

TRAINING MATERIAL

Title:

Technology for N recovery as liquid fertilizer starting from liquid manure or biogas digestate with plasma manure processing system

Training:

What is the technology?

N2 Applied's manure processing unit enables local production of nitrogen (N) fertiliser using only air, electricity and a liquid organic substrate (animal slurry or biogas digestate). The technology enriches the organic substrate with nitrogen from the air, creating nitrogen enriched organic fertiliser (NEO). The enrichment process also makes the fertiliser slightly acidic, which stops the formation and emission of ammonia (NH_3)

Who is the vendor of the product?

N2 Applied is the Norwegian technology company that aims to fundamentally improve global food production by increasing yield and reducing emissions. N2 has developed a patented technology that enables farmers to produce fertiliser using slurry or digestate, air and electricity. The key product of the company is the nitrogen enriched fertiliser effectiveness which is on par with chemical fertiliser.

Which are the advantages of the technology and the problems addressed?

Processing slurry or digestate with N2 technology reduces ammonia and greenhouse gas emissions in storage and field application. And by adding nitrogen directly from air, the liquid organic substance is enriched with nitrogen and turned into Nitrogen Enriched Organic fertiliser (NEO). The NEO fertiliser has an increased nitrogen use efficiency compared to untreated slurry or digestate and matches the performance of chemical fertiliser. Additionally, the smell is removed. Last but not least this significantly improves the carbon farm's footprint by reducing the use of chemical fertiliser, stopping methane emissions from slurry and digestate and reducing indirect nitrous oxide emissions which are directly related to ammonia emissions.

How is the technology implemented on the farm?

The N2 unit is a device that is easy to install on a farm and only needs a 400V 3-phase electricity connection to operate. The unit can be delivered on site in a 20 ft container or installed in any location that is ventilated. The unit is connected to internet for remote monitoring and support. It needs a liquid input stream and storage for the liquid output stream. The liquid input stream needs to meet the <3mm particle size and <8% DM requirements. Pre-processing with a filter or separator is advised and sometimes needed. The liquid input requires a buffer storage for the liquid input stream.

The unit is provided with a pump to transport liquid product into the unit for processing. The unit pumps the treated product frequently (semi-batch) into a separate storage. This storage needs to be provided by the farmer.

How does it work?

One method of alleviating the NH_3 emission from animal slurries is acidification, which works by lowering the pH of the substrate, favoring NH_4^+ in solution rather than forming gaseous NH_3 . This can offer a solution to NH_3 loss both in storage and on field application. The plasma treatment technology acidifies slurry or digestate in a sustainable way while also increasing the N content of the substrate to form nitrogen enriched organic substrate NEO. Unlike other acidification methods, which use sulphuric acid inputs to lower pH, N2 Applied's solution uses only air and electricity, removing the need to handle dangerous chemicals. N2 Applied's technology consists of a two-stage process which neutralizes liquid organic waste by absorbing activated ambient air into the liquid phase of slurry or digestate. With the small-scale plasma unit running on electricity, nitrogen in the air is fixed as NO_x . In the absorption system this NO_x reacts with water and oxygen in the slurry or digestate to form NO_3^- , a process that also acidifies the solution by releasing H^+ ions, shifting the equilibrium from NH_3 to NH_4^+ .

Turning slurry/digestate into NEO:

The mineral-N content from the input product is generally doubled by the plasma treatment. Assuming a digestate containing 4 kg Total-N/ m^3 of which 2 kg $\text{NH}_3\text{-N}/\text{m}^3$, treatment generally results in 6 kg Total-N/ m^3 with 4 kg mineral-N/ m^3 available as ammonium nitrate. The ammonia-N in the untreated product is stabilized as ammonium nitrate in the treated product. This significantly reduces the emission loss. Assuming an untreated digestate containing 4 kg Total-N/ m^3 of which 2 kg $\text{NH}_3\text{-N}/\text{m}^3$, a large part of the ammonia will be lost in storage or during application. Assuming 30% ammonia loss, around 1.5 kg-N will remain available for plant uptake, compared to more than 4 kg-N for the treated product. This means that the treatment nearly triples the crop available N rather than doubling it.

Which are the authority permits in which EU countries?

The N2 unit complies to CE Directives 305/2011/EU (Construction Products Regulation), 2014/30/EU (Electromagnetic Compatibility Directive) and 2014/35/EU (Low Voltage Directive). The NEO product still falls under Nitrate Directive regulations.

For other information: https://nutriman.net/farmer-platform/technology/id_276

or visit our website www.n2applied.com





The N2 unit

