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Dissertation On Arsenous Acid

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XI.

Diſsertation
On Arsenous Acid
by
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The Authors in whose works I have met with Arsenous are the following viz

Dana. Epitome of Chimical Philosophy, Concord 1825. Page 120. 14th line

Epitome of Experimental Chimistry by William Henry M.D. 2nd American Edition Boston 1810. Page 223. 6th line from the bottom

Comstocks Grammar of Chimistry Hartford 1822. Page 155 Section 344.45.

Arsenous

The chemical nomenclature was originally formed in Latin, & the name of each element terminated in <u>um</u>, as <u>Sulphurum</u> Molybdenum &c. Of course Arsenicum was & is now the term by which the metal Arsenic is designated in the nomenclature

It is a principle in nomenclature, that when an element is known to form only one acid, with an acidifying principle, the name of that acid shall terminate in <u>ic</u> as <u>carbonic</u>. If however the same element forms two acids with one acidifying principle, the name of the acid containing the greatest number of equivalents of the acidifying principle terminates in <u>ic</u>, as Sulphuric, & the name of that, containing the leſs smaller number of equivalents of the acidifier terminates in <u>ous</u>, as Sulphurous

According therefore to the principles of nomenclature we have in the case in question

Arsenicum — the metal

Arsenic Acid — $2 As + O_5$

Arsenous Acid — $2 As + O_3$ — in analogy with

Sulphurum	Molybdenum
Sulphuric Acid	Molybdic Acid
Sulphurous Acid	Molybdous Acid &c

Is the Sesquioxide of Iron an Antidote to Arsenous Acid

Recently the attention of physicians has been called to the subject of poisoning with arsenous acid by Dr J Lawrence Smith who has published in the American Journal of Science vol XI No 2 a paper on this subject. In this paper a number of interesting points are discuſsed, the most important of which however relates to the mode of obviating the deleterious effects of this article when administered in doses or quantities too large to produce true & proper medicinal effects. Dr Smith says page 292. "the remedy most to be relied on is the hydrated peroxide of iron; it being a veritable antidote to poisoning by arsenic; however there are some objections the principal of which is the slowneſs of its absorption, for it is only where it encounters the poison that its salutary effects are displayed by forming with it an inert arsenite of iron." The substance here spoken of as the hydrated peroxide of iron is in reality sesquioxide of iron combined with one equivalent of water, and on the supposition that the compounds of of oxygen & hydrogen are acids, this compound would be a hydrate of the sesquioxide of iron.

This quotation from the American Journal of Science embodies the views of the French experimenters generally respecting the action of these two substances upon each other: and as they assert that the hydrate of the sesquioxide of iron has ~~been~~ preserved the lives of animals to which arsenous acid had been administered in poisonous doses, all the facts connected with the subject deserve a fair examination.

According to Dr Christison the hydrate of the sesquioxide of iron was introduced as an antidote to poisoning with arsenous acid by M.M. Bunsen & Berthold of Göttingen, & their results have been confirmed by M.M. Soubeiran & Miquel & by M.M. Orfila & Lesuer in their experiments on dogs; & by M Bouley who experimented on the horse.

Let us now examine critically the rationale of above given of the action of arsenous acid & the hydrate of the sesquioxide of iron upon each other.

It is said that both substances are absorbed,

& both are extravasated; ∴ then by chemical affinity an inert substance is formed & life if it had been endangered by the arsenous acid, is preserved provided the hydrate of the sesquioxide of iron becomes extravasated in time to prevent any deleterious action upon the tissues. But the proofs of this absorption & extravasation have yet to be placed before the public; nor does the assertion that the deleterious effects of arsenous acid are produced in the different tissues of the system, rest upon any ~~proof~~ evidence whatsoever. It was first shown by Couerbe that arsenic in some form was a normal ingredient of the bones, muscles & viscera. This however ~~can~~ is no proof that when life is destroyed by arsenous acid, it was first absorbed & then acted upon the tissues. Are the remedial effects arsenous acid in intermittent due to absorption & extravasation? Does it cure cutaneous eruptions when taken internally by being absorbed & then extravasated under the cuticle? I think not. If the maxim of Linnaeus be true, that all medicines are poisons, & that a poisonous is only an excessive medicinal effect, & since no medicinal effect is produced by absorption & extravasation then life can not be destroyed by this mode of operating & the action of the antidote fails to be accounted for on this principle

If however absorption & extravasation really takes place, it is reasonable to infer that these substances would appear on the surface of the body or on the transparent cornea, where they might be inspected, no such effect however has been reported.

