

Chemical Examination of the Petroleum of Rangoon. By ROBERT CHRISTISON, M. D. F. R. S. E. Professor of Materia Medica in the University of Edinburgh, &c.

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AT the close of the preceding session, the Council of the Society did me the honour of entrusting me with the chemical examination of several articles sent not long ago to the Society by Mr SWINTON, Secretary to Government at Calcutta. The articles in question are, 1. Specimens of the *black varnish* used in different parts of Hindostan and the Burmese territories, with specimens of the juices of which these varnishes are said to be compounded ; 2. Specimens of *naphtha* from Persia, and of *petroleum* from Rangoon ; 3. Specimens of *wood-oil*, a variety of fluid turpentine ; 4. Specimens of crude caoutchouc, and of solutions of it in wood-oil.

The only one of these articles which has hitherto yielded results of such interest as to induce me to lay them before the Society, is the petroleum of Rangoon, which appears to contain a compound inflammable principle hitherto unknown.

The petroleum of Rangoon, termed by Mr SWINTON Earth-oil, and more generally in the East, Ground-oil, is probably the same with what may be procured in various parts of our eastern dominions, by merely digging a few feet into the soil. In the vicinity of Rangoon it may be obtained in immense quantity for the mere trouble of digging it. It is used in Hindostan as pitch for all manner of wood-work ; and is likewise a favourite external remedy for rheumatism, being employed for that purpose in the way of friction.

I am not aware that either this, or any of the European petroleums, has been subjected to careful analysis; and I should suppose no such analysis has been made, because no chemist, even with a careless examination, could have failed to observe that it contains a peculiar principle, the discovery of which would have given the analysis publicity.

The petroleum of Rangoon, at ordinary temperatures in this country, is a soft solid, of the consistence of lard. Its specific gravity, at the temperature of 60° Fahr. is 880, water being 1000. At the temperature of 86°, it is of the consistence of thin paste, and at 90° it melts completely, and forms a sluggish liquid, which acquires more fluidity as the temperature rises. Hence in the East, during the hot season, when it is dug for, it must be in the fluid state, and consequently entitled to its vulgar name ground-oil. It has a powerful naphthous odour, different from that of most other petroleums.

It is impossible to analyze this petroleum by means of the ordinary chemical solvents. Most of these solvents, such as the acids and alkalies, have little or no action on it; while alcohol, which acts feebly, and ether and the volatile oils, which act energetically, dissolve all its principles indiscriminately. The only practicable method of analysis, therefore, is the process by distillation.

When six ounces of petroleum were distilled, there was first procured, at a low heat, an ounce of nearly colourless naphtha; then another ounce of straw-yellow naphtha; then, at a higher heat, about another ounce, much more yellow, yet still fluid at 60° Fahr.; next, a considerable quantity of a yellowish liquid, which concreted at 60° into a loose mass, composed of numerous crystalline needles and plates, in a yellow naphthous fluid; and, as the distillation went on, this matter became more and more solid, but even towards the end was not firmer in consistence than lard. The residual matter in the retort, when the heat had been raised to full redness, was a spongy charcoal.

The naphtha, when rectified by a second distillation over a

lamp, and then by a third distillation from the vapour-bath, is limpid and colourless, like sulphuric ether, and its density is 779. From the trials I have made, I consider that the Rangoon petroleum, when distilled on the large scale, will yield nearly a third of its volume of this colourless naphtha.

I need scarcely observe, that, in eastern countries, where the fresh juice of the caoutchouc tree cannot be procured, the naphtha from the Rangoon petroleum may prove a useful article. Like other kinds of naphtha it freely dissolves, or rather softens, caoutchouc; which, after the evaporation of the solvent, is recovered with its original properties. When it is to be used for this purpose, however, it must be carefully separated by distillation from the crystalline matter I am presently to describe, which rises as the distillation advances, and gives the naphtha a yellow colour. For, if any material proportion of this impurity be present, the caoutchouc solution dries very slowly, and long retains a greasy surface.

The yellowish, concrete, crystalline matter, like the petroleum itself, is not acted on by the caustic alkalies, or by the strong acids. Alcohol dissolves it very sparingly; ether and the essential oils, freely and entirely. None of these solvents, therefore, is of any use for separating the crystalline matter from the mass. But I have succeeded in procuring it in a state of purity by the following process:

The mass being cooled down to about 40° Fahr. it was spread out on filtering paper, and then subjected to strong pressure between many folds of common blotting paper. In this manner, an oily-like matter was taken up by the paper, and a pale yellowish-white crystalline substance was left, which was subsequently deprived of its remaining colour by repeated solution in boiling ether and recrystallization. Ether dissolved it largely, forming a pale yellow solution, which, on being cooled by immersing the vessel in very cold water, became a soft mass of interwoven crystals. This mass was then taken out, spread quickly on filtering

paper, and immediately subjected to strong pressure between folds of blotting paper. The yellow colouring matter, which all remained in solution in the ether after it cooled, was thus, in a great measure, imbibed by the paper; and the crystalline matter was procured in a state of purity by repeating this process twice.

