of supertartrate of potass are, tartaric acid 70·15, potass 25·13, and water 4·72, in 100 parts.

[2] *Phillips's Trans. of Pharm.* 1824.

phuric acid, which, however, can be detected by adding muriate of barytes to the solution, when a precipitate insoluble in an excess of muriatic acid will be thrown down, if sulphuric acid be present. One hundred grains of the crystallized acid saturate 200 grains of crystallized subcarbonate of soda.

Medical properties and uses. — Tartaric acid, largely diluted and sweetened, forms a cooling agreeable beverage in fevers and diseases connected with an increased secretion of bile. It is incompatible in prescriptions with solutions of salts containing potass, which it converts into a bitartrate, which being of difficult solution is thrown down in minute crystals. It also precipitates salts of lime and of lead. Dissolved in water, and added to an aqueous solution of carbonate of Soda, it forms a good substitute for soda-water.

APPENDIX TO THE ACIDS.

In the following Appendix I propose to give a short account of two acids, which, although they have not a place in any of the British Pharmacopœias, yet, are of great importance; the one being a remedy of considerable efficacy in a certain class of diseases, and the other demanding the attention of the medical practitioner, from the frequent employment of it as a poison.

I. — Acidum Hydrocyanicum.

Hydrocyanic (Prussic) Acid.

This acid is found in many vegetable productions; such as the bark of the Prunus *Padus*, or Bird-cherry; the leaves of the Peach and Nectarine trees, Bitter-almonds, and the kernels of many fruits; but, for the purposes of medicine it is artificially prepared.

Preparation. The best method of preparing Hydrocyanic acid, for medicinal use, is the following, which was first employed by Scheele.

Mix two ounces of Prussian-blue with six ounces of red precipitate of mercury, and add six ounces of water. Boil the mixture for some minutes, constantly agitating it, when the blue colour will disappear, and the mass assume a yellowish-grey hue. Pour the whole on a filter, and wash the residuum with a little hot water, which is to be added to the filtered liquor. Pour this upon an ounce and a half of clean iron filings, and add three drachms of strong sulphuric acid.

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