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By repeatedly exposing this substance in vapour, and the crystalline state, to the sunbeams, a deposit of a dew of a greenish colour is effected; so that, though heat does not alter it, light produces from its chemical affections a most important change. Some of the iode I have now with me in a tube hermetically sealed, has been thus transmuted.

By raising a perpendicular to the iode in the state of vapour, and placing this in the sunshine, a green shadow is projected.

The violet vapour which rises on application of heat cannot be regarded as an emanation thrown off from the iode, and which dissolves the substance, and holds it suspended therein, but rather the iode itself finely dispersed and comminuted; the alteration of the size of the crystalline particles, and the variations of the figures of the groups, tend to the latter supposition.

Query? Is iode the metallic radicle of chlorine? or of muriatic gas? or a substance sui generis, elaborated in the vegetable æconomy?

I am, with much respect and many thanks,

Gentlemen,

Very obediently yours,

J. MURRAY.

To Messrs. Nicholson and Tilloch.

LVI. On Alcohol or Spirituous Liquors, and on the Changes which they undergo on being rectified with alkaline, saline, earthy, and other Substances; to which is subjoined a simple Process for obtaining highly dephlegmated Spirits of Wine without Injury to its constituent Principles. By M. DUBUI, of Rouen*.

FOR upwards of two centuries, chemists have been proposing methods for freeing common spirits from a certain quantity of water, malic acid, and other foreign bodies which they obstinately retain, in order to procure pure alcohol, or highly rectified spirits of wine. It is now about a hundred years since Boerhaave, Cartheuser, Stahl, and other chemists were occupied with this object, and since, by means of their improvements, this valuable fluid has been obtained freed from the heterogeneous substances which alter its properties. Of all the old methods, that of Lemery seems the best: it consists in distilling in a vapour-bath spirits at 22 degrees in a matrass with a very long neck, surmounted by a head, &c.

Alcohol thus distilled marks in general from 38 to 40 degrees in the common hygrometer, (at the temperature from 5° to 12°

* *Annales de Chimie*, tome lxxvi. p. 314.

centigrade): this liquor, when at such a degree of lightness, is described by Baumé as highly rectified spirit of wine. "Its physical and chemical properties, in addition to its levity, consist in being perfectly diaphanous, very volatile, very inflammable, burning without smoke, having an agreeable smell, a hot taste, and it does not alter the aqueous tinctures of turnsole, or of the petals of violets."

Such are the characters which ought to distinguish every alcoholic extract of wine, cider, perry, rum, &c. when well rectified, deprived of water, and of the malic acid which we meet with almost always in weak spirituous liquors.

We may, by means of salt or alkaline and earthy matters, bring alcohol to a superior degree of rectification, to the point of marking 46 or more in the areometer: but it is clear that these substances act more or less on the elements of alcohol during distillation; for the liquor which results has new properties, since it acts differently with the reagents from the spirit of wine obtained without intermedium, such as that prepared by Lemery's process, which we shall henceforth call *pure alcohol*.

Lowitz, Richter, and other chemists successively suggested various substances, which have a great affinity for water, in order completely to dephlegmate alcohol. In short, if the substances mixed with spirit of wine, only take up the aqueous principle which it contained in excess before it attained its last stage of rectification, we may then conceive what immense advantages, by these processes, spirituous fluids might confer on the arts and commerce in general*; but the series of experiments about to be detailed will remove all uncertainty on this head, and enable us in future to appreciate the means hitherto employed in the rectification of alcohol. We shall show that every saline admixture changes spirit of wine more or less, either by acting on its constituent principles, or by being dissolved, or even interposed in a state of minute division.

The substances which have been alternately employed in these operations, or the *dephlegmation* of spirit of wine, are; 1st, the two fixed alkalis; 2d, the muriate of lime; 3d, the muriate of potash; 4th, quick-lime; 5th, calcined gypsum; 6th, sulphate of soda, and latterly, acetate of potash fused and reduced to powder.