Whether the arsenous acid is absorbed or not a question arises respecting the formation of the arsenite of iron, reported to be inert. I boiled for several hours some of the hydrate of the sesquioxide of ~~oxo~~ iron; made by precipitation with ammonia from the sulphate of the sesquioxide, ~~without observing any~~ with arsenous acid without observing any change to take place in either substance. A result coinciding with that of Mr Brett of London & confirmed by Dr Turner who says the salts of arsenous acid with the exception of the arsenite of potassa & of ammonia can only be procured by double decomposition

The vital powers it is well known sometimes suspend & sometimes allow chemical action to go on within the stomach in the same manner as without it, but I am unacquainted with any facts which favour the opinion that they cause a chemical union of substances which have no affinity for each other. It may however be said that a decomposition of the hydrate of the sesquioxide of iron is effected in the stomach or in the tissues so as to present the protoxide of iron in a nascent state to the arsenous acid, which under these circumstances combines with it, thus forming the inert arsenite of iron above mentioned; This leads us to an examination of the changes produced in the medicinal powers of an article by chemical combination. Some substances in their elementary states are medicinally inert, but by combination they receive certain peculiar & distinguishing medicinal powers which are imparted to all the compounds into which they enter. For example, metallic antimony is inert; but all of the compounds of antimony are more or less refrigerant. Metallic iron is inert, but all its compounds are tonic. It is also true that two elements which are each separately inert, by combination give rise to a body possessing medicinal properties; as nitrogen & hydrogen which are themselves inert, ~~by~~ but ammonia is medicinal. Nor do elementary bodies, as Iodine for example, possessing medicinal powers lose those powers by chemical combination, though they may in a given specified compound be exalted or ~~str~~ weakened. Neither is the iodide of potassium nor that of iron inert. There are therefore two classes of medicinal agents; viz. those which ~~post~~ in their elementary state, possess medicinal powers, & those which in that state are inert, but which by combination become medicinal. When however the power of producing medicinal operative effects upon the system depends upon some external & sensible property of any ~~body~~ substance as acidity or acridness, this power is most commonly destroyed by combination. This law has many exceptions; some salts are neutral; in others the acid predominates & in others the external & sensible properties of the base are unimpaired. Since therefore the external characters of bodies are not destroyed by chemical combination we cannot fairly infer that their occult properties are at all affected; and indeed if in all cases of chemical combination those properties of the constituents of a compound which are conizable by the senses were destroyed; no inference can therefore be made respecting the destruction of properties not cognizable by the senses. The generally received opinion which regards every change of form . . as destroying one set of properties in an article I believe to be incorrect; changes of form by chemical combination may invest it with new powers -may exalt or weaken those it originally possessed, but none of them are lost, unless they depend upon sensible character. On the contrary the fact that cyanogen acts medicinally as cyanogen in all its combinations, (provided a sufficient ~~dose~~ quantity of the compound is taken to get a dose of the article) is a striking proof that a decomposition of the cyanogen & a recomposition of its elements has not taken place in the formation of the new body.

If this reasoning be correct the arsenite of iron should not be an inert article. Arsenous acid when combined with potassa will if taken in sufficient quantity produce the deleterious effects of the crude acid. The insolubility of the arsenite of iron is no argument against its being active. Calomel is insoluble & is an active article; and arsenious acid itself exceedingly active as it is is a nearly insoluble substance

There is however direct testimony on this point. Mr. Brett says that the hydrate of the sesquioxide of iron will not decompose the arsenite of potassa, but the sulphate of the sesquioxide will decompose it; that the hydrate of the sesquioxide of iron administered to a rabbit a few minutes after a small dose of arsenic had no apparent effect in retarding its death; & that gr V or VI of a carefully prepared arsenite of iron seemed to act nearly as fast as the arsenic itself in destroying life. It may be stated in this connection that the smallest dose of arsenious acid ever known to destroy life was gr iiss which proved fatal to a child four & a half years old in six hours after it was taken. In concluding his article on arsenious acid Dr Christison adds respecting this antidote says, "From the circumstance that

Orfila & Bouley & others have found it neceſsary to give the sesquioxide of iron in very large quantities in proportion to the arsenic, so as to obtain any good effect, it seems probable that this substance like charcoal powder & magnesia is not a true antidote; but may neverthelefs be occasionally of use by enveloping the coarser powder of the arsenic with its fine impalpable adhesive particles" How much good the sesquioxide of iron may do in this way or whether it does any I am not prepared to say. From the reasons above given I am certain that it cannot be an antidote to arsenious acid; & if it is serviceable at all in obviating the deleterious effects of this substance, the method pointed out by Dr Christison appears to be the only one poſsible by which service can be rendered.