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A short introduction to Waterleau

- **Waterleau Group** is an environmental services company in the field of water, air and waste treatment.
- **Waterleau NewEnergy (WLNE)** is an anaerobic digestion (AD) plant located in Ypres (West-Flanders, Belgium).
- **The plant** is operational since 2012 and can process around 120 kilotonnes (kt) of feedstock at mesophilic regime.



DESCRIPTION OF BUSINESS/PRODUCT

Nutrient Recovery & Reuse (NRR) technology

- **Feedstock:**

- mixed and heated up to 40°C.
- AD takes place for approximately 30 days in mesophilic digesters (and 10 days in the post digester).
- Generated digestate is hygienised (1 hour 70 °C) and solid/liquid separated by means of a decanter centrifuge.

- The **Solid Fraction** of digestate:

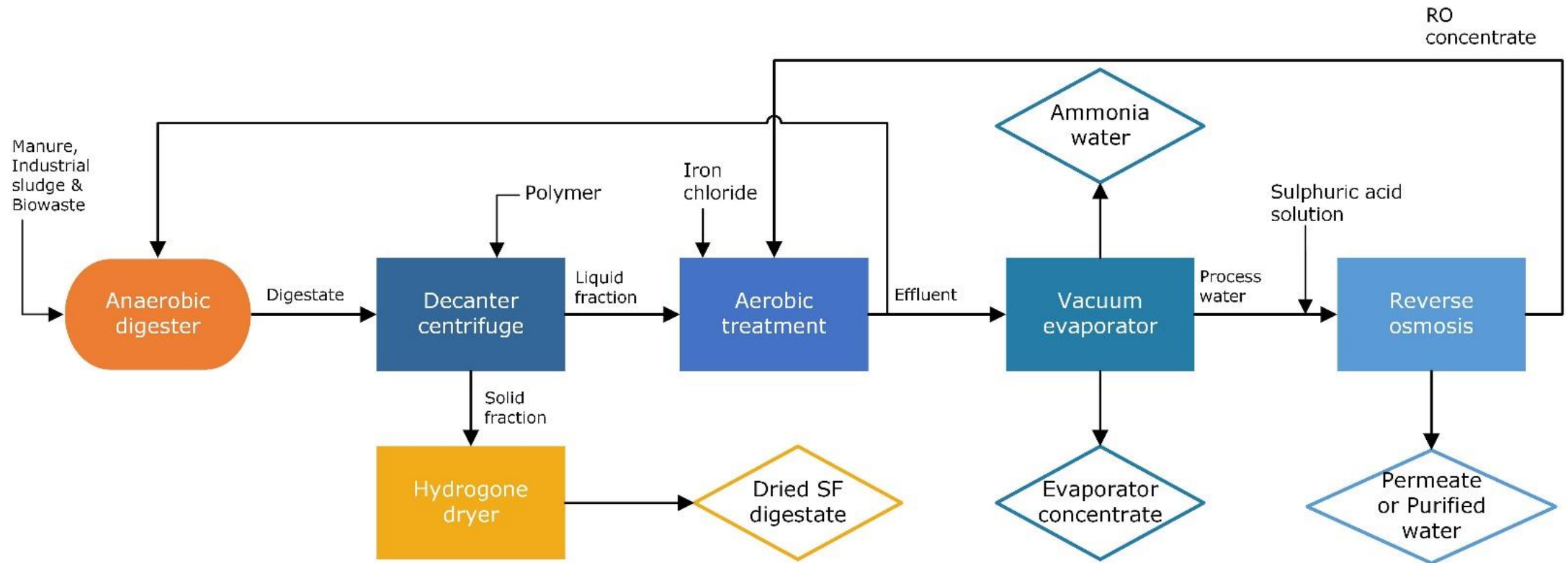
- is dried in a Hydrogone® dryer. This is an indirect dryer which can evaporate 1-1,8 tonnes of water per hour.
- With this type of dryer, there is no direct contact between hot air and the SF of digestate. Instead, the SF of digestate is mixed with discs filled with steam. This in turn reduces ammonia (NH₃) losses.
- Flue gas from the drying step is cleaned by an air scrubber to produce air scrubber water, recirculated in the process.

- The **Liquid Fraction** of digestate:

- is processed in an 'aerobic' basin for stabilization of the organics.
- The effluent subsequently flows to an evaporator where it is heated at 50-60 °C.
- NH₃ and water partially evaporate and are largely separated from each other based on volatility in the 4 consecutive stages of the evaporator.
- After condensation of these gaseous streams in the condenser the following three products are generated:
 - Currently, **ammonia** water finds application in exhaust gas treatment as DeNOx agent.
 - The **process water** generated from the evaporator is treated in an RO system before being reused in the digestate processing cascade or discharged.
 - The **evaporator concentrate** is either mixed with the dried **Solid Fraction of digestate**, used in **formulation NPK of compost** or **exported** to the Netherlands

Type	Mass
Manure and solid fraction manure	32 kt
Industrial sludge WWTP and other biowaste	37,9 kt
Glycerine and molasses	1.1 kt
Total	71 kt

