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Edmund Davy Esq.

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XLVI. *An Account of some Experiments on the Action of Iodine on volatile and fixed Oils, &c.* By EDMUND DAVY, Esq. Professor of Chemistry and Secretary to the Royal Cork Institution.

To Dr. Tilloch.

DEAR SIR,—I BEG to send you for insertion in your very useful Journal, an Account of some Experiments I have made on the Action of Iodine on volatile and fixed Oils, &c. With sincere good wishes for your health and happiness,

I remain, dear Sir,

With great respect, yours very truly,

EDMUND DAVY.

Being lately engaged in making some experiments with iodine, I was led to try its action on different volatile and fixed oils, &c. The results I obtained are, I presume, novel; and a brief account of them will make some addition to our present knowledge of the agencies of this singular substance.

Action of Iodine on Oil of Turpentine.

When a small portion of iodine is brought in contact with a few drops of turpentine, a violent action takes place, considerable heat is generated, and part of the iodine rises in vapour. In one instance, when I put less than a grain of iodine into a small curved tube, and poured a little turpentine on it, the heat produced was very sensible to the hand. In another case, when I added about ten drops of turpentine to about a grain and half of iodine, in a small phial, the action was very violent; a portion of the turpentine appeared to be decomposed, it became tenacious, adhered to the glass, and was of a dark olive-brown colour. Turpentine is a very good solvent of iodine, and dissolves a considerable quantity of it with much greater facility than alcohol does. When iodine is put into turpentine, a hissing noise is produced, the iodine quickly dissolves, and forms a solution of a reddish yellow colour, which, when very concentrated, is dark yellowish-brown. This solution is not affected by water, or by the mineral acids when diluted, or by the greater number of metallic salts. The nitrates of silver and mercury, however, decompose it, and the iodides of silver and mercury are formed. By dissolving iodine, turpentine, to a certain extent, loses its characteristic odour and volatility; the solution, when weak, does not affect vegetable colours, or tarnish polished silver; but when strong, it gives a reddish-brown tint to litmus, and a dull yellow to silver and tin. It stains linen yellow, and gives to starch a slight yellowish tint. Rectified sulphuric ether and alcohol combine

combine with the solution of iodine in turpentine, and form homogeneous fluids. Phosphorus soon destroys the colour of the solution of iodine in turpentine, the fluid acquires the odour of phosphorus, and reddens litmus paper; probably in this case the hydroiodic acid is formed. Alkalies also readily change the colour of solution of iodine in turpentine, and form yellowish saponaceous substances. When heat is applied to the solution of iodine in turpentine, a portion of the oil distills over unaltered; but as the solution becomes more concentrated, a dense yellowish-brown oil rises, which holds the iodine in solution.

The affinity of turpentine for iodine is much greater than that of water; hence turpentine readily separates iodine from its solution in water. This effect is immediately produced by merely agitating an aqueous solution of iodine in contact with turpentine; the water becomes colourless, and the turpentine assumes a reddish colour. In this way, an aqueous solution of iodine made above twelve months since, was immediately decomposed by turpentine. A piece of cork, also, after being acted upon by iodine for several months, so as to become soft and of a dark-brown colour, yielded in water a solution of iodine of a brownish yellow colour, which by agitation with turpentine became colourless, and at the same time the oil acquired a fine red colour. Turpentine, also, separates iodine from its aqueous solution, in cases when the mineral acids and a number of metallic salts are present; as the sulphuric, nitric and muriatic acids, the sulphate of zinc, muriate of platinum, nitrate of nickel, &c.

The property of separating iodine from its solution in water, ether possesses in common with turpentine. When chlorine is passed through a solution of iodine in turpentine, the colour of the solution gradually disappears. The iode of chlorine acts strongly on turpentine, and readily dissolves in it. I put about half a grain of iodine into a platinum spoon, and introduced it into a bottle of chlorine; the iodine melted, and readily formed the yellow iode of chlorine. I then poured a little turpentine into the spoon, when a violent action took place; the iode was partially decomposed, and a portion of its iodine rose in vapour; the remainder of the iode dissolved easily in turpentine, and formed a solution of a red colour, which, on being exposed to the action of the solar rays for a short time, became colourless, but did not affect litmus paper. I witnessed an interesting result on submitting the red solution of the iode of chlorine in turpentine to the action of chlorine. A platinum spoon being filled with this solution, was put into a bottle of chlorine; it presently began to boil, its colour disappeared, and the fluid burst into flame; a black carbonaceous matter, arising from the decomposition of the turpentine, deposited itself on the sides of the bottle. Being

desirous of ascertaining how far the iodine in the compound was connected with those effects, I filled the spoon with turpentine and put it into a fresh bottle of chlorine, when ebullition immediately took place, and was succeeded by the inflammation and decomposition of the oil.

