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INDUSTRIAL COAL.

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Recent years have seen the large coal consumer consider the question of coal quality prior to coal quantity; and at the present time the question has assumed gigantic proportions in the minds that govern many of our largest and more prosperous manufacturing plants and municipal centres. That the scientific control of the coal bin will demonstrate itself on the dividend sheet has been proved beyond doubt, and it is toward the untiring and intelligent effort of chemists that this change has occurred.

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Coal is probably one of the most dissimilar substances used in commerce, even specimens taken from the same section varying to astonishing figures when an analytical report is presented; it is, therefore, of the utmost importance that buyers should have a report on a specimen that represents, as far as possible, the average composition of the bulk.

Once the manufacturer has derived benefits from buying coal on analysis and specifications it will be but a step further when he starts to burn his fuel scientifically. Under proper and well regulated conditions a coal should deliver its heat by polluting the flue gases to an extent of not less than 12%. Flue gases frequently contain as little as 2% or 3% of CO₂ and under this condition much heat is utilized for no other purpose than heating air.

A report on a coal analysis should present to the purchaser the following points: moisture, volatile matter, fixed carbon, ash, and for certain industrial problems sulphur and phosphorus. The moisture determination should imply natural moisture, as the writer in a recent experiment found that certain soft coals could be dampened artificially to such an extent as to appear to carry 16% of moisture; of course an analysis allowing this as natural would give the fuel a false value, and would be of little or no use in making a comparison. When coal is to be purchased on specifications the following method will be found quick, economical and capable of yielding satisfactory results to purchaser and vendor. When a number of specimens are being examined care should be exercised to have the various determinations made under precisely the same conditions.

To secure a sample, take about 5 pounds, break this up and quarter it down until a sample weighing approximately 100 grams (about 3 ounces) is left. This should be finely powdered and stored in an air-tight jar until the analysis has been secured. This operation should be conducted with all possible haste to prevent the absorption or loss of moisture.

Estimation of Moisture.

Coal cannot be dried in the usual manner, owing to a peculiar property possessed by this fuel, viz.: that when heated to a temperature of 105° C. or thereabouts it loses weight for a time and then increases. To secure concordant results all samples (which for this determination should be in a bulk weighing 1 gram) should be heated together in the air bath. Place the samples in uncovered crucibles and maintain the oven temperature at 104° to 107° C. for 1 hour; the crucibles should be dried in a desiccator, the resulting weight in milligrams subtracted from 1,000 and the result divided by 10 gives percentage moisture.

Volatile Combustible Matter.

The sample for this factor should also weigh 1 gram, and is placed in a crucible * having a tightly fitting cover. Enclose the sample by the cover and heat over a Bunsen flame for 7 minutes. The flame should be quite substantial, about 6 to 8 inches. This determination should be conducted in a place free from extensive drafts; when the crucible has been cooled and dried in a desiccator the weight is ascertained in milligrams, and from the gross loss the weight of moisture is deducted, leaving, when divided by 10, the volatile combustible matter in percentage. This determination should always be made on a fresh sample of coal, and not on the one used to determine moisture.

Fixed Carbon and Ash.

It is usual to consider this operation as a continuance of the determination for volatile combustible matter. The crucible lid is drawn slightly to one side, the crucible supported in an inclined position and a good flame from the Bunsen burner directed from below. The metal crucible for this operation doubtless has many advantages over the porcelain article, mainly through its superior heat-conducting qualities. Whichever form is adopted it is probable to be somewhat of a prolonged task, but may be hastened by allowing the mass to cool from time to time and stirring while heated with a short length of platinum wire. When the carbon appears to be burned out heat for a few minutes longer, then cool in a desiccator and weigh; the loss from the weight when volatile combustible matter was determined represents fixed carbon and the remaining matter is reported as ash.

This long operation may be simplified to a considerable extent by powdering the coke left behind when the volatile combustible determination was disposed of; the mass is then placed in a previously weighed dish, platinum preferred, and three to four c.c. of alcohol poured in and the coke allowed to become thoroughly moistened, the dish is shaken laterally and the pasty mass run up on the side of the containing vessel. If the layer is too thick in any one spot it may be thinned by blowing through a glass tube; a match is lighted and the wetted mass ignited, the dish being supported on a metal triangle. When the alcoholic flame ceases, a blast lamp flame is directed from below, which causes the ash tofall from the side into the bottom of the dish; it is then cooled and weighed. By this method carbon and ash may be determined in 15 minutes, as against an hour or more over the first method described.

For many industrial purposes an analysis containing the foregoing factors will be sufficient, but many other coal consuming processes require sulphur at least, if not phosphorus, to be determined. Assuming, however, a purchaser or vendor to be in possession of a report containing the percentage

^{*}Many text-books and chemists advise the use of platinum crucibles throughout the various manipulations, but it is doubtful if thin porcelainware will not, in many instances, give entire satisfaction.