

Oil gas produced by the process, using regular pressures, might also be used for carbureting water gas. Under conditions as in 1915 it will probably be cheaper for the operators of a coke-oven gas plant to extract all the crude benzene possible from the gases, rather than to attempt to leave a considerable percentage in the gas for the purpose of making it more marketable.

RECOVERY OF CRACKED OIL.

The percentage of recovered oil is dependent on the temperatures and pressures under which operations are conducted. The data obtained with the larger tubes are in no wise different from those obtained in the laboratory experiments except in such degree as is explainable by reason of inadequate condensation.

Although the average quantity of oil recovered in the benzene-toluene process ranged between 25 and 35 per cent, it will be found that with efficient condensation 35 per cent or more may be consistently obtained. In fact, with oils having a specific gravity of 0.90 and 0.91, such as those being recovered at the development plant in December, 1915, the percentage of recovery runs consistently between 40 and 50 per cent.

RESIDUUM OF RECOVERED OIL AFTER REMOVING LOW-BOILING FRACTIONS.

Up to the time of writing no opportunity has been afforded for the detailed study of that part of the recovered oil which distills above 175° C. It is known that this residuum carried up to 2½ per cent of naphthalene, on the basis of original oil, also undetermined percentages of diphenyl and anthracene. The proportion of the higher aromatic compounds could be increased, so far as percentage formation on the basis of original oil is concerned, by running the residuum through the tubes again or by operating at higher temperatures and pressures.

At times the general character of the products obtained from the tubes has varied widely. Several tubes at times have produced an oil of a bright emerald color, whereas oil of dark or reddish color was usually obtained. Just what conditions or constituents imparted this green color to the recovered product has not been determined.

The residuum contains a considerable percentage of valuable lubricating oils; in fact, in the early stages of operations the recovered oil distilling above 175° C. was used by the workmen for lubricating purposes and found to give excellent results. The percentage of refined lubricating oils obtainable and the general character and value of such oils remain to be determined.

It is hoped that the Bureau of Mines will be able to take up a systematic and extended study of the products formed in the proc-

ess. From the experimental evidence there is no doubt but that many valuable and important facts concerning the nature of the recovered oil remain to be determined, and some of them may have an important industrial bearing.

COST DATA.

It is difficult to give cost data for a unit plant for either the gasoline or benzene-toluene process. Although several plants are being projected for 1916, only one plant has been constructed during the period for which data have been given. This installation is the one owned and operated by the Aetna company. The conditions under which this plant was erected were such as to make the costs unusually high. Consequently it would not be fair either to the company or to the process to quote such figures. Also their quotation is inadvisable because of the fact that it is recommended that the installation be changed in a number of particulars in any projected plant. These changes have been pointed out in connection with the discussion of various parts of the mechanical equipment.

The cost of a plant on a unit basis will depend largely on the size of the installation. Practically the same amount of piping, etc., will be required for a four-tube unit as would be needed for a plant twice the size. The cost per tube of the necessary plant accessories decreases with the number of tubes installed. A 200-barrel tank, for example, does not cost much more than a tank of half that capacity.

The erection of the furnaces constitutes only a part of the expense to be incurred. The tanks for the storage of raw and finished products, a still, agitators, and other equipment for a complete plant will constitute a much greater part of the expense. Costs of this character will be largely obviated if either or both processes are operated in connection with a petroleum refinery where such equipment is already available.

The cost of a gasoline plant will be considerably less than that of a benzene-toluene plant, as little or no carbon is formed and elaborate equipment for the removal and reception of this substance is not required; also a gas scrubber and a gas holder would not be needed, as the volume of fixed gases generated in making gasoline is small.

If the oil is preheated prior to being introduced into the tube, less heat will be required to bring the oil up to the desired cracking temperature. The amount of gas consumed will be less, and the size and cost of the furnace can be reduced accordingly. These are important considerations in estimating the amount of money needed for the erection of the plant. The furnaces necessarily will cost more if the oil is fed in cold.