On first procuring this crystalline substance, I considered it as the same with the naphthaline procured not long ago from coal-tar by Mr KIDD, as related in his paper in the Philosophical Transactions for 1821. This opinion I was led to form from the appearance of the crystals, the nature of the substance which yields them, and the process of distillation by which they were procured.

On a careful examination, however, I find that the crystalline principle of petroleum differs materially from that of coal-tar, as well as from every other known body; and I shall therefore beg leave to denominate it *Petroline*, according to the analogy suggested by the name of Mr KIDD's crystalline principle.

As procured by the process described above, petroline forms foliaceous masses of small crystals of snowy whiteness, and bright pearly lustre. It is somewhat unctuous, and has a naphthous odour, which becomes very faint on exposure for some time to the air, and is removed altogether by boiling in alcohol. It fuses at 135° into a transparent, limpid, colourless fluid; but softens ten degrees lower. From a state of fusion it concretes on cooling into a translucent brittle mass, like wax, the density of which is 909 at 60° Fahr. At a temperature intermediate between the boiling point of water and a low red heat, the fluid boils, and distillation takes place. The greater part of the petroline condenses in the form of a fluid, which becomes on cooling a translucent waxy mass, with its original properties. But owing to the elevated temperature required for its distillation, a part is decomposed, a little charcoal is left behind, and a small quantity of inflammable gas passes over with the undecomposed sub-

limate. When heated in the open air, it catches fire, and burns with a dense white flame and much black smoke.

Petroline is insoluble in water, cold or boiling. Boiling alcohol takes up a small quantity, not more than a 450th of its weight, and on cooling deposits the greater part in minute shining crystals. Boiling ether, its proper solvent, easily takes up a fifth of its weight, which on cooling is in a great measure separated in a congeries of micaceous crystals, so abundant as apparently to convert the ether into a solid mass. Oil of turpentine also dissolves it in large quantity, and so does naphtha.

Caustic potass and caustic ammonia in solution have no visible effect on this substance. When boiled with it, it simply fuses, rises to the surface, and is there found, on cooling, with its usual properties. Concentrated muriatic, nitric, and sulphuric acids are equally without action, even when aided by the heat necessary to boil each. It simply melts and rises to the surface, and, except that it becomes slightly yellow with nitric, and slightly brown with sulphuric acid, no change of property is perceptible. It has no action with acetic or oxalic acid.

With iodine aided by a gentle heat, it quickly unites, forming a violet-coloured fluid, which on cooling becomes a dirty greenish-brown solid, very soluble, like each of its elements, in sulphuric ether.

I have not made any inquiry into the other chemical relations of petroline, my object at present being merely to establish its claims to be considered a new principle, distinct from any other hitherto known. In its properties it resembles naphthaline more than any other substance; but at the same time it differs from that body in very many respects. Naphthaline volatilizes at common atmospherical temperatures; does not fuse under 180° Fahr.; and, when heated a little above 400°, boils and sublimes in fine micaceous crystals. It is heavier than water. It forms a rose-coloured solution with acetic or oxalic acid; and with sulphuric acid it unites to form a peculiar acid, termed the Sulpho-

naphtalic, which, like other acids, neutralizes bases and forms salts with them. A single glance will satisfy every one how completely this account of the properties of naphtaline differs from the description given above of the properties of petroline.

It remains for me to determine its elementary composition. This I have not hitherto found leisure to accomplish ; but I am engaged in the requisite experiments at the present moment, and will soon make them known to the Society. The experiments hitherto made merely enable me to say, that it contains a very large proportion of carbon.

APPENDIX.—*December* 1834.

A few months after the preceding paper was read before the Royal Society, the author observed in *BUCHNER'S* Repertorium, an account of the discovery, in 1830, by *Dr REICHENBACH*, of a new crystalline principle in tar, to which that chemist gave the name of Paraffine. As the properties of paraffine seemed from that account to be obviously identical with those of the Petroline of the Rangoon petroleum, and as *Dr REICHENBACH* had ascertained its properties and composition fully, any farther investigation of the crystalline matter of petroleum appeared unnecessary. The original paper is now published, partly because allusions have been made to it in chemical works, and partly to serve as an introduction to the ulterior inquiry of *Dr GREGORY* on the same subject.

The author, soon after laying this paper before the Royal Society, examined by the same process the petroleum of St Catherine's near Edinburgh, of Rochdale in Derbyshire, and of the island of Trinidad ; but was unable to detect a similar crystalline principle in any of them.