CRYSTALS.

BY WILLIAM JAGO, F.C.S., ASSOC. INST. CHEM.

The well known "lead tree" depends on the fact that zinc is a more active element, chemically, than lead; hence, if zinc be introduced into a solution of a compound of lead with an acid, the lead is "displaced," and its former position usurped by the zinc. The lead is deposited in the metallic state, and under favorable conditions assumes a beautiful crystalline form. The experiment of making a lead tree may be performed with a *minimum* of apparatus and experience of chemical manipulation. An ordinary pickle bottle, or other vessel of clear glass and similar shape, being obtained, fill it with a solution of lead acetate (sugar of lead). About an ounce of the acetate will be sufficient for a bottle of the size mentioned; if dissolved in spring water, a slight sediment will be formed—this, however, if allowed to subside, will not interfere with the experiment. Distilled or even rain water is preferable for making chemical solutions. Next a fragment of *clean* zinc, about the size of a small walnut, must be procured, the more irregular the better; suspend this by a piece of string, the end of which passes through a hole bored in the cork of the bottle containing the acetate. Put the zinc in the bottle, cork it up, and so arrange the length of the string that the zinc is just beneath the neck; fasten it in this position, and set the whole arrangement where it will not be disturbed. In a short time crystals of lead will be seen to deposit themselves on the zinc, and soon it will be covered with a tree-like growth of crystals. If left perfectly still, it remains a long time before the mass drops off. With this and other similar experiments, one half the pleasure consists in watching and studying the crystal growth for one's self.* Silver, which is in many respects a metal closely allied to lead, may also be made the subject of interesting experiments on crystallization; the so-called *Arbor Dianæ* is produced by placing a globule of mercury in a solution of nitrate of silver; a growth ensues of long thin crystals of an amalgam of silver; these, in addition to their beauty of shape, possess that magnificent luster which causes mercury and silver to be almost unrivaled among the metals.

Those who possess a microscope will find a few prepared specimens of crystals a valuable addition to their stock of slides. Not only are they of great interest, but as an introduction to microscopic analysis and microscopic study of rocks, the systematic student will find them worthy of special study. It has been previously stated that the crystalline form of many substances is one of their most characteristic properties; and as in the detection of poison and other important cases there is often a trace merely of the substance to be obtained, a microscopic examination is of great importance; it has, too, this further merit, that the substance is afterward available for other chemical tests.

Fig. 1.—Common Salt.

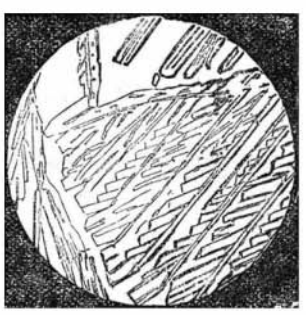

Fig. 2.—Potassium Nitrate.

Fig. 3.—Oxalic Acid.

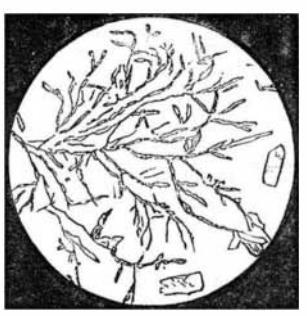

Fig. 4.—Potassium Dichromate.

The preparation of such slides is very simple. In the first place, the glass slips must be perfectly clean and free from grease; it is well to wash them in a solution of soda, rinse with rain or distilled water, and then wipe dry with a clean linen cloth. The substances that may be selected for study are legion; those figured are very suitable for a first attempt; make solutions by putting a pinch of common salt, potassium nitrate (saltpeter), oxalic acid, and potassium dichromate in separate clean test-tubes, and add to each a teaspoonful of water, they will dissolve rapidly to clear solutions. Take a drop out of the common salt test-tube on the end of a glass rod, and place it on a clean slide, spread the drop out with the rod in as thin a layer as possible; warm the slide very gently over a lamp until the salt begins to crystallize round the edge of the drop, then place it under the microscope and watch the progress of crystallization. Little cubes of salt will be seen to form, and ultimately the field will appear as shown in Fig. 1.

