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NOTES

ON SOME OF THE

CHEMICAL REACTIONS OF STRYCHNIA.

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In the following paper it is proposed to give the result of some experimemts in regard to the relative value of the various tests which have been proposed for the detection of strychnia.

The various solutions were made with great care from pure strychnia, generally dissolved in just sufficient quantity of dilute acetic acid, and the reagents were generally applied by means of a glass rod dipped in a saturated solution of the reagent, to a *single drop* of the strychnia solution, delivered upon a glass slide, from a graduated burette which furnished a grain of fluid in each drop. Therefore, each drop contained an amount of pure strychnia, corresponding to the fractional dilution of the solution.

To prevent repetition in giving the various tests, the amount of strychnia operated upon will frequently be stated simply in the form of a fraction, it always being understood to imply the fractional part of a grain of strychnia, in one grain of water.

1. Ammonia.

1. $\frac{1}{100}$th grain of pure strychnia in one grain of water, gives with ammonia an immediate white precipitate, at first amorphous, but very soon it begins to assume a crystalline form, and in about three minutes the drop becomes a solid mass of lengthened prisms.

2. $\frac{1}{300}$ gives no immediate precipitate, but in a few seconds beautiful stellate crystals begin to form, which very soon become abundant.

3. $\frac{1}{1000}$ behaves much the same as 2—not so abundant.

4. $\frac{1}{2500}$, with the microscope, crystals begin to form in about a minute, in three minutes they are very obvious to the naked eye. If the drop be rubbed with the glass rod, rings of granules are very obvious to the naked eye in a few seconds, and the ppt. is much more abundant than when not thus treated.

5. $\frac{1}{5000}$, no indication after stirring for several minutes, except when viewed with the microscope, a few granules appear.

From the above, the limit of the test, when applied to a single drop, is when it holds in solution $\frac{1}{2500}$th its weight of strychnia.

2. Potash.

This reagent behaves much the same as ammonia, its limit being about the same. In applying this test it is very important that the proper quantity of the reagent be added, for if either too much or too little, no ppt. will be produced.

3. Carbonate of Potash.

1. $\frac{1}{1000}$th grain of strychnia gives an immediate white precipitate of star-like crystals, which will redissolve if a sufficient quantity of the reagent has not been added.

2. $\frac{1}{5000}$, in a few seconds small granules, prisms, and a few star-like crystals begin to form, which soon become rather abundant.

3. $\frac{1}{10000}$, in a few seconds, lengthened granules may be observed with the microscope, in a few minutes they are obvious to the naked eye.

4. $\frac{1}{20000}$, after a few minutes small granules are very perceptible.

5. $\frac{1}{30000}$, after several minutes, no indication with the microscope.

4. Carbonate of Ammonia.

In $\frac{1}{1000}$ and $\frac{1}{5000}$ solutions the same results as with carbonate of potash. In a $\frac{1}{10000}$th solution, no indication after 15 minutes.

5. Iodide of Potassium.

1. $\frac{1}{1000}$th, solution in a few seconds gives a white crystalline ppt. of tufts of long prisms.

2. $\frac{1}{5000}$, it is several minutes before crystals begin to form; if the solution be stirred, however, they begin to appear in about two minutes.

3. $\frac{1}{10000}$, by stirring, crystals begin to appear in about five minutes.

4. $\frac{1}{20000}$, crystals begin to appear in about seven minutes.

5. $\frac{1}{30000}$, with the microscope crystals can be seen in ten minutes, in about twenty minutes they are just perceptible to the naked eye.

6. Sulphocyanide of Potassium.

1. $\frac{1}{1000}$, gives an immediate mass of white crystals.
2. $\frac{1}{5000}$, in a few seconds the crystals are very abundant.
3. $\frac{1}{10000}$, by rubbing, in a few minutes crystals begin to form.
4. $\frac{1}{20000}$, after several minutes, a few crystals may be observed upon the border of the drop with the microscope.

7. Tannic Acid.

1. $\frac{1}{10000}$, gives an immediate white curdy precipitate.
2. $\frac{1}{20000}$, gives very satisfactory results.
3. $\frac{1}{30000}$, after a few minutes the ppt. is quite perceptible.
4. $\frac{1}{40000}$, after several minutes it is just possible to observe a white cloudiness.

The satisfactory limit of the test is when it is applied to a drop of fluid holding in solution $\frac{1}{25000}$th its weight of strychnia. The ppt. is very soluble in acetic acid; and if obtained from dilute solutions, it is, also, soluble in a drop of potash, giving a red liquid; but when produced from strong solutions, the ppt. will not all dissolve in a drop of potash solution.