DESCRIPTION OF BUSINESS/PRODUCT



MARKET

Nutrient Recovery & Reuse (NRR) technology

- At Waterleau NewEnergy (WLNE), digestate is upgraded into valuable biobased fertilizers:
- Dry solid fraction (SF) of digestate is dried and composted in Flanders.
 - This product has a positive effect on the dry matter (DM) content and structure of the compost.
 - The proximity of WNE to many composting companies and the French border reduces transport costs,
 - and the product containing concentrated nutrients is well accepted in northern France.
- The evaporator and RO produce permeate or purified water, condensed ammonia water and an evaporator concentrate.
 - Condensed ammonia water is not suitable as fertiliser, because of its high pH (>10) and therefore also high risk of NH₃ volatilisation and crop burning.
 - The solution is sold to a Belgian waste incineration plant and used as reductant for the DeNO_x exhaust gas treatment system.
 - The evaporator concentrate with high potassium (K) concentration is traded as fertilizer.
 - Alternatively, it is mixed with the dried SF of digestate. In both cases, it is exported to France or the Netherlands.
- Reverse osmosis (RO) permeate is reused as process water, for heat recovery or discharged after further polishing to surface water.

Table 5. Composition of the recovered products at Waterleau NewEnergy

	Digestate	Dried SF of digestate	Evaporator concentrate	Ammonia water	Purified water
Dry matter (g kg ⁻¹)	57	904	187	-	-
Organic matter (g kg ⁻¹)	33	637	91	-	-
N-total (g kg ⁻¹)	6.5	29	13	96	0.63
P-total (g kg ⁻¹)	1.0	24	2.1	0.0005	0.000024
K-total (g kg ⁻¹)	3.9	15	22	0.00055	0.000073
S-total (g kg ⁻¹)	0.93	10	11	0.5	0.0022

Dry solid fraction mixed with evaporator concentrate



Ammonium Sulphate - $\text{NH}_4 - \text{SO}_4$
based on a new concept developed
within WLNE: Capex vs pricing

Drivers for nutrient recycling

- **Economic benefits**

- The province of West-Flanders is a nitrate vulnerable zone, characterised by intensive pig husbandry and manure production that exceeds the capacity of the province to allow manure application on fields within legal limits. As a consequence, manure and manure derived digestate has to be exported.
- Long distance transport of manure/digestate outside the province of West-Flanders is expensive and Waterleau NewEnergy has implemented the biogas plant with a cascade of nutrient recovery and reuse (NRR) technologies oriented towards the reduction of digestate volume and the up-concentration of nutrients into mineral and organic products and reduce the volumes that need to be transported, thereby saving costs for transport.
- Table 6 shows the economical benefits of the NRR system at WNE, compared to the conventional treatment of digestate.

Without NRR	t y ⁻¹	€ y ⁻¹	€ t ⁻¹ digestate
Digestate	65 000	975 000 – 1 300 000	15 - 20
Without NRR	t y ⁻¹	€ y ⁻¹	€ t ⁻¹ digestate
Evaporator concentrate (30%) + Dried SF (100%)	2 500 + 3 000	0	0
Evaporator concentrate (70%)	5 833	244 986	3.8
Condensed ammonia water	724	7 240	0.11
Total		258 610	3.9

DRIVERS – what's our story

- Technical:
 - innovations is tremendously
 - WLNE developed his proper technology
 - $\text{NH}_3 \gg \text{NH}_4\text{-SO}_4$ (fertilizer)
 - Evaporator concentrate > new technology for drying
- Economic:
 - real benefits > transport, reduce waste, create green products
 - Opportunities: We don't invent the warm water, but we use it for a better result
- Social:
 - green deal, sustainability, footprint, ...
- Environmental:
 - solve the problem of today and tomorrow
- Legal/Regulatory:
 - Communication: very difficult
 - manure, waste: better control at the source, not the end user

BARRIERS

- What's all about:
 - WLNE will switch from Electricity production >>> biomethane based on market evolution
 - invest 5.000.000€
 - How does our future look like?
 - Example: NH₃ - Ammonia
 - NH₃ water was certified and got a permit as fertilizer since 2013
 - 3/8/2021 (holiday –time): withdraw permit by simple email >>> product became manure - product
 - Transport from ADR >>> ADR +GPS
 - Regularization time: 30 days

BARRIERS

- Economic:
 - How to invest in the future if there is no honest competition
 - prices of end products are 1/10 compared to chemical or artificial fertilizers based on how they can be used (170 kg N rule)
- Social:
 - Manure > very negative image > why so negative?
- Environmental + Legal/Regulatory:
 - 10 years ago there was much more certainty to invest, now a day how to get a permit
 - There is a lack of vision towards the future
 - Decision making takes too long
 - Communication is almost impossible (no calls – only by mail)
 - Contradiction
 - Biomethane: use of manure stands for max CO₂ reduction
 - The use of manure in operations creates 10 times more difficulties to get a permit only based on N-emission cfr upcoming legislation
 - Creates a lot of uncertainty



Dry solid material with evaporator concentrate



MANURE



MANURE



Ammonium phosphate
 NH_4

WAY FORWARD / RECOMMENDATIONS

- Renure
 - New European Projects since 2018 > project **SAFEMANURE**
 - “**re**covered **n**itrogen from man**ure**” as fertilizer replacer
 - Waterleau New Energy produces already 10 years cfr Renure
- Create more trust: manure/waste: better control at the source (producer)
- Conclusion:
 - promises or a dream becomes real
 - Flanders... or **1-EUROPE?**

Q/A

- More questions?
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