

Oliver Arnold of Arnold & Partner introduces the company's 'zero liquid discharge' system, creating pellets from agricultural waste

# Zero liquid discharge – from slurry to pellets

Increasing livestock density globally is generating so much slurry that its nutrients cannot be spread on local farmland. Ground water contamination caused by overfertilisation is lowering the acceptance of our agricultural structures and stricter laws have been passed recently, especially in Germany.

The problem becomes even more visible when considering all the storage volume and transport needed to move the slurry to nutrient-poor areas. Economic and ecological steps towards reducing the water content of slurry must be found, as the substance contains more than 90% water. In the Netherlands, it is not uncommon that slurry is transported to Ukraine, costing up to €40 per cubic metre during winter months.

In regions with lots of livestock, there are many biogas plants to digest the slurry with additional waste, generating gas, producing electricity and heat via a combined heat and power (CHP) plant.

Until now, there have been many installations where solids and fibres are dried in a belt dryer after the slurry has been separated in a screw press separator. As most of the nutrients can be found in the liquid part after separation, there is not much volume reduction by simply drying the solid material. Mostly, these installations are constructed to benefit from subsidies by using the waste heat from



Zero liquid discharge building with the Arnold multistage vacuum evaporator

the CHP facility. But there is not enough heat available to also dry the liquid part.

To process the liquid part after the separation, some reverse osmosis installations have appeared in recent years, but most of them are no longer operational due to clogging, high electricity usage, and because they demand a very fine pre-separation of the solids and generate multiple end products with different ingredients, which is not optimal for further processing.

For some years, thermal evaporation units -mostly under vacuum – have been appearing on the agricultural

market. This can be a highly efficient way to separate the nutrients from the water with a high level of purity and high concentration. This technology has proven to be sophisticated; at least Arnold & Partner can say that from its experience.

Liquid evaporation can be designed in a 'multistage' version to recover the heat multiple times, making this technology much more efficient than drying.

Nevertheless, sometimes it could make sense to combine both technologies to have no liquids and be able to sell a conditioned, tradable product. This can

be realised by concentrating the liquid phase in a vacuum evaporator, as long as it is 'pumpable', and then drying the concentrate in a dryer up to 90% of DM. The dried product can be pelletised.

This whole process is called 'zero liquid discharge' and there are already specialised applications in the chemical industry, but it has not been realised with slurry or digestate, especially at agricultural biogas plants.

**'Zero liquid discharge' in agricultural biogas plants**

With more than 35 years of experience in handling slurry,

Arnold & Partner has planned and successfully commissioned worldwide the first zero-liquid discharge installation processing digestate from agriculture origins, using the waste heat which was generated by the substrate itself in the biogas plant.

At the heart of the whole installation is Arnold's own product: the Arnold vacuum evaporator. The evaporator, as the whole process, combined with the dryer and pelletiser, is highly automated, odourless, robust, and requires stunningly low maintenance. Directly after pressing, the hot pellets can optionally be batch stored for one hour over 70°C for sanitisation reasons, which is often required when exporting.

“Our evaporator has several advantages in comparison with other competitors for coupling with a dryer regarding



Nutrient pellets in big bags

consumption of heat, electricity, and concentration grade. This results in needing a smaller dryer, affecting investment and running costs.

“Another big plus of our special process is that all the nutrients in the origin substrate will also be found in the pellets, without

any loss. Other processes cannot keep the ammonia in the product without its volatilisation. They regain it in a sour washer generating ammonium-sulphate-solution as a side product.”

There are many benefits to capturing nitrogen: during storage and by spreading

the slurry on the fields in a traditional way, a large quantity of ammonia can be volatilised, causing a huge impact to our environment, whereas when captured being a valuable fertiliser.

Enough fertiliser exists from livestock. When we process part of the slurry into pellets and bring them where the nutrients are needed, by using much less transport capacity, we are closing cycles and do not need to import artificial chemical fertiliser and so further reduce resources and energy. This is exactly the way to go in the near future.

In the meantime, there are also buyers and distributors for this type of pellet from agricultural origins. A guaranteed sales price makes the business case more secure. ●

**For more information:**

Visit: [arnold-partner.ch/index.php/en/vacuum-evaporator](http://arnold-partner.ch/index.php/en/vacuum-evaporator)

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