FIXED CARBON DEPENDS ON CRUDE

CHICAGO EXPERT SAYS THAT HIGH FIXED CARBON IN REFINED ASPHALT IS NOT AN INDICATION OF CRACKED OIL IF CRUDE ALSO HAS HIGH FIXED CARBON

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(NOTE.—*Mr. Law, in our issue of November 20th, and Col. Howard, issue November 27th, favored the elimination of the Fixed Carbon Test. Mr. Pullar advanced an original suggestion in our issue of November 13th—that the Fixed Carbon Test be retained in specifications but that all asphalts be classified according to their sources and a different maximum limit be imposed for each class. In the following article Mr. Kirschbraun agrees with Mr. Pullar that the test has certain usefulness, and urges consideration of the liquid crude when imposing a maximum limit for fixed carbon in the refined product. He gives a formula establishing the permissible fixed carbon in any asphalt refined from crude of known fixed carbon, but it is of the empirical class of formulae against which Mr. Law presented strong arguments in his article. This shows the difference of opinion among engineers and chemists on this test.* THE CANADIAN ENGINEER *would like to hear from municipal highway or consulting engineers or road contractors who may have definite opinions regarding the Fixed Carbon Test.*—EDITOR.)

SINCE Mexican asphalt has come upon the market, there has arisen considerable comment upon the value of fixed carbon tests. Mexican asphalt has generally shown a high fixed carbon figure, and in many cases it fails to meet specification requirements where the usual maximum is given. On this account, rather than upon the merits of the matter, various producers have advised the elimination of this requirement in specifications. While the arguments presented in this direction are rather of a commercial origin, there is no question but that there should at least be a revision of this clause if retained in asphalt specifications.

In the following discussion the writer shows that the fixed carbon figure in asphalts produced from liquid crude is dependent, among other conditions, upon the nature of the crude from which such asphalt is obtained. It will be observed that the hydrocarbons yielding fixed carbon are, in the course of distillation, retained in the asphaltic product. This product will then have a normal fixed carbon figure represented by the quotient of the fixed carbon in the crude, divided by the percentage yield of asphalt. This applies under theoretically ideal refining conditions.

For example, if we have a crude showing 8% of fixed carbon and the yield of asphalt obtained therefrom is 50%, we should normally have a product giving 16% of fixed carbon. On the other hand, if we have a crude showing 4% of fixed carbon, the product should normally give 8%, on the basis of 50% yield.

If, however, refining conditions are not perfect, there will be formed decomposition products, the hydrocarbons of which yield fixed carbons, and thereby give to the resulting product an increased fixed carbon figure over and above that derived from the normal content of the crude. This is a matter of fact observation. The fixed carbon figure, thereby becomes an index of this decomposition, and herein lies the significance of the test as also the danger of its application.

It is evident that the results must be properly interpreted in the light of the above conditions, and this is only possible when the character of the crude is known, and also the yield of asphalt obtained therefrom. This is a simple matter when applied to refinery control or to inspection work at refineries, but presents some difficulties when applied in specifications generally. It is thought, however, that to those having a sufficiently wide knowledge of crude materials and methods employed in production, this would prove no special difficulty, even though it should be necessary to make tests of crudes and laboratory products in order to determine proper standards.

In the light of the present knowledge of the subject, the writer has arrived at the following tentative conclusions regarding the value of the fixed carbon test:—

(1) As a matter of refinery control it is extremely valuable in gauging the efficiency of the distilling operation.

(2) To the asphalt chemist familiar with crudes and methods of obtaining asphalt therefrom, it is a valuable indication of the care used in refining.

(3) If the fixed carbon requirement is embodied in specifications no fixed maximum should be stated unless such limit takes into consideration the effect of the character of the crude material. In order, therefore, to properly incorporate a fixed carbon requirement in specifications, the writer would suggest a clause (this referring to material of approximately 50 penetration) somewhat as follows:—

"The yield of fixed carbon obtained upon ignition of the asphalt cement must not exceed 14%, unless the amount is smaller than 3% in excess of the quotient of the fixed carbon from the crude, divided by percentage yield of asphalt."

To state this mathematically and to better advantage, the fixed carbon in the asphalt cement should not exceed

$$\frac{\text{Fixed carbon from crude}}{\text{Per cent. yield asphalt}} + 3\%$$

In other words, where the test shows in excess of 14% of fixed carbon, the above formula will apply if such excess is due to the character of the crude from which the asphalt is produced.

So far as known to the writer, the fixed carbon test was first generally applied to the bitumens of the paving industry by Mr. Clifford Richardson. Following, fixed carbon requirements have been largely introduced in specifications for paving asphalts and road binders. The value of this test has been subjected to considerable question, and in many instances much confusion has arisen through improper and empirical interpretation of results. Fixed carbon determinations must be properly considered in connection with other analytical data and further, in