SULPHOZONE, A SUBSTITUTE FOR SULPHUR.*

BY CHARLES ROBERTS, F. R. C. S., ETC.

Sulphur, in the sublimed, precipitated, or powdered form, is extensively employed by medical men, veterinary surgeons, and horticulturists, for destroying the animal and vegtable parasites infesting man, animals, and plants. The substance to which I have given the name of sulphozone (from its strong smell and powerful chemical action) in order to distinguish it from the sulphur of commerce, is a preparation containing free sulphurous acid as its active and essential principle.

For many years past, large quantities of sublimed and powdered sulphur have been used in this country and on the Continent, for the destruction of the mildew and blight attacking vines, hops, roses, fruit and other trees; and it is now, I believe, almost the sole remedy employed for that purpose, as no other has been found so generally effectual or so convenient of application.

From careful and often repeated series of experiments, I have arrived at the conclusion that the beneficial action is to be attributed to the presence of a small but variable quantity of free sulphurous acid (occasionally hyposulphurous acid) which exists as a constant impurity in the sulphur of commerce. Sublimed sulphur contains more acid than powdered crude sulphur, and is more certain in its action, while precipitated sulphur, being almost or altogether free from acid, is quite useless. I find that when substances are carefully purified from all traces of sulphurous acid by repeated washing with spirit and water, they are equally ineffectual in destroying mildew and other vegetable and animal organisms, and that seeds germinate as quickly and as vigorously when sown in pure sulphur as in fine sand, and that molds grow on the surface when a little organic matter, as flour, has been mixed with the sulphur. I find also that cheese mites are not destroyed by pure sulphur, but live and multiply indefinitely in cheese covered with sulphur; though they are immediately destroyed by commercial sublimed sulphur. On the other hand, when pure sulphur is impregnated with sulphurous acid, it destroys mildew and other minute organisms with an energy proportioned to the quantity of acid it contains, and it does not appear that one form of sulphur possesses any advantages over the others, provided the quantity of acid is uniform. Many other substances which contain no sulphur, when impregnated with sulphurous acid in a similar manner and to the same extent, are equally effectual in destroying mildew.

It has been observed that, when a piece of silver leaf is suspended over a roll of sulphur, it is slowly converted into the sulphide of silver, and it has been inferred therefrom that sulphur vaporizes at ordinary temperatures; and the theory has been advanced, by a well known vegetable physiologist, that the oxygen, given off by the leaves of plants to which sulphur has been applied, oxidizes it and produces sulphurous acid, and thus the action of sulphur in destroying vegetable organisms may be accounted for. But this theory is not borne out by my experiments. When silver leaf is suspended over pure sulphur, it does not tarnish more rapidly than when suspended in the air, and its conversion into the sulphide by the roll sulphur may be explained by the fact that that substance contains free sulphurous and hydrosulphurous acids and sulphuretted hydrogen, which are constantly escaping from it. When pure sulphur is applied to the leaves of plants, no evidence of oxidation can be detected by either litmus or starch and iodine paper. If oxidation were to take place under such circumstances, the product, if sulphurous acid in the first instance, would be immediately converted into sulphuric acid by further oxidation, and it could not escape detection. Further: precipitated sulphur, being in a much finer state of division than sublimed sulphur, would be more easily oxidized, and ought to prove the more potent agent; but practically it is found to be the least so.

Sulphur in various forms is used by medical men and veterinary surgeons for the destruction of the itch and other insects, and in the treatment of various diseases (as ringworms), caused or accompanied by fungous growths, infesting the skin and hair of men and animals; but sulphurous acid, in solution, is in many instances substituted for them on account of its more certain action. Many surgeons, indeed, believe that the beneficial action of sulphur ointment in the treatment of itch is to be attributed to the grease of which it is made, rather than to the sulphur it contains; and this is probably true, as the quantity of sulphurous acid is exceedingly small, and I find the action of the ointment is remarkably increased when the sulphur has been strongly impregnated with acid previous to being made into ointment, and this is equally true of its other applications in medicine.

In addition to its destructive action on organized bodies, sulphurous acid possesses a powerful chemical action on the organic and inorganic products of decomposing animal and vegetable substances, and on emanations from persons and animals suffering from infectious diseases; hence it is one of the most potent and valuable disinfectants we possess, and it appears to prevent the spread of small pox, diphtheria, cattle plague, etc. Its qualities as a deodorizer are also very considerable. It attacks and destroys sulphuretted hydrogen, and neutralizes the strong smell of ammonia and other alkaline bases, but without losing its antiseptic properties, or destroying their manurial value. (Crookes.)

From my experiments and observations, and from the well known properties of sulphurous acid, I conclude, therefore, that it is the acid, accidentally present in the sulphur, which is the active agent in the destruction of mildews and blights, and that the sulphur is only the medium for its application. This is a fact, not only of scientific interest, but of great practical and commercial importance; for under the mistaken impression that the sulphur itself is the active agent, great care and expense have been incurred to secure its freedom from acidity, which is by no means necessary.