8. Bichloride of Platinum.

1. $\frac{1}{1000}$, an immediate yellow amorphous ppt., soon becoming granular.
2. $\frac{1}{3000}$, in a few moments an amorphous ppt, which soon becomes granular.
3. $\frac{1}{5000}$, in a few minutes the results are very good.
4. $\frac{1}{10000}$, if the solution be rubbed, small granules begin to appear in a few minutes, and soon the result is satisfactory.

9. Terchloride of Gold.

1. $\frac{1}{1000}$, gives a bright yellow amorphous ppt., which soon becomes partly granular; most of the granules float upon the surface of the drop. A portion of the ppt. collects into little yellow flakes.
2. $\frac{1}{10000}$, gives an almost immediate precipitate.
3. $\frac{1}{30000}$, gives very satisfactory results.
4. $\frac{1}{40000}$, at this degree of dulution the ppt. is still perceptible, but not satisfactory.

When the ppt. obtained from a solution containing $\frac{1}{5000}$ or less of its weight of strychnia is boiled, the ppt. will dissolve and give a yellow solution, from which it will again be deposited with little or no change upon becoming cool. If the solution contains more than $\frac{1}{5000}$ its weight, the ppt. will not entirely dissolve upon boiling; after cooling there will generally be a metallic gilding upon the sides of the tube. The ppt. produced from $\frac{1}{5000}$, or more, dilute solutions will readily dissolve, without change of color, upon the addition of a drop or two of potash solution; if then the solution be boiled it will become a fine purple color, with sometimes a purple ppt. When the ppt. is from a stronger solution than above stated, it does not readily dissolve in potash, and when the mixture is boiled it yields a fine purple solution, with more or less of purple tint.

10. Chromate of Potash.—(Yellow.)

1. $\frac{1}{1000}$, gives an immediate yellow mass of crystals, soluble in thirty drops of strong acetic acid.
2. $\frac{1}{10000}$, crystals begin to form in a few seconds, but they are not very abundant after standing 15 minutes.
3. $\frac{1}{20000}$, with the microscope a few prisms may be observed in eight minutes, but to the naked eye no indication after 20 minutes.

11. Bichromate of Potash.

1. $\frac{1}{1000}$, an immediate mass of brilliant yellow dendroidal crystals.
2. $\frac{1}{10000}$, in a few seconds much the same as 1.
3. $\frac{1}{50000}$, crystals began to form in a few seconds, in a few minutes they are abundant.
4. $\frac{1}{100000}$, in a few minutes beautiful octahedree appear, resembling those of oxalate of lime.
5. $\frac{1}{150000}$, by rubbing, the crystals are obvious with the microscope in a few minutes, and in several they can readily be seen with the eye.

The precipitate produced by this reagent is not as readily soluble in acetic acid, as that produced by the yellow chromate of potash.

12. Carbazotic Acid.

This, and the three following tests, we have formerly recommended in our lectures. The only specific account we have seen of any of them, is in the recent edition of Taylor on Poisons, in which the iodine test is suggested.

An alcoholic solution of carbazotic acid will produce with—

1. $\frac{1}{100}$ grain of strychnia an immediate yellow amorphous ppt., soon becoming tufts of a twig-like form.
2. $\frac{1}{1000}$, almost immediately a ppt., soon becoming same as 1.
3. $\frac{1}{5000}$, by rubbing a few seconds, a copious deposit of granules.
4. $\frac{1}{10000}$, in about a minute much the same as 3.
5. $\frac{1}{20000}$, in a few minutes small granules are very obvious.

13. Chloride of Palladium.

1. $\frac{1}{100}$, an immediate dirty white ppt., soluble in acetic acid, insoluble by boiling.
2. $\frac{1}{1000}$, an immediate yellow precipitate.
3. $\frac{1}{5000}$, in a few seconds the ppt. is perceptible, and soon becomes pretty good.
4. $\frac{1}{10000}$, after rubbing for several minutes a few granules can be observed with the microscope.

14. Iodine.

Of the various tests recommended for strychnia, this is the most delicate. It was applied in the following experiments, by dissolving three grains of iodide of potassium in one fluid drachm of water, and then adding one grain of iodine.

1. $\frac{1}{1000}$, immediately a copious brownish yellow amorphous ppt., soluble in alcohol and ether, but only soluble in large excess of acetic acid. The ppt. partially dissolves in a few drops of potash solution, but is immediately replaced by a dirty white precipitate.
2. $\frac{1}{5000}$, a yellowish ppt., soluble in potash, and replaced by a dirty white precipitate.
3. $\frac{1}{50000}$, the precipitate dissolved in potash gives a faint white precipitate.
4. $\frac{1}{80000}$, the ppt. is immediately produced, and soon collects into little yellow flakes.
5. $\frac{1}{100000}$, if the drop be touched with a small drop of the reagent upon the end of a glass rod, it gives immediately a very obvious yellow precipitate.

