8.4 Fuel testing methods

8.4.1 Overview

Fuel experiments present the data that can be used in air pollution control, and are essential in evaluating fuel and in combustion computation. In particular, the analytical results of sulfur in fuel, when firing liquid fuel, are essential in ensuring that emission standards in law and ordinances are being adhered to, because they are directly connected with sulfur oxides emissions from fuel firing facilities. The main points are explained below.

8.4.2 Analytical method of sulfur in fuel

As analytical method of sulfur in fuel, dimethylsulfonazo III titration method, microcoulometric titration type oxidation method, neutralization titration method, fluorescent X-ray method and bomb method are used.

In dimethylsulfonazo III titration method, the petroleum or petroleum based fuel sample is burned with oxihydrogenh flame, and produced sulfur oxides are absorbed by hydrogen peroxide solution, and the sulfuric acid is determined by titration with barium perchlorate standard solution using dimethysulfonazo III indicator. The microcoulometric titration type oxidation method is analytical method which conduct the sample fuel into heated combustion tube, and burn it in an oxygen and inert gas flow, absorb the sulfur dioxide generated by combustion in electrolyte, titrate coulometrically and obtain the sulfur content from the quantity of electricity consumed at that time.

In neutralization titration method, the fuel sample is burned with air flow in heated quartz combustion tube, and generated sulfur dioxide is converted to sulfuric acid and it is titrate by sodium hydroxide standard solution.

Fluorescent X-ray method used the no dispersion type fluorescent X-ray apparatus, and in bomb method, the fuel sample is burned with sodium carbonate solution under the atmosphere of high pressure oxygen in bomb, and generated sulfate is determined gravimetrically as barium chloride.

8.4.3 Analytical method of nitrogen in fuel

As analytical method of nitrogen in fuel, there is a macro kjeldahl method in which fuel sample is heated and decomposed in concentrated sulfuric acid to which a catalyst has been added, and the nitrogen in fuel compose ammonium sulfate. An alkali compound is added this ammonium sulfate and then ammonia generated by steam distillation operation. Further, it is absorbed in boric acid and is titrated by the sulfuric acid standard.

In micro kjeldahl method, the same operation is repeated, the ammonia generated by steam distillatin is absorbed in dilute sulfuric acid, and 1-naphthol solution and sodium hypochlorite is added to induce coloration, then nitrogen is determined colorimetrically at 730 μm.

And microcoulometric titration method, and chemiluminescence method are used.

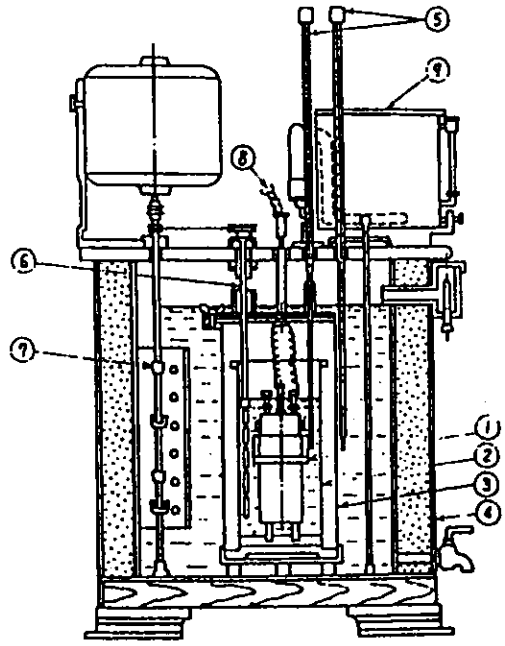
8.4.4 Analytical method of carbon and hydrogen in fuel

The sample fuel is gradually heated and burned at low temperature in an oxygen flow, and the water vapor and carbon dioxide are generated absorbed into both an absorption tube packed with magnesium perchlorate and an absorption tube packed with a powder mixture made by assition of magnesium silicate to molten hydroxide a carrier, and the increased mass of these volume is hereby weighed.

8.4.5 Testing method on Calorific value of fuel

For example, testing method that the fuel sample is burned in bomb of Calorimeter as shown in Fig.8.4.1, Compressed pure oxygen in high pressure, and from the scale reaching of Beckman thermometer, the Calorific value of fuel is calculated is used.

In this case, thermal equivalent of Calorimeter is measured by using the benzoic acid for calibration or international calfonific value standard.



① Bomb
② Inside cylinder
③ Intermediate cylinder
④ External wrapping
⑤ Beckman thermometer
⑥ Stirrer for use inside pipes
⑦ Stirrer for use externally
⑧ Ignition fuse
⑨ Heated water tank

Fig.8.4.1 Example of a calorimeter