In consequence I successively distilled pure spirit of wine (from

* It would be highly useful, as is now the case with most of the acids, the sulphuric in particular (the highest degree of concentration of which it is capable being known), if the *maximum* of lightness or rectification of alcohol was also fixed in an invariable manner: but in order to avoid errors, the hygrometers ought to be graduated alike in every country.

38 to 40 degrees) with these different salts, following precisely the processes pointed out.

This alcohol, when rectified with the alkali of tartar or of soda, either caustic or partly carbonated and very dry, acquires in truth three or four degrees of lightness: after this proof, its smell becomes more subtile; but it loses its natural mellowness. It greens the aqueous tincture of the petals of the violet: in addition it abundantly precipitates the water taken from wells charged with calcareous sulphate; effects which demonstrate that spirit of wine rectified over alkalis is altered in its elements, or receives in addition some heterogeneous principle.

Pure alcohol rectified over the muriates of lime and potash slightly calcined, acquires also levity, and even more than with the alkalis, but the liquor produced by it also contracts new properties. These do not belong to good alcohol: they give it a hot, bitter, pungent taste. It is easy to demonstrate the presence of the salts employed in this rectification, either by ammonia, or by the nitrates of silver and mercury, &c.

Quick-lime coarsely pulverized and mixed with pure alcohol, creates sufficient heat to permit a portion of the fluid to distil over without employing external heat: this first product gives certain signs of alkalinity, by acting sensibly on the aqueous juice of the black plum. The residue distilled in the vapour-bath contracts more and more the pungent property, and instantaneously becomes turbid on mixing with it common water saturated with carbonic acid: it is easy by putting the liquor in a large conical glass, to perceive at the bottom after it rests two days a remarkable quantity of carbonate of lime, &c.

Pure alcohol distilled over calcined gypsum also acquires lightness, less however than with the four foregoing substances: the spirit of wine produced contracts a peculiarly disagreeable smell: besides, it renders turbid the infusion of flowers of red poppy, whereas pure alcohol heightens the colour of it: it likewise communicates a shade of dead leaves to the tincture of violets,—properties which indicate its alteration, or the presence of a foreign body in the spirituous fluid.

Glauber's salts, or sulphate of soda calcined and deprived completely of its water of crystallization, seemed an excellent intermedium for dephlegmating alcohol without acting on its elementary principles. I repeated this operation several times with success, and always obtained, by employing a part of this salt pulverized over two of liquid at 36, 37 and 38 degrees, a spirit of wine marking from 38 to 40 degrees, and which had all the properties of that prepared without any intermedium: but notwithstanding its agreeable smell, it held in solution a small quantity of the saline substance employed in its distillation, for pure barytes

barytes occasioned in it a slight precipitate. It was also easy afterwards, by means of the blue vegetable colours, to discover in it the presence of the alkali set free by the subtraction of the sulphuric acid united to the ponderous earth.

By a second rectification over the same calcined salt, we may have alcohol at 42 degrees, but vain will be the attempt to give it a higher degree of levity by other distillations: this liquor differs only from spirit of wine prepared without intermedium, in so far as it contains a slight quantity of sulphate of soda in solution.

By the calcined Acetate of Potash.

This method, which was lately suggested by an eminent chemist of Paris, succeeds beyond every other: pure alcohol distilled in the vapour-bath over this salt acquires more than 46 degrees (at the temperature of $10+0$ Reaumur); but having examined this liquor, I soon perceived that it was no longer spirit of wine: it differed from it, 1st, by having a very pungent smell, something like the tincture of salt of tartar of the shops. 2d, It had an acrid soapy and bitterish taste. 3d, It changed into green the aqueous tincture of the petals of violets, &c.

It is therefore very evident that the alcohol obtained by this process is of a great levity, but the properties peculiar to this fluid remove it from the rank of pure spirit of wine, and make it a new liquid.

