

ART. VIII.—*Technical Analyses of Coal, and Coal-testing.*

By A. M. WRIGHT, M.S.A. (London), Fellow of the German Chemical Society (Berlin).

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As the results, so far as the estimation of moisture, volatile combustible matter, and fixed carbon are concerned, are only comparative, to be of any value it is necessary that they be obtained under exactly the same conditions.

The methods used for the various determinations in the coals analysed are as follows:—

Moisture.—Weigh 2–5 grams of the pulverised sample into a platinum crucible; place the crucible uncovered in an air bath having a temperature ranging from 105° C. to 110° C., and heat at this temperature for exactly one hour; cool, weigh, and call the loss in weight “moisture.” As coal when dried at 100° C. loses in weight for a time, and then grows heavier, the sample cannot be dried in the ordinary way until a constant weight is obtained.

Volatile Combustible Matter.—Weigh 1–2 grams of the sample into a platinum crucible, place the cover on tightly, and heat over a good Bunsen burner for exactly three and a half minutes; then bring a blast lamp under the crucible for exactly three and a half minutes more, taking care not to allow the crucible and contents to cool while changing burners. Cool and weigh, the loss in weight being moisture and volatile combustible matter. This determination should always be made on a fresh sample of coal, and not on the sample used for the moisture-determination.

Fixed Carbon and Ash.—After weighing the crucible for the previous determination, heat over a good Bunsen burner until the carbon is completely burned off and the residue shows no unburned carbon. Cool and weigh; the difference between this weight and the last is the weight of fixed carbon in the coal, and the residue in the crucible is the ash. The sum of percentages of fixed carbon and ash is approximately the percentage of coke that may be obtained from the coal.

Sulphur—Eschka's method was used, heating with an alcohol-lamp. As this method is well known, no description is needed.

Heating-value.—For the actual calorimetric determinations, Rosenhaim's modification of the Thompson calorimeter was used; for comparison, the calculated heating-values are according to a formula suggested by the American Coal Analyses Committee.*

* Chem. News, 1898, p. 75; Trans. N.Z. Inst., vol. xxxi, p. 564.

TRADE SAMPLES.

—	Moisture.	Ash.	Volatile Combustible Matter.	Fixed Carbon	Sulphur	Coal-sub- stance.	Coke.	Heating-value.		
								With Calorimeter (Actual).	Calculated.	Evapora- tive Power.
								Calories.	Calories.	lb.
Wes' port (average) ..	3.68	2.75	36.39	57.23	1.58	92.04	59.98	7473.5	7491.3	13.97
Westport (good) ..	2.10	2.27	30.42	65.21	1.24	94.39	67.48	7698.8	7667.3	14.30
Point Elizabeth ..	9.88	0.88	35.95	53.29	1.45	87.79	54.17	7063.3	7142.7	13.32
" ..	10.48	1.63	31.87	56.02	0.97	86.92	57.65	7003.6	7053.2	13.16
Co-operative Coal-mine	5.81	1.12	34.72	58.35	1.35	91.72	59.47	7381.1	7455.9	13.90
Westport Cardiff ..	3.33	1.55	38.28	56.94	1.02	94.10	58.39	7651.8	7635.0	14.24
Puponga ..	6.78	8.90	33.16	51.16	0.61	83.71	60.06	6895.2	6779.6	12.65
Malvern ..	25.83	3.96	36.89	33.36	0.68	69.53	37.32	5388.6	5638.5	10.52
Wool-h d Creek ..	26.90	5.45	29.42	33.33	1.63	66.12	43.78	5102.4	5401.2	10.07

To determine which coal is the most economical to use, actual boiler tests must be made on each variety as received. Combined with the boiler test should be careful chemical analyses, which will furnish standards of quality for future reference. Alone, chemical analyses are not sufficient, as every boiler requires a particular variety of coal for the production of best results, and then a coal can be selected from which the maximum capacity of heat can be obtained; but, as stated before, this can only be determined accurately by means of actual boiler tests, and subsequently by chemical analyses.

Particularly in rapidly determining the heat-value of successive consignments of the same coal, or of similar coals, the quantity of ash forms the readiest basis of comparison. The ash-determination can be made accurately and rapidly, where it is impracticable to make calorimetric determinations sufficiently often.* Coal high in ash has its fuel-value per ton diminished, and, allowing for the moisture, any variation in the quantity of ash gives a sufficiently good criterion of the variation in calorific value. As the ash accumulates, and is mixed with smaller particles of coal, preventing their complete combustion, the grate is stopped up, thus diminishing the rate of combustion and the steam produced.

From actual calorimetric determinations, compared with the ash-determination of various lots of coal of the same class, the following results show that as the ash increases so the calorific value diminishes, the calculations being made on a 2-per-cent.-moisture basis.

Ash.	Calorific Value.	Ash.	Calorific Value.
2.83	... 7372.2	4.82	... 7150.2
3.01	... 7303.3	4.91	... 7133.8
3.53	... 7279.1	5.45	... 7045.7
3.85	... 7204.6		

Of thirty-two samples of coal examined in this way, twenty-seven, or 84 per cent., varied as above.

As it costs money to handle ash, coals with a high percentage of ash are also more expensive from this standpoint.

Another important factor to be considered is the fusibility of the ash. Coals containing much sulphur produce an ash which is readily fusible, and may thus choke up the grate completely. The completeness of combustion depends greatly upon the absence of fusion in the ash, as, in fusing, the ash

* Jour. Soc. Chem. Ind., 1904, p. 11.

encloses unburned carbon, and thus further combustion is stopped.

An item which does not enter into serious consideration as far as the more commonly used New Zealand coals are concerned is the question of moisture; this is objectionable, both because of reducing the fuel-value per ton and on account of the heat consumed in evaporating it. A certain amount of the heat produced by fuel is necessary to raise its temperature to that of the grate, as well as for evaporating the moisture contained in it. A fuel very low in heating-value may often use up heat in burning, and thus prove a constant source of loss in heat-energy.

For permission to submit this paper I have to express my thanks to Mr. Gilbert Anderson, managing director of the Christchurch Meat Company, in whose laboratory all the experimental work has been done.

ART. IX.—*Some New Compounds of a Similar Nature to Antifebrine.*

By P. W. ROBERTSON.

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ANTIFEBRINE, acetanilide, $C_6H_5 \cdot NH \cdot CO \cdot CH_3$, is prepared by heating together acetic acid and aniline. The acetic acid may be replaced by any fatty acid, and the resulting compound is known as the anilide of the corresponding acid. Many of these compounds have already been obtained, but the melting-points of the known members of the series show such little regularity that it was determined to prepare the missing members in order to investigate the nature of the irregularities. Again, by treating the derivatives of aniline, such as toluidine, naphthylamine, &c., with the fatty acids, new series of compounds can be obtained, and these have hitherto been investigated only to a slight extent. No less than thirty-five new compounds of this nature have been prepared in a pure condition. Their medicinal properties have not been investigated, but it is quite possible that some of them might prove to be antipyretics as valuable as, if not more valuable than, antifebrine itself.