Precisely the same experiments being made with the other solutions, the shapes of the respective crystals are shown in the accompanying figures. Potassium nitrate differs remarkably from the salt; instead of the little cubes, we have the crystals arranged in long parallel feathers. The oxalic acid, again, shows forms differing from the other two; from a center the crystals radiate out in every direction. Of the four specimens, however, the potassium dichromate is the most beautiful; the crystals, instead of being colorless, are of a deep amber hue, while, in mode of arrangement, they resemble a fern group rather than mere inanimate matter. The figures must be looked on as giving some idea only of what is actually seen. The leading outlines have been drawn, but to copy the delicate tracery of the finer crystals is impossible. In the case of the potassium dichromate in particular, some parts of the field defy all attempts at even affording a conception of their exquisite beauty. But were even all this possible, there is yet the greater charm remaining to the actual worker, and that is to see the growth proceeding. The specimen being so placed that the edge of the crystals already formed is just within the field, the main lines shown are first rapidly filled in, and then the smaller branches dart out until, the water having evaporated, the whole of the salt has regained the solid state.—*Knowledge.*

* It should be stated that lead acetate is a poisonous salt. In all cases chemicals should be kept clearly labeled and locked up.

On the Utilization of Bones.

It was through the endeavors of Liebig and Stöckhardt that the value of bones as a manure was fully recognized, and a great many establishments were erected to reduce them to a state fit for agricultural purposes. The bones, without any further preparation, were ground by crushing machines, thus producing the "crude bone dust." This primitive manufacture was, after some time, abandoned, and is now only used for certain special and limited purposes. More recently, to effect a readier pulverization, by rendering the bones more brittle, treatment with milk of lime was recommended. This having been unsuccessful, heating them in steam was tried, and, at the same time, it was found that the large amount of fat yielded would give a valuable by-product. Thus an independent manufacture rapidly arose. For the separation of fat, the bones, after having been sorted out and broken up by some appropriate means, are boiled with water in boilers heated by steam.

These vessels have grown in size from one-half to six cubic meters capacity. The bones are immersed in them in boxes made of iron bars, and steam is injected as long as any appreciable quantity of fat gathers on the surface of the water. This is then skimmed off, and, mostly without further purification, sold to soap manufacturers, as it is rich in fatty acids. The production of fat depends on circumstances; on an average it is 2 to 4 per cent, of select fatty bones it is 6 per cent. The extraction of fat by boiling with water is always very imperfect, up to 6 per cent of fat remaining behind in the bones. A great step was therefore taken, when, two years ago, Seltsam-Forchheim introduced the extraction of fat by petroleum spirit (benzine), in an apparatus ingeniously constructed. This method allows of bones of all kinds being extracted, it makes the production of fat double and even triple as large, and yields a fat of better quality. The bones thus extracted are exposed to the action of steam of 1½ to 3 atm., in order to swell the gelatin to and break the solidity of the bone. The juice which condenses with the steam is either sold to farmers or concentrated to a jelly. It is preferable first to extract the fat before gaining the glue (gelatin), but not to combine these two operations, as some works do. After the bones are steamed, they are brought into the oven or kiln. This need not have more than one story, and ought to be well ventilated. The further comminution of the dried bones is effected by wooden or iron pounders. The bones are now mostly reduced only to grout, and there are 3 to 4 degrees of grain obtained. It is therefore necessary to carefully mix the different sorts of dust, in order to prepare a product of the usually required composition, namely, 20 per cent phosphoric acid, and 4 per cent nitrogen. As iron, in the form of nails, etc., cannot entirely be removed before pounding and grinding, and as it would greatly damage the millstone, it is best to fix magnets at suitable spots. Animal charcoal is prepared either by burning the whole bones or the bone grout in closed spaces or vessels. Although the first method seems to have several advantages over the second one, it would only be profitable if the price of bones be extremely low. The burning of the ground bones was formerly almost exclusively done in iron pots, holding about 80 pounds, of which 80 to 100 were placed in an oven. The ammonia thereby formed was allowed to escape, but, more recently, the gases issuing from the oven were made to pass through a coke tower, and washed with sulphuric acid. This oven has recently been much improved, and will probably soon be replaced by the oven constructed by Sebor. Instead of using pots, Sebor burns the bones in iron cylinders of 3 to 4 meters in length, which can be opened at both ends to empty and recharge. The burning is finished in four to six hours. By condensing the escaping gases with water, the solution of ammonium carbonate, of up to 15° B., is obtained, also animal oil. The ovens, which contain a number of such cylinders, are heated by coal, recently also by gases from generators. A full third of the nitrogen contained in the grout is obtained as ammonium salt; dilute sulphuric acid, if used as absorbing liquid, would probably raise the yield considerably. The bone oil, which contains 9 to 10 per cent nitrogen, is best utilized by heating it with lime, and obtaining sulphate of ammonia. There was, and is perhaps still, a prejudice that the animal charcoal burnt in cylinders is inferior to that burnt in pots, on account of a coating of glossy carbon being more readily formed. This can, however, only be admitted in case of deficient management or a faulty arrangement of flues. Proprietors of cylindrical ovens do not complain of difficulties in selling their produce. The freshly-prepared charcoal energetically absorbs water and gases from the air. It is therefore wetted, and it is well that so much water should be taken up, that the charcoal contains 6 to 7 per cent of it, as this will keep constant. In addition to the products mentioned there is glue prepared from bones. The washed bones are treated with hydrochloric acid, until they can be squeezed together with the hand, *i. e.*, till all earthy matter is dissolved. The crude gelatin, which then remains behind, is worked into glue in the ordinary way, after the acid has been washed away. This kind of glue is inferior in quality to that prepared from leather, and the process of extraction has now lost a great deal of its profitableness, owing to the rising price of hydrochloric acid, although, on the other hand, precipitated phosphate of lime is obtained as a valuable by-product, its phosphoric acid being soluble in citrates.