From the above short detail, and the facts resulting from experiments carefully made on pure alcohol from 38 to 40 degrees, extracted from the various mucoso-saccharine substances which have undergone the spirituous fermentation, it appears demonstrated that all the six saline substances above cited, have an action more or less direct, not only on the last portions of water which adhere very strongly to the alcohol, but also upon the constituent parts of this same fluid: hence we must conclude, that all these intermedia do not exactly procure a spirit of wine dephlegmated to the *maximum*, and preserving all the physical and chemical properties which ought to render it saleable and useful.

It has also been proposed to subtract the water from alcohol at 36 degrees, by distilling it in the vapour-bath with a weak dose of sulphuric acid: for instance $\frac{1}{10}$ th of its weight. I have observed that so long as spirit of wine does not exceed 38 degrees, it preserves by this rectification the properties which characterize it; but if we add a new portion of acid to the latter, the product then acquires, with its specific lightness, a fragrant odour slightly ethereated: this already announces an alteration in the elementary principles of the spirituous fluid.

The common alum of commerce calcined, considering the great quantity of humidity which it loses during its exposure to fire,

seems also very convenient for taking up the superabundant water in the composition of alcohol: in consequence I added one part in powder to two of this liquor marking 36°. After two days, the whole was distilled in the vapour-bath, and this spirit of wine then yielded 39°. It had a very agreeable taste, but I was much surprised at the new property which it had acquired: it reddened strongly the aqueous tinctures of turnsole and flowers of violet. I then rectified a third time this last alcohol over varied proportions of calcined sulphate of alumine, and obtained constantly nothing but a liquor from 39 to 40 degrees. Hence I concluded that alum deprived of its water of crystallization does not take up the phlegm which is foreign to pure alcohol, without acting directly on its constituent principles; but a weak portion of this salt is also volatilized during the operations, and held in solution, or in a state of minute division, by the spirituous fluids; for not only does it redden the blue vegetable colours, but it is also evidently disturbed by the water of barytes; effects which indicate the presence of alum in this alcohol.

I have also rectified alcohol at 39 degrees over gray calcined muriate of soda: we know that this salt retains a great part of its weight in water of crystallization, and that a red heat long continued can remove it: it was in this state that I presented it to pure spirit of wine, hoping to give it a superior degree of purity: but after several rectifications and distillations in succession of these two substances in the vapour-bath, the alcohol remained in its primitive state, and with all the properties which characterize it; which proves that the muriate of soda, even when deprived of water, does not act in any way upon the spirituous fluid at a strong degree:—only like the sulphates of soda and of alumine, a feeble portion of this salt is volatilized by the caloric and the alcohol during the operation; for this liquor becomes sensibly whiter by the addition of some drops of nitrate of mercury and silver, an effect which does not take place when the spirit of wine is very pure. It seems very astonishing that salts equally well fixed as alum is in the fire, the sulphates and the muriates of soda, should be volatilized during the distillation of the alcohol, and by a heat so moderate: but something analogous has been already noticed in No. 163 of the *Annales de Chimie*. Messrs. Dabit and Ducommun of Nantz found muriate of ammonia, carbonate and sulphate of lime, in the distilled water proceeding from a reservoir which had previously contained animal substances. Kirwan and Lavoisier also say that the nitrate of potash is volatilized with boiling water. I can also say that I collected very often the vapours which emanate during the preparation of the alkaline salts, or of tartar emetic, kermes mineral, sulphate of iron, acetate of lead prepared on a very large scale,

scale, and I found it always easy to discover traces of saline metallic substances which form the base of it; which explains in some measure the volatilization of salts which has been mentioned, and their solution or mixture in a state of minute division with alcohol after the distillation of these substances.

Reflecting on the hygrometrical properties of charcoal, and on the aptitude of pure alumine and common clay for water which it retains in abundance and even at a high degree of heat, and considering also the inertness of these substances towards alcohol, I employed them successively in the dephlegmation of spirit of wine: consequently I made various experiments, the chief of which only I shall detail here.

1st. By Charcoal.

