

CHEMICAL ANALYSIS OF SOOT.

When one considers the very different conditions under which coal is burnt, it is obvious that the character of soot must vary. All conditions in the furnace greatly affect the amount of carbon lost as soot, but the fact stands out, that, where equal amounts of coal are consumed, domestic installations are worse offenders than boiler furnaces. Loss of efficiency through the escape of soot itself is small. This is, however, an indication of a far greater loss in the shape of unburned, invisible gases, which loss may reach as high as 10 per cent.

Soot is composed of:

(1). *Carbon*, in a finely divided state. This, as is well known, is lamp black, the basis of most black paints, and it has a great covering power. It has the power of absorbing the corrosive acids which are produced by the combustion of coal containing sulphur.

(2). *Tar*. It is common coal tar which makes the soot cling tenaciously to everything with which it comes in contact. Tar contains carbolic acid and other creosote bodies of an injurious nature.

(3). *Acids*. Sulphurous acid, (H_2SO_3); sulphuric acid, (oil of vitriol, H_2SO_4); sulphuretted hydrogen, (H_2S); hydrochloric acid, (HCl).

These acids corrode and tarnish all the common metals. They attack many of the stones and building materials, especially limestone. Draperies, paper, paints and other decorative materials suffer to no less extent. In burning the sulphur in the coal, the relatively inactive sulphurous acid is produced, but this soon becomes oxidized in the air to the far more active and corrosive sulphuric acid. These acids are also poisonous and detrimental to health.

(4). *Ash*. This is the least injurious of all the constituents of coal and may be, for all practical purposes, considered as common dirt.

(5). *Ammonia*, (NH_3). Ammonia is found in soot only in very small quantities and is of less importance than the other corrosive agents.

(6). *Arsenic*. This poisonous substance has been found in small quantities (generally less than 0.1 per cent. of the soot).

The amounts of these constituents of black smoke vary between the widest possible limits, depending upon the composition of the coal, methods of firing, amount of air, temperature of the furnace, and other conditions. The following analysis of soot taken from Cohen and Ruston's *Smoke, A Study of Town Air*, gives a good general idea of what one must expect: