

Decomposition of Carbonate of Ammonia<sup>ammonia</sup> by Gypsum.

Mr. Nugent

Dear Sir

The mutual decomposition of Gypsum and Carbonate of Ammonia, though admitted by most writers on chemistry, has recently been a subject of much controversy in this Province; and as the question is of some importance in agriculture, you may be willing to publish a few additional facts <sup>relative</sup> on the subject.

In some papers lately published in the Colonial Farmer, I attempted to apply this decomposition to some practical uses; and had previously convinced myself of its reality, by some experiments, which I did not publish, from a wish to avoid tedious details, and from a belief that the authority of Liebig & Johnston would form a sufficient guarantee <sup>for</sup> its truth. I have now however the pleasure of communicating to you a more complete series of experiments, performed by James S. B. Fraser Esq. of Pictou; ~~and~~ which, though originally undertaken merely to satisfy himself upon the subject, he has permitted me to publish.

To a quantity of powdered gypsum, previously ascertained to be free from carbonate of lime,\* a solution of Carbonate of Ammonia was added; considerable effervescence took place, the gas disengaged appearing to be Carbonic Acid. The mixture was allowed to stand for 24 hours, and was then filtered; the solid matter carefully washed, and the liquid boiled down to one fourth of its original volume, when it deposited a quantity of crystals of sulphate of lime, showing that the gypsum had been in excess.

Assuming that decomposition had occurred, as stated by Liebig, the liquid separated by filtration should contain Sulphate of Ammonia, and the solid matter should in part consist of Carbonate of Lime; whereas if no change had been effected, the former should be a solution of Carbonate of Ammonia, and the latter the powder of Gypsum, as at first. To decide this the following process was employed.

\* Most of the common gypsum contains a little carbonate of lime.

To a portion of the filtered liquid lime water was added, when the solution which had before no smell emitted the odour of ammonia. To a second portion was added pure potash, when a strong ammoniacal smell was disengaged. Into a third portion was poured a solution of muriate of lime, which produced no milky or precipitate, but in a short time caused abundance of crystals of sulphate of lime to be deposited. These experiments showed that ammonia was present in the solution, and that it was not in the state of a carbonate; and afforded a presumption that it was a sulphate.

To establish the point more clearly the presence of sulphate of ammonia, Nitrate of Barytes was added to a fourth portion of the solution, and produced a precipitate of Sulphate of Barytes, in too large quantity to have been caused by any sulphate of lime, which could have been present, in the portion of the liquid employed.

The solid matter remaining on the filter, having been mixed with a little water, citric acid was poured upon it, when a violent effervescence ensued, showing that a large proportion of the sulphate of lime had been brought to the state of a carbonate; and since the former experiments showed that the carbonate of ammonia poured upon the gypsum, had become sulphate of ammonia, no doubt remained that double decomposition had actually occurred.

"To understand the cause of such a decomposition we must take into account not merely the affinity of the ammonia for the Sulphuric acid, but that of the lime for the carbonic acid. Thus if the affinity of lime for sulphuric acid be represented by 80, and that of ammonia for the same acid by 70, the lime will be the stronger, and can, when by itself, expel ammonia from its union with sulphuric acid; but if carbonic acid be <sup>combined with the ammonia</sup> present, and if the affinity of lime for carbonic acid be equal to 50, and that of ammonia for the same acid be 30, then double decomposition must ensue when carbonate of ammonia is brought into contact with sulphate of lime. For the forces preventing decomposition are the affinities of sulphuric acid for lime and carbonic acid for ammonia, that is  $80 + 30 = 110$ ; while those tending to cause de-

composition, are the affinities of Sulphuric acid for ammonia and of Carbonic acid for lime, or  $70 + 50 = 120$ ; and the latter being most powerful, the constituents of the salts will change places."

The question of the practical utility of this property of gypsum, involves some farther considerations. The experiments noticed above, show that the Carbonate of ammonia produced in the decay of various liquid manures, and which escapes into the air, may be converted into sulphate of ammonia, and retained in the liquid, by gypsum. They also show that the small quantity of carbonate of ammonia contained in rain water, will be converted into a sulphate, when it comes into contact with gypsum in the soil. But these experiments do not prove that gypsum can absorb and decompose carbonate of ammonia, when emitted in the state of vapour from stables, or diffused in the same form in the atmosphere. To decide the latter point, the following means were used.

Some powdered gypsum spread over the bottom of a flat box, and moistened, was exposed in a stable for four days. It was then washed and the water separated by filtration, and boiled down to half its former bulk. A portion of the water placed in a phial, gave, on the addition of pure potash, a very faint ammoniacal odour, but a feather dipped in muriatic acid, and held over its surface, distinctly showed the evolution of ammonia. By other processes, similar to those before noticed, it was ascertained that the salt of ammonia present in the water was the sulphate.

It is therefore evident that moist gypsum is capable of slowly absorbing and decomposing the vapour of carbonate of ammonia. It must therefore be useful when spread over fermenting manures, or the floors of stables, both in ~~the~~ diminishing their ammoniacal odour, and in preserving the ammonia which is being dissipated in the air. It is however probable that dry gypsum can exercise very little influence in this way; and it is also probable that, in many stables, carbonate of ammonia may be produced in so great quantity, that a little gypsum spread upon their floors, may not be able to decompose it.

with sufficient rapidity. These considerations enable us to account for some failures in the use of gypsum as a retainer of ammonia, and also to some extent limit its efficacy. On the whole, however, this application of gypsum, should, <sup>probably</sup> be considered one of the most important of its ~~various~~ agricultural uses.

While I hope that the experiments above detailed, will be sufficient to convince intelligent farmers of the correctness of the views on this subject entertained by most agricultural chemists, I should be very sorry to make them a pretext for underestimating the merits of the Colonial Farmer. The opinions of Liebig on this subject were advanced in his report without any formal proof; and I have no doubt that Mr Smith, in questioning their accuracy, was influenced by a regard to the interests of truth, and ~~by~~ a fear of adding to the false opinions already too ~~prevalent~~ prevalent, by adopting a new and improved opinion.

Pecton Oct 7, 1843. yours  
J W Dawson

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Le can fronte  
of 2 y Carb Strum.

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I have sent this from a wish to settle the controversy about Gypsum & of ammonia. If you print it do it correctly - as a few small errors might spoil it yours respectfully  
J W D