In one litre of alcohol at 36° *mean temperature*, I put four ounces 128 grammes of burnt birch wood while yet warm, shaking the whole frequently to facilitate the immersion and imbibition of the charcoal: in four days I filtered, and the alcohol still marked 36 degrees. A similar operation took place with very pure alcohol marking 36 degrees: after several days maceration over charcoal this spirit of wine had also preserved its primitive state. These effects tend to establish that charcoal absorbs both the alcohol, and the water which it contains in superabundance.

The mixtures of charcoal and of spirituous liquor were afterwards distilled to dryness in the water-bath: the alcohol, which marked originally 36 degrees, rose one degree by this operation, but the latter remained as it was. I repeated these experiments, 1st, upon animal charcoal; 2d, upon the charcoal of various woods; but I only obtained alcohol at 39 or 40 degrees even when operating on very considerable masses, and by dividing the products into fractions in order to establish *areometrical* points of contact; which proves that charcoals have not more affinity for pure water than for alcohol merely (and this has been already remarked). Alcohol, from whatever substance produced, acquires by its rectification on charcoal, a sweeter smell and a more agreeable taste than that which is obtained in the common manner or without intermedium.

By pure Alumine and common Clay.

Into one litre of alcohol at 39 degrees I put eight ounces of pure well dried alumine: after two days immersion, and always at the same temperature, I decanted with precaution a sufficient quantity of spirit of wine, and observed that it yielded 40 degrees. Afterwards I distilled in the vapour-bath to dryness. The fluid which came over had a pungent very disagreeable smell,

and marked 41 degrees : I heated the alumine strongly in order to deprive it of about 32 grammes of moisture which it had imbibed from the alcohol, and redistilled the latter over this earth. The liquor acquired upon a second rectification a new degree of lightness, to the point of marking 42 degrees of strength *mean temperature*.

This alcohol constantly retains all the properties which characterize good spirit of wine: the smell, taste, and far less the reagents, do not discover the presence of any foreign body: its specific gravity as to that of water is nearly : 8.292 : 10.000.

We may also obtain alcohol in its highest degree of rectification, by employing, instead of pure alumine, common potters' clay well washed, then passed through a sieve, and finally well dried before using it; but the attempt is vain in this way to give a greater degree of lightness to alcohol, as I was convinced after successive distillations and rectifications. I conclude therefore that this earthy substance has no action upon the elements of alcohol, and that it only deprives it of the water which is superabundant to its spirituous essence. In consequence of this, and as we are ignorant if this intermedium has already been employed in any similar case, we suggest this new method to chemists and distillers with confidence, and from our experiments we are of opinion that this liquor the most highly rectified, and not at all altered in its constituent principles, ought always to mark 42 degrees in Baumé's areometer *mean temperature*. We may add that alcohols of a higher degree distilled over saline intermedia are more or less altered in their constituent principles, that nevertheless the practice may be advantageous in the preparation of varnishes for the perfumer and watchmaker, and for coating metal work. But these liquors can never be called good *potable* alcohol.

We are also of opinion that alcohol rectified over saline and alkaline substances, even reduced to a proper degree, cannot be employed in the composition of medicines, because every thing inclines us to believe that it thereby acquires new properties which might deceive the medical attendant who prescribed it.

We shall conclude our present paper with some general observations upon alcohol, or ardent spirit, produced by the fermentation of every kind of mucoso-saccharine substance.

Since the fine experiments of Lavoisier, and of several chemists, we know that the inflammable liquid known by the name of spirit of wine is composed of carbon, oxygen, hydrogen, and a little azote according to M. de Saussure. Setting out from these data, we may conclude generally that all alcohols, from whatever substance produced, ought to be perfectly identical and homogeneous in their elementary principles; because, since they
are

are composed of the same radicals, the proportions of which are known, they ought to have the same properties, the same taste, and act in the same way with the reagents, being well purified, and having attained their highest degree of rectification.

