

**SULPHATE OF AMMONIA:
ITS CHARACTERISTICS
AND PRACTICAL VALUE
AS A MANURE**

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Sulphate of Ammonia: Its Characteristics and Practical Value as a Manure by R. Warington

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R. WARINGTON

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Characteristics and Practical Value

AS

A MANURE

By

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PART I

**HISTORY AND CHARACTERS OF SULPHATE
OF AMMONIA**

THE MANUFACTURE OF AMMONIA SALTS

The earliest forms of Ammonia with which men became acquainted were, apparently, Sal Ammoniac and Spirits of Hartshorn. The *sal ammoniacus* of Pliny, and other ancient writers, appears from their account of its origin and properties to have been simply rock salt. The true sal ammoniac (chloride of ammonium) was certainly known to the Arabians in the twelfth century, and is spoken of as imported from Egypt and India. It is mentioned in the Custom-house tariff of the city of Pisa in 1408. In 1716 the Jesuit Sicard describes the process for manufacturing sal ammoniac at Damayer in lower Egypt. The soot obtained by burning camel and cattle dung as fuel was collected, and heated in closed vessels, the sal ammoniac subliming into the upper cooler part as a solid cake. Sea salt and urine were, according to some accounts, added to the soot.

Small quantities of sal ammoniac occasionally occur as a sublimate in the crevices of volcanoes; this occurrence was first recognised by Porta towards the end of the sixteenth century.

In Europe, during the eighteenth and early part of the nineteenth centuries, ammonia was generally prepared from

the alkaline liquor obtained by the destructive distillation of horn or bone. The products of the distillation consisted in part of an aqueous liquid containing much carbonate of ammonia, and in part of a fœtid oil floating above it. After removing the oil the ammonia was separated either by crystallisation as sulphate, or by sublimation as chloride. Until the introduction of coal gas for lighting purposes the distillation of horn, bone, feathers, wool, blood, soot, and other nitrogenous organic substances was the process almost universally resorted to for the manufacture of ammonia. At the present day ammonia salts are still obtained as bye-products of the distillation of such materials, but the quantity thus manufactured is relatively very small.

The use of coal gas for illuminating purposes commenced with the beginning of the present century; the first building—Boulton & Watt's Foundry in Soho—being lit with coal gas in 1798, and the first street—Westminster Bridge—in 1813. The ammoniacal liquid and tar produced by the distillation of coal were for many years literally *waste* products. The ammoniacal liquid appears to have been occasionally diluted and applied to land as a manure, but with unsatisfactory results. The position of affairs in 1842 may be gathered from two paragraphs in the excellent Prize Essay by Dr. George Fownes, published in the *Journal of the Royal Agricultural Society*, IV., 498. On page 541, he says:—

“The only purely azotized manure is the ammoniacal liquid of the gas works This liquid has been tried by many persons as a manure for corn, but with very variable success, as may be expected from its indefinite nature. . . . The best mode of using this substance will certainly be to reduce it to an impure ammoniacal salt, sulphate or chloride, so as to get rid of the sulphuret, sulphite, etc., which can hardly fail to be prejudicial to vegetable life, and then to apply such salt scattered over the ground in a sparing manner; always on the supposition that the compounds mentioned have been shown to be capable of assimilation by the plant.”

At the close of his essay, his knowledge of the enormous quantity of nitrogen stored in coal leads him to a prophetic

utterance, which after more than fifty years have passed seems nearing its fulfillment. He says:—

“In terminating these remarks on the subject of manures, I would once more call attention to the salts of ammonia. Should these really be found to produce the beneficial effects anticipated, we shall possess at home, within the limits of our own island, resources for the improvement of agriculture, compared with which guano and nitrate of soda, and all such things, are quite insignificant; resources which only require to be judiciously used to produce the most extraordinary results. Coal contains nitrogen. When distilled at a red heat for the purpose of getting illuminating gas, the greater part of this nitrogen unites with hydrogen, and gives rise to ammonia, which is afterwards separated more or less completely, and manufactured, although frequently in a very wasteful and imperfect manner, into ammoniacal salt. Admitting that coal contains one per cent of nitrogen which can thus be employed (a supposition probably not far from the truth), it is easy to see what a prodigious quantity of ammonia might be furnished by our coal-gas works, properly conducted.”

We must now refer in a little more detail to the production of ammoniacal salts from coal, which furnishes almost the whole of the enormous quantity now manufactured, and is capable of still further development.

Coal (excluding anthracite) usually contains 1.2 to 1.6 per cent of nitrogen; the average proportion may be taken as about 1.33 per cent. Anthracite contains about 0.9 per cent. About 90 per cent of the coal annually consumed is burnt in such a way that none of the nitrogen which it contains is obtained in a useful form. It is only when the coal is heated in closed vessels that the manufacture of ammonia salts becomes possible. The most favourable conditions for the recovery of the nitrogen in the form of ammonia are those found in a gas works, but even here only a small proportion of the nitrogen originally present is finally obtained as ammonia, the proportion so obtained never exceeds one-fifth, and sometimes is no more than one-tenth of that originally present in the coal. One ton of coal containing 1.33 per cent