2. *Action of Iodine on other volatile and fixed Oils, &c.*

The effects of iodine on oil of lavender are similar to those already noticed respecting turpentine. When iodine is brought in contact with the oil of lavender, a strong action takes place, heat is evolved, and a dark reddish-yellow solution is formed. Analogous results are afforded with iodine and the oils of caraway, peppermint, and origanum; but the action of iodine on these oils is more feeble than on those of turpentine and lavender, and it is stronger on the oil of caraway, than on the oils of peppermint and origanum. Oil of amber acts very feebly on iodine, and a solution of a reddish-yellow colour is slowly formed. Iodine is soluble in naphtha, and to a certain extent in olive oil and oil of ivy.

Fixed vegetable oils and animal oils have very little action on iodine. When put into rape oil, iodine does not dissolve; it becomes brown by a gentle heat, and acts slightly on the oil. The effects of hemp, linseed, olive, and castor oils, are very similar to those of rape oil. Those oils in general separate iodine from its solution in water, but the action of iodine upon them, and also upon spermaceti and pilchard oils, is very slight.

Iodine readily combines with camphor by a gentle heat, and a dark-brown soft solid compound is formed, which is deliquescent, soluble in water, but more soluble in alcohol or turpentine. When turpentine is added to the aqueous solution of iodine and camphor, it separates the compound and leaves the water colourless. On adding alcohol, the camphor is separated, whilst the iodine remains dissolved in the turpentine.

Resin unites with iodine by a gentle heat, and a dark brown compound is formed, which is soluble in alcohol. Turpentine separates the iodine, and water the resin.

3. *Observations, &c.*

From the foregoing experiments, &c. it seems that iodine exerts a strong action on volatile oils, and especially upon turpentine and lavender; but on fixed oils its effects are much less considerable. In general, both the volatile and fixed oils separate iodine from its solution in water. The action of iodine on volatile and fixed oils resembles that of chlorine on these bodies, a circumstance which serves to extend the analogies which Sir Humphry Davy has traced between iodine and chlorine in their

their chemical agencies *. As oil of turpentine separates iodine from its solution in water, and in cases when acids and a number of metallic salts are present, it may, in many instances, afford a useful test to detect the presence of iodine, or be employed as a means of separating it in a fluid form from other substances with which it may exist in solution. The nitrates of silver and mercury seem to offer the best means of detecting and separating iodine from its solution in turpentine; the iode of silver is of a paler and duller yellow colour than that of mercury. Polished silver, which Sir H. Davy found to be one of the best tests of the presence of iodine in compounds dissolved in water †, does not furnish satisfactory indications of its presence in turpentine, especially when it exists only in minute quantity. Except in cases when the fixed alkalies and ammonia are present in excess, starch seems in general to be a very delicate and unexceptionable test of the presence of iodine; but when added to a solution of iodine in turpentine, it merely acquires a yellow tint. The addition of starch to a solution of iodine in water, alcohol, &c. occasions, as is well known, the immediate formation of the purple compound of starch and iodine. But if starch in its common state of dryness be pulverized and mixed with iodine in small proportion, a very peculiar effect will take place, which I have not seen any where noticed. The mixture, at first, is of a grayish colour; but in a little time it acquires a faint purple tint, which gradually becomes deeper and deeper, till it appears almost black. These changes are probably connected with the absorption of moisture from the atmosphere; for if water be added to the above mixture, the purple compound will be directly produced. The agency of water or moisture seems to be necessary to the formation of the purple compound of iodine and starch, as may, I think, be deduced from the following experiments: I put some iodine into a small tube, and nearly filled it with starch in powder, which had been well dried: no apparent effect took place; the tube was gently heated so as to raise the iodine in vapour, and the starch was agitated. The same process was again repeated, but the starch merely assumed a light-brown colour. On exposing it to the atmosphere it slowly acquired a purple tint, and when moistened with water, or placed on wet paper, it immediately became of a bright purple colour.

Royal Cork Institution, March 11, 1822.

* Phil. Trans. 1814.

† Ibid.