This alcoholic identity may exist within the range of *physico-chemical possibilities*: but I candidly own that I was never thoroughly convinced of it; for notwithstanding numerous experiments for twenty-five years past on the alcoholic fluids produced by wine, cyder, rum, cherry brandy, fermented grain, &c. I constantly remarked that all these liquids, when distilled and rectified several times even in the vapour-bath without mixture, or the intermedium of charcoal as recommended by Lowitz, and brought to their highest degree of *spirituosity*, still exposed their origin, and that it was always easy to say which alcohol came from wine, cider, perry, rum, &c.

The odour which issues from the various kinds of alcohol when rubbed on the hands, the organ of taste, in diluting these fluids in a sufficient quantity of warm water, and their mixture with a little sulphuric acid, are the most simple as well as the most certain methods for instantly unmasking the peculiar *aroma* of each kind, and the substance from which it has been produced.

There exists a term, however, at which all these alcohols cease to be cognizable; but they are then *denaturalized*, if we may so express ourselves, and this happens in their *etherification*.

In fact, the extremely volatile odorous and expansive fluid, long known by the name of ether of *Frobenius*, which chemists prepare by distilling equal parts of alcohol at 36 or 37 degrees and concentrated sulphuric acid, may be made with every kind of spirituous liquor; and when the product which results from it is well rectified, and marks from 36 to 60 degrees in Baumé's areometer, then I do not hesitate to assert that it is impossible to ascertain to what kind of alcohol ether thus prepared belongs. It would seem that at the moment of the affusion of the acid over the spirituous fluid, the aroma which characterizes it is vaporized or destroyed by the *dissociation* or alteration undergone by the elements which compose it*.

I may add that the various alcohols at an equal degree of verification do not always produce one and the same quantity of

* By the effect of the reaction of the concentrated acid on alcohols, and by the aroma which emanates from it, we may always distinguish the kind of ardent spirit employed in this operation: but as soon as the mixture is half cooled, then the liquors which result from it are perfectly identical, as to their smell alone; but their colour is more or less intense: this seems to depend on the different proportions of the oleaginous aromatic principle which characterizes each kind of alcohol, and which is acted upon by the acid.

ether. I have met with alcohol which produced 1 l-16th more than any other. Does this arise from the heterogeneous principles which they contain more or less, or from the varied proportions of elementary substances of which they are composed, or lastly from a still stronger portion of aroma?

Without attempting to account for these varieties at present, I shall merely say that the alcohols which seem to give most ether are: 1st, that produced from perry; 2d, wine; 3d, cider. The spirits denominated cherry brandy, rum, geneva, and whisky, are far inferior to those just enumerated in respect of the quantity of ether which they yield.

LIX. *Description of a Hydro-pneumatic Blow-pipe for the Use of Chemists, Enamellers, Assayers, and Glass-blowers.* By Mr. JOHN TILLEY, of Whitechapel*.

SIR,—**B**EING a travelling fancy glass-blower, I work with a machine which I have contrived for my own use, and which I have been advised, by a great number of respectable gentlemen, to lay before the Society of Arts, &c. The invention consists of a tin-box, with a partition in it reaching from the top at one end to within an inch of the bottom. The vessel is air-tight at this end. It is three parts filled with water. By means of a tube reaching within half an inch of the bottom, I blow into the water at the air-tight end; the air rises in bubbles through the water to the top, and forces the water under the partition into the other compartment. The weight of the water acts upon the air which had been blown in, and forces it through a blow-pipe directed to the lamp, and keeps up a continued blast till the air is exhausted. More air may be blown in from time to time, so as to keep the blast regular and continual. It is thus I execute my fancy glass-blowing. The whole apparatus, including lamp and case, weighs only three pounds and a half.

I believe I am the first glass-blower who ever worked with such a machine.

If the Society should think me deserving of any reward, it will be very thankfully received by,

Your obedient humble servant,

JOHN TILLEY.

Direct for me at Mr. Thomas Yandall's, bookseller, Old Street Road, near Shoreditch Church.

* From *Transactions of the Society for the Encouragement of Arts, &c.* for 1813—Fifteen guineas were voted by the Society for this communication, and one of the machines is preserved for public inspection in the Society's Repository.