Sulphur, like charcoal and many other substances, possesses the power of absorbing a large quantity of sulphurous acid; and by a modification in the refining process the acidity may be considerably increased, and the quantity of sulphur correspondingly diminished, and a more certain and uniform agent produced. For horticultural purposes, however, it is necessary to limit the quantity of sulphurous acid, or it will prove destructive to the plant as well as to the parasite. This limit I have established practically by experiments made on rose trees infested with mildew; and as the rose mildew is with difficulty destroyed by common sulphur, except by repeated applications, this preparation (to which I have given the name of sulphozone, for reasons given above) may be considered to be of the maximum strength, and four or five times stronger and more potent than sublimed sulphur. In substituting it, therefore, for sulphur, a great saving will be effected in the cost of sulphur, its carriage, and the time and labor of applying it. There will, moreover, be the additional advantage of not loading the foliage with a large quantity of sulphur powder, which must in some measure impair its health by its mere mechanical presence; and in the case of hops, the brewers will have less ground for objecting to the quality of the produce. Sulphozone, being a fine drypowder like sulphur, may be applied in a similar manner and with the same apparatus, care being taken to use a much smaller quantity (namely, about a quarter of that of sulphur).

For medical, veterinary, and sanitary purposes, a very strong sulphozone has been prepared to take the place of sulphur in the officinal preparation, and for use as a disinfecting powder. This substance is exceedingly destructive to organic life, and is not adapted for horticultural purposes except for dressing the stems and branches of deciduous trees in the winter, and for destroying insects where it can exert no deleterious influence on surrounding vegetation, or for disinfecting and deodorizing manure heaps, etc, for which purpose it is better adapted than any other disinfecting powder, as the sulphurous acid fixes the ammonia—the most valuable constituent of manure—and makes it available for gardening and farming purposes, while chlorine and other disinfectants destroy it, and reduce the value of manure in proportion to the extent of their action in deodorizing it.

*Paper read at the Meeting of the Royal Horticultural Society at Birmingham.

Influence of Marriage upon Health.

M. BERTILLON, lately having had to draw up a paper for the Academy of Medicine of Paris on the influence of marriage on mortality, consulted the registers of the only three countries in Europe which were carefully enough kept to give him a reply to his question, those of France, Belgium, and Holland. He shows that if the male sex be first considered, we find that, from 25 to 30, 1,000 married men furnish 6 deaths; 1,000 unmarried, 10 deaths; and 1,000 widowers, 22 deaths. From 30 to 35, of 1,000 married men, 7 die; of 1,000 unmarried men, 11½ die; and of 1,000 widowers, 19 die. From 35 to 40, of 1,000 married men, 7½ die, of 1,000 bachelors, 13 die; and of 1,000 widowers, 47½ die; and so on at all the following ages, the married man continuing to live with greater facility than the bachelor. It has been said that since the most fortunate men can afford to marry, it is not astonishing that these persons should live longer. But this will not, of course, account for the very great mortality of widowers at all ages, which, indeed, surpasses that even of bachelors.

However, it must be noticed that 8,000 young men marry in France yearly, under the age of 20. This is very fatal to such young men, for M. Bertillon finds that, whilst 1,000 young men from 15 to 20 furnish 7 deaths, when unmarried, no less than fifty deaths occur among 1,000 young married men under 20. Women seem to reap less advantage from marriage than men, and there is but little difference in the mortality of unmarried and married women before the age of 25. It is but little marked even between 25 and 30.

Apparatus for the Production of Ozone with Electricity of High Tension.

Experiment has shown that in the production of ozone by electricity, the maximum amount of oxygen is ozonised by the silent or glow discharge. In using the Holtz electro machine, the form of the apparatus usually employed must be varied to give good results.

When the poles of the machine itself are separated to a sufficient distance, the electricity passes between them, either in the form of a diffuse brush, spanning the whole interval, or with a very minute brush upon the negative pole and a glow upon the positive, the intermediate space not being visibly luminous. This is the so-called dark, or silent discharge.

When this occurs, the strong odor shows that a considerable amount of the atmospheric oxygen is converted into ozone.

If this discharge is made to take place in an enclosed space through which air or oxygen can be driven, the ozonising effect of the electricity is hightened and can be utilized. The apparatus which I have employed, and which has afforded very satisfactory results, consists of a straight glass tube about 20 centimeters long and having an internal diameter of 25 centimeters, the two ends being stopped with corks covered on the inner side with a thin coating of cement to protect them from the action of the ozone. Through the axis of each cork is inserted a glass tube of about 5 m.m. caliber and 7 centimeters in length, having a branch tube inserted perpendicularly at the middle, and long enough to permit a rubber tube to be slipped upon it. The outer ends of the tubes themselves are closely stopped with corks, through which are passed straight, thick copper wires carrying suitable terminals at their inner ends, and bent into a ring at the others. They are fitted so as to make tight joints, but to allow of motion in order to vary the distance between their inner ends. One of these wires carries a small ball; the other terminates in a disk with rounded edge, set perpendicularly to the axis of the tube, and so large as to leave an annular space of some two or three millimetres breadth around it. The gas is admitted through one of the branch tubes and escapes through the other, after having passed through the whole length of the tube.