The manufactured bone-glue has also been combined with that of bone-dust. On steaming and boiling the bones a part of the glue is dissolved. From this a glue in the form of a jelly was at first prepared and brought to the market. It has, however, gradually been improved, and now, by extracting the bones with steam, a solid glue can be obtained, which successfully competes with the best kinds known. For the preparation of this it is essential to obtain a concentrated glue-juice expeditiously, without overheating it. This is best effected by the new patent process of Abr. Zwillinger, who proposes to alternately conduct steam and pump air in during the extraction. The glue-juice thus obtained is bleached by a current of sulphurous acid, and is, after clearing, ready for concentration. The residue from the extraction, which can easily be powdered when dry, furnishes a bone-dust of 1¾ to 2½ per cent nitrogen, and 26 to 28 per cent phosphoric acid, which can be sold at a moderate price. This also may be converted, by treatment with sulphuric acid, into a superphosphate, which cannot be so readily prepared from dust not previously extracted, and which is much valued by farmers. The nitrogenous substance which has been extracted from the bone-dust with the glue, is sometimes substituted by horn, blood, or leather, to endeavor to give a product similar in composition to the original. It is of a finer grain than this, yet it is not generally considered equivalent to it. Such admixtures can be separated by shaking up the bone-dust with chloroform, their quantity and the amount of nitrogen can then be determined. — *Dr. R. Jones, Chem. Zeit.*

Isolation in Contagious Diseases.

At a recent meeting of the Académie de Médecine, M. Hillairet read a report prepared in answer to a questions aked by the Minister of Public Instruction, regarding the length of time a pupil affected with any of the contagious diseases should remain separated from the other pupils. M. Hillairet's report may be summed up in the following propositions:

1st. Pupils suffering from varicella, smallpox, measles, mumps, or diphtheria should be completely isolated and hold absolutely no communication with the other members of the school. 2d. Isolation should continue forty days for smallpox, measles, scarlatina, and diphtheria; twenty-five days for varicella and mumps; the patient should have repeated baths before being allowed to join his comrades. 3d. The clothes worn by the patient at the time he fell sick should be submitted to a heat of 90° C., and then to repeated fumigations of sulphur. 4th. The bed clothes, curtains, carpets, furniture, and even the walls of the room occupied should be carefully disinfected, washed, and aired. 5th. If the pupil is taken sick at home he should not be allowed to return to school without the certificate of a physician attesting that all these precautions have been faithfully carried out.

Mica Face Masks.

It is reported that the mica face masks made by Herr Raphael, in Breslau, are proving very beneficial to workmen exposed to great heat, acid fumes, flying sparks, or fragments of stone or metal. The mica plates are fixed in metallic frames, protected with asbestos. The masks cover the eyes more effectively than mica spectacles do, and the whole face as well. The neck and shoulder may at the same time be protected by a fireproof cape of asbestos or other proper material. The space between the masks and the face allows the use of inner glasses for improving vision or shading the eyes. The tough and flexible mica prevents the breaking of the glasses by heat or flying fragments.

Oil of Peppermint in Neuralgia.

Dr. Meredith, in the *Birmingham Medical Review*, recommends oil of peppermint as an external application for allaying the neuralgic pain so often complained of in cases of *Herpes zoster*. He has used it with great relief to the patient even when the eruption was out in a fresh florid condition. He thinks that the value of this remedy in relieving neuralgic pain deserves to be better known.

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