bonates; and finally, another sample was pulverised as finely as possible in a pestle and mortar. On testing each residue, the results showed their capacity, when compared with the original intact substance, was considerably impaired for ozone. Any material alteration, moreover, in form or substance, causes a proportionste lessening of its power, and even the accumulation of suspended organic matter arrested in the process of filtration, or of gum and resin on the surface, eventually determines a cessation of this property.

But the affinity to which this is attributable : it consists of that of the second order necessary for chemical combinations, as first set forth, and the condition governing its action is, that the substance possesses a surface mechanically fitted for the reception and retention of oxygen. The oxygen thus situated seems to evince all the energy of combination, but lacking that force necessary for the constitution of a new form. The action of this induced oxygen lies only in proximity to the surface of the charcoal, or other ozonizable substance to which it owes its origin. For the purpose of calling its energy into play, actual contact is indispen-This is illustrated very strikingly in the sable. ensuing experiment.\* If coarsely powdered animal charcoal be intimately mixed with small portions of phosphorus, the great oxidizing power of the charcoal quickly determines the combustion of the phosphorus; again, should an accidental scrap of iron find its way into charcoal used as a filtering medium, an occurrence not uncommon, the metal becomes soon covered with a thick coating of oxide. which eventually cements charcoal and iron into a conglomerate mass.

Oxide of iron itself is an ozonizing substance; thus it is, that iron being a less oxidizable metal than zinc, becomes converted into rust on exposure to the atmosphere, in a considerably shorter period of time than the latter metal, simply from the fact that the oxide regenerates ozone, and hence, continuously supplies the combining oxygen to the compound. Most acids are ozonizing bodies-that is, possess the power of generating ozone: by this means they determine the oxidation of the base with which they combine. Zinc and iron are slowly oxidizable in water, if devoid of acid; but in the presence of sulphuric or nitric acid, owing to the ozonizing effect of such on the oxygen of the the water, speedily determines the oxidation of the metal, and forms a secondary compound salt.

Substances capable of ozonizing, as a rule, may be artificially produced by certain substances containing oxygen as an element, and capable of having such expelled by heat or other agency, without otherwise altering or destroying their structural arrangement. In organic and other natural products, this property is also often met with to a considerable degree.

Animal charcoal is of the class of substance in question—by depriving the organic substance in the process of burning of its combined oxygen, it becomes thus permanently ozonizable. This process of burning in practice is rarely, if ever, achieved in the first instance. Sugar-refiners, and others using this charcoal, find that after the second or third burning the substance is considerably improved in its filtering power. In the use of animal

\* Transactions of the Royal Institution, vol.i.

charcoal for filtering impure water, great caution is requsite in its proper selection and adaptation. If badly-burned charcoal be chosen, it will probably give rise to a numerous series of failures. A species of putrefaction of the uncharred organic remains is almost certain to set up in the locality of the defective parts, and soon by spreading, contaminate the whole of the charcoal, together with any substance in contact with it. We find instances occur, that water, after having been in contact with this substance, becomes actually less pure from Such the introduction of this extraneous matter. qualities of charcoal are actually useless for all practical application, and on the evidence of the tests before mentioned, should be scrupulously rejected.

The treatment of animal charcoal by re-burning. solely for this reason, is beneficial; for all others it is depreciatory to its virtue. The ozonizing capacity has been shown previously to exist in the combined substance, that each elementary constitutent was incapable of exercising this property and hence we may reason in proportion, that the balanced constituents are varied from their combination, so would the ezonising power be impoverished. Washing the dilute muriatic acid, and reburning, have been much used in the revivilication of expended charcoal. The preference is now given almost exclusively in favour of the latter, but in practice they are both, after a certain time, incapable of effecting their purpose, and the charcoal becomes useless. In theory the failure is attributable to similar though opposite causes. By the treatment with the muriatic acid, the mechanically acquired matter that may be present on the surface of the charcoal is loosened, and the phosphate of lime and earthy salts, by being superficially destroyed, leaves a partially renewed surface of the charcoal for ozonic action. The carbon, however, is left in excess. In reburning, the foreign matter is charred, and part of the carbon of it, together with that of the charcoal, is volatilized. A new surface is here again exposed, but the phosphates and earthy salts are in excess, and the residual charcoal from the organic matter is introduced as a foreign element on the surface of the renewed charcoal; in course of time the excesses of these extraneously introduced substances determine the cessation of the normal virtue of the charcoal. Much waste and great amount of labour is expended in these fruitless restorations of old charcoal and freeing it from impurities

By certain of the experiments hereinenumerated, animal charcoal has been shown by constant use to become improved. After a continued action on soluble organic matter for years the ozonizing power has been stated to have been increased. How great, then, the fallacy of submitting such to renewal, if, by that process, the standard of its ozonizing capacity be reduced to its original condition, or still worse, lessened, as above shown.

The defect of used charcoal has been sought after in the wrong cirection. If the impurity consists of calcinable matter, such as suspended clayey substance, chalk, &c., burning is ineffective; if, on the other hand, from organic substance, other chemical means for its extraction should have been resorted to, and thus the acquired impurity abstracted, leaving the charcoal improved by the process of its action, and literally imperishable.