In using the apparatus, the wires must be connected with the poles of the machine in such a manner that the disk becomes the terminal, as this arrangement gives the greatest degree of expansion and diffuseness to the current. On turning the machine and adjusting the ball and disk to a proper distance, a nebulous aigrette surrounds the latter, quite filling the interval between it and the wall of the tube, while the part of the tube between the disk and ball is crowded with innumerable hazy streams converging upon the positive pole, or simply causing the latter to be covered with a faint glow. A current of air or oxygen sent into the tube must pass through this, and ozone is very rapidly produced, and in great quantity. The condensers are of course not used with the machine when this apparatus is employed.

Noctilucine.

Mr. T. L. Phipson treats of noctilucine as a new and special organic substance, widely spread throughout the world of Nature, and which shines like phosphorus. It is not only the cause of the phosphorescence of the flesh of animals and fish, but it is also secreted by glowworms, fire flies, *scolopendra*, probably by all animate objects that shine in the dark, and produced by certain living plants (agaricus, euphorbia, etc.,) and by the decomposition of vegetable matter under certain special conditions, such as the fermentation of potatoes, etc.

At ordinary temperatures, noctilucine is a nitrogenous, almost liquid substance, capable of dilution with water, but insoluble, and appearing to have a density slightly less than that fluid. It is white, contains (when newly extracted from a luminous animal, living or dead) a small proportion of water, and has a slight odor somewhat resembling caprylic acid. Insoluble in alcohol or ether, it is readily decomposed by mineral acids and alkalies; potash sets ammonia free from it. Fermented in contact with water, it manifests after a time the odor of decayed cheese. While damp, noctilucine absorbs oxygen and gives off carbonic acid gas; but exposed to the air, it dries in thin, translucid, amorphous flakes, very similar to the slime of slugs. When fresh, it is strongly phosphorescent, owing to its oxidation by contact with moist air, and it will even shine under water while there is any air. In oxygen gas it is a little more brilliant; and it is more especially so in air when the wind blows from the S.W., that is, in the presence of ozone. This production of light ceases so soon as the oxygen of the matter is consumed; but if air in the smallest quantity is adherent to it, noctilucine shines for some moments in moist carbonic acid gas.

In phosphorescent animals, noctilucene is secreted by a special organ, and appears to be at once effectively luminous. Under certain conditions of temperature and humidity, it is also generated by dead animal matter, flesh, blood, and sometimes urine.

Whencesoever it originates, its light is invariable and monochromatic, giving a spectrum mainly visible between the lines E and F, and possessing always the same chemical properties.

The *scolopendra electrica* secretes noctilucene in a state of comparative purity, and by making several of these myriapods run about over a large glass capsule, in the month of September, a sufficient quantity may be obtained for examination and analysis to determine its chief properties. It can also be obtained, but is less pure, from glowworms and the phosphorescent surface of dead fish, by scraping the luminous matter on to damp filter paper.

The secretion of noctilucine by the superior luminous creatures, such as insects (*lampyrus, elater,* etc.), is doubtless up to a certain point under the influence of the nervous system, so that they have the faculty of causing their light to cease at will, in which case the secretion is arrested for the time; but glowworms' eggs continue to shine for some time after they have been laid, so that they must also contain a small quantity of noctilucine. In the lower orders of animate beings, such as the little *noctiluca miliaris* of the English Channel, the flexible *polypi,* etc., there is also no doubt of the existence of a special organ for the production of the light; and, where there are scarcely any indications of a nervous system, the secretion of the material appears frequently to be susceptible to the influence of external circumstances.—*Mechanics' Magazine.*

MR. JOHN KEEFE, a fireman on the Northern Central Railroad, did a noble thing on Sept. 23. As the express train going south was approaching Milo Station, Yates county, N. Y., a little child three years old was seen to be on the track, but too near for the train to be stopped before reaching it. This man, John Keefe, thereupon climbed forward on the engine, got down on the cow-catcher, and, as the train thundered along, reached forward and picked up the child from destruction.

THE importance and value of some of the patented stove improvements may be judged of from statistics which were made public at the recent meeting of the stove manufacturers of the United States, held in Cincinnati. It appears that this interest has, in this country, a combined capital of over $30,000,000, that it employs 150,000 men, and that the probable product, during the current year, will not fall short of 2,500,000 stoves.