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Petroleum

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PETROLEUM.

Petroleum, one of the best known and most widely distributed products of nature, has never had its origin traced to a certain and generally accepted source, since hardly any two scientists can ~~exactly~~ agree concerning it.

There are, however, several theories which are deserving of mention. One maintains that petroleum is formed in some way in connection with coal by the decomposition of vegetable matter taking place under pressure. A later theory is that this oil was produced by the decomposition of vast multitudes of fish and other marine animals, which once inhabited the great inland seas that formerly covered the places where are now petroleum deposits. But last and perhaps most novel is the explanation offered by the fact that certain volcanic gases in their action on limestone are able to produce methane and ethylene together with their homologues.

That the first theory may be true is clearly shown in many instances, but perhaps the best example is that afforded by the Dawley and Dingle mines in Shropshire,

England, where the liquid petroleum oozes out from the coal strata and drops on the miners below, who are o-liged to protect themselves from the oil by a covering of boards.

The theory of an animal origin rests on many strong arguments supported by numerous geological facts. But the possibility of this being a sufficient source might be seriously questioned since in 1880, 2,600,000,000 gallons were drawn and the supply was in no way diminished. Such a vast amount of animal life as would have been necessary to produce the now existing supply can hardly be imagined.

The last and most interesting theory from a chemical standpoint, is that natural gas and petroleum may have been formed by volcanic action. This hypothesis, as yet not widely maintained, is clearly shown by many facts to be tenable. It may first be observed that in case of an oil deposit there is a corresponding deposit of limestone, calcium carbonate, and gypsum, calcium sulphate. These are of almost unlimited extent, and as may easily be seen, must have come in contact with heated volcanic gases at some time in their history. Now

since we can conceive of no condition at present which could not have been possible then, and as we are able to prove by actual synthesis through chemical processes and to show by clearly defined chemical equations this formation of petroleum from the combined action of volcanic gases on limestone, there can be no question either from lack of material or possibility of formation that this may be the source of natural gas as well as of petroleum. As an illustration of the extent of petroleum deposits, it may be mentioned that since 1860 the oil wells of the United States have yielded 17,000 million gallons, equal to over 100,000,000 cu. yds. or a cavern 100 yds. wide, 20 ft. deep, and 82 miles long. An immense amount of material must therefore have been used, and it is difficult to imagine how so great a quantity could have been stored within the limits of the area of deposit in the United States.

But more important than these speculations is a consideration of the petroleum industry. Within the United States are two principal oil regions; one in New

York and Pennsylvania, the other in West Virginia. The former yields the lighter and illuminating oils, the latter furnishes most of the lubricating compounds. In practice the crude oil from the different wells is collected in pipe systems, among which the Standard Oil Company's is chief, and conveyed to the refineries for purification. The process varies somewhat for the different kinds of oil; yet since there is usually indiscriminate mixing of the crude oil in the pipes, the same general method is pursued. The crude oil with its impurities is pumped into large stills, where it is roughly fractionated. The first portions coming over below the boiling point of water constitute the petroleum ethers, which may be further divided into cymogene B. P. 0° C. and Rhigolene, B. P. 18° C. These compounds are of little importance, though they are sometimes used in surgery as a local anaesthetic. After these come the gasolene, naptha, and benzine distillates with boiling points varying from 70° to 150° C. Then follows at from 150° to 180° the illuminating oils, the most important and larger fraction. At a higher temperature come the lubricating oils, vaselines, and several grades of paraffine. The distillates

thus roughly obtained are further purified by agitating with dilute sulphuric acid, which, breaking up the aromatic compounds and the phenols, forms with them sulphonic acids. The fatty acids together with all other acids and tarry products are broken down and decomposed. The sulphuric acid is then drawn off and the oil carefully washed by agitating with a strong soda lye, which makes soluble salts with the sulphonic acids and phenols and neutralizes the remaining sulphuric acid. Then follows another treatment with dilute acid and a final washing with water, which effectually removes all impurities. If necessary, the fractions are again distilled and in the case of illuminating oils are exposed, in shallow pans, to the sunlight in the open air for some days, when the more volatile portions which may remain are spontaneously evaporated, making the so-called sunned oils.

In chemical composition petroleum is not a definite compound but a mixture of hydro carbons of varying composition. The American oils are largely composed of the homologues of methane $C\ H_4$, while German and Russian oils are for the most part homologues of ethylene $C_2\ H_4$.

The following impurities and additional compounds are

found in nearly all crude oils; sulphretted hydrogen, carbon bisulphide, arsenic, phosphorous, copper, calcium iron, and aluminium. Besides the hydrocarbons already mentioned benzene, C_6H_6, occurs in nearly all crude petroleum; while of its different homologues xylene, toluene, cumene, pseudocumene, and mesitylene, an isomer of cumene, have been isolated. Hydrocarbons isomotric with the ethylene group, called napthenes, are found in nearly all foreign oils especially in the Russian. A small quantity of oxygen is almost always present; but whether in acids, phenylated compounds, or acid lacto-alcohols, is a subject of some dispute, though the oxygen probably occurs in the form of phenols or simple carboxylic acids. The residues from petroleum distillates have received considerable attention of late and several new products have been obtained. Viridine, afterwards called thallene, a substance isometric with anthracene but wholly unlike it in physical properties, was discovered by distilling the residues at a red heat. Anthracene has also been prepared but not in sufficient quantities to encourage its manufacture from this source. Many other compounds chiefly interesting

for their chemical nature have in this way been discovered.

At present the petroleum industry is confined to the production of illuminating oils, lubricating compounds, and paraffine; yet the field is by no means exhausted, as new discoveries repeatedly show. That there is a large opportunity for original work, is clearly indicated by the numerous uses to which the petroleum compounds are beginning to be put. The mechanic arts have been greatly benefited in many ways by the introduction of petroleum products. In the crude form petroleum may be used as a fuel at a moderate cost, and is especially valuable where wood or coal is not admissible; while naptha and gasolene are used directly for power in engines constructed for the purpose, where only a small power is required and limited space is available. They are much used to furnish power for pumping engines in houses, on farms, or in places where steam and a boiler are objectionable, or forbidden by license or insurance. In medicine many petroleum compounds have been adopted and successfully prescribed. In its action on the animal economy, petroleum is not generally considered a

poison, yet it does have a decided narcotic effect when taken into the system in any considerable quantity, and that death has resulted from its use, is recorded in several instances.

From the variety of its products and their wide application as well as from its cheapness, the importance of petroleum is at once apparent. It is in fact one of the most valuable gifts of Nature.

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