If a few drops of the last named solution be placed in a watch crystal, and a drop of the test fluid be placed by its side, and allowed to flow into the solution, as they meet yellow streaks can readily be observed, and the solution will become turbid.

15. Bromine.

This reagent was prepared by saturating a strong solution of hydrobromic acid with bromine.

1. $\frac{1}{1000}$, gives an immediate bright yellow amorphous ppt.
2. $\frac{1}{10000}$, a greenish yellow precipitate.
3. $\frac{1}{50000}$, a dirty yellow ppt., which after a time nearly all dissolves.
4. $\frac{1}{80000}$, the ppt. is perceptible but soon dissolves.

16. Color Test.

It is well known that if strychnia, or its salts, be dissolved in sulphuric acid, and then a small quantity of bichromate of potash, ferridcyanide of potassium, peroxide of lead, or of peroxide of manganese, be added, a series of colors are developed. This is known by the name of the color test. We have succeeded best by placing the strychnia, or a drop of the solution evaporated to dryness, in a watch glass, and by its side a drop of strong sulphuric acid, into which a fragment of bichromate of potash was introduced, and stirred until it imparted a yellow color; then by inclining the watch glass the colored sulphuric acid was allowed to flow over the strychnia.

1. $\frac{1}{1000}$ grain of strychnia in one drop of water, gave in a majority of a number of experiments very satisfactory results, however, in some the reactions were just perceptible. In solutions stronger than the above the results were always very satisfactory.

2. $\frac{1}{5000}$, in many cases we failed to get any indication, in others there was a faint trace of color, which very rapidly disappeared.—In no instance was there such a reaction as should be sufficient for medico-legal purposes.

3. $\frac{1}{1000}$ of a grain, dry, will always give a fine reaction; by allowing the acid to flow upon a portion of the deposit at a time, several indications may be obtained from the same deposit.

4. $\frac{1}{5000}$, dry, in a majority of instances the results were very good; in some, however they were very faint. The success of the experiment depends much on the character of the deposit left by evaporating the solution to dryness; sometimes the principal part of it is in the form of a ring, which, when examined with the microscope, consists of well-defined crystals; at others, the deposit is a confused mass distributed over the space occupied by the drop. In the latter case the result will not be nearly so satisfactory as in the former.

5. $\frac{1}{10000}$, in a number of cases manipulated differently, the majority gave no indication; some few a slight trace, but in no instance was the reaction satisfactory.

As the color test is relied upon, perhaps, more than any other for medico-legal purposes, it is important to remember that it is interfered with by the presence of morphia. When *one part of strychnia* is mixed with—

1. One part of morphia it gives very good results. The colors, however, are not so bright as with strychnia alone.

2. $1\frac{1}{2}$ of morphia. If a small quantity of this mixture is used the reaction is very good, but in a larger quantity, the reaction is just perceptible.

3. 2 of morphia. A small quantity of this mixture will give a pretty good reaction; $\frac{1}{30}$th grain gives but a mere trace.

4. 3 of morphia. A very small quantity of this mixture will give but little indication, and a larger quantity gives no reaction indicative of the presence of strychnia.

17. Physiological Test.

We are indebted to Marshall Hall for this test. It consists in administering strychnia to frogs, by which they are rendered violently tetanic; he recommended the frogs to be placed in a solution of the poison. Dr. Harley proposes to inject the liquid into the thoracic or abdominal cavity of the frog.

In the following experiments a small portion of the strychnia solution—from $1\frac{1}{2}$ to 2 grains of fluid—was taken up by a pipette, the end of which was then introduced into the stomach of the animal, and the solution dislodged by blowing through the tube. The frogs were then placed under an open glass receiver. The species used was the *Rana Halecina.—Kalm.* From experiments made upon more than one hundred individuals, we are led to believe that this species is more sensitive to the effects of strychnia than any of the other several species found in this locality; however the difference observed may have been due to some other cause than difference of species. The weight of the frogs used in the experiments detailed below, varied from 13 to 45 grains.

1. When a solution holding $\frac{1}{100}$th its weight of strychnia was used, the animals immediately became rigid, with violent tetanic spasms, and died, on an average, in 8 minutes.

2. When a $\frac{1}{1000}$ solution was used, the symptoms usually began in about three or four minutes.

3. $\frac{1}{10000}$ solution: the symptoms appeared in some in ten minutes, in others they were delayed as long as 24 minutes.

4. $\frac{1}{20000}$th solution; of 22 frogs used, in 17 of them the symptoms appeared in from 27 to 45 minutes; in the other five there were no unequivocal symptoms; there was, however, very great prostration, and some slight tetanic movements.

5. $\frac{1}{30000}$th solution; of 10 small individuals used, eight were seized in 45 minutes, the others did not show unequivocal tetanic spasms.

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