TEFSA Filtration Equipment
General Document

LIQUID MANURE TREATMENT PLANT

PROJECT DEVELOPED BY:

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FINAL TREATMENT PLANT

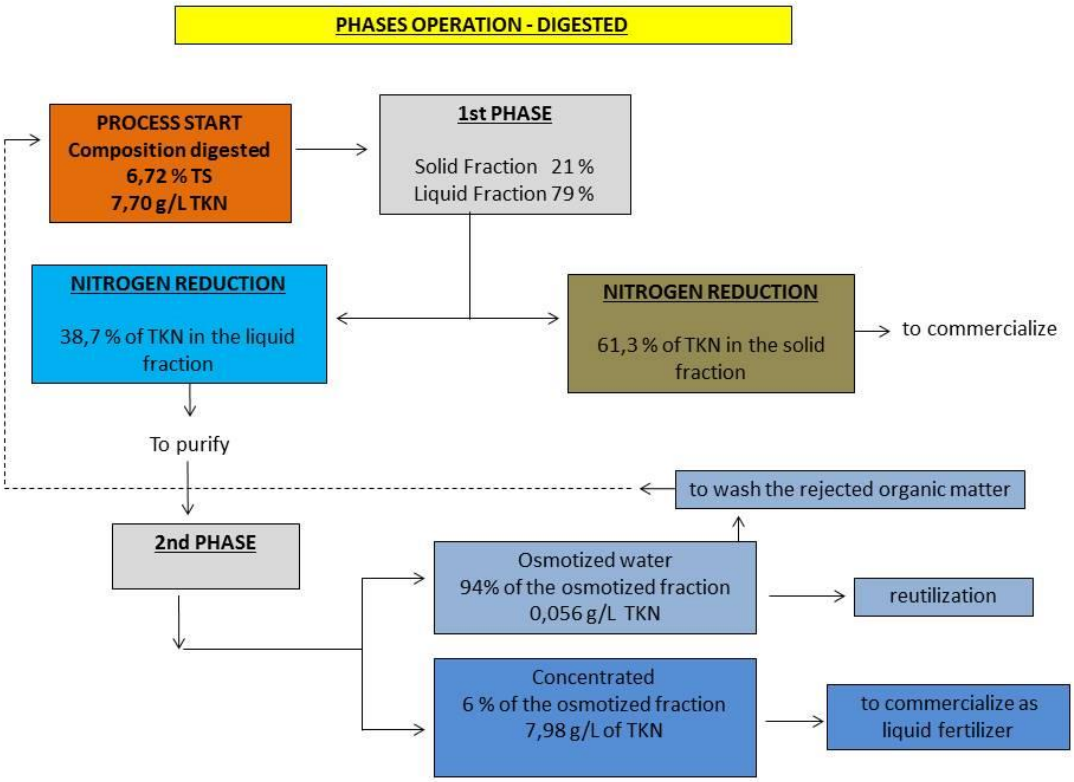
The purpose of the final treatment plant for liquid manure is to eliminate wastewater from the farms and the product generated in a biogas plant in a viable manner.

This process can be divided in two phases; in the first one we obtain a concentration in the separation of the liquid-solid of 61.3% of nitrogen in the solid fraction and of a 38.7% in the liquid fraction.

These percentages may vary depending on the amount of dry material and nitrogen contained in the product to be treated, mainly if they are digested from biogas plants or slurry according to their origin (from fattening pigs, farmed sows, etc.)

As can be seen in the table in the first phase, we obtain 79% of water with negligible organic matter content and 38.7% of salts; the organic matter representing 21% of the total treated will contain 61.3% of the salts.

This first phase is very suitable for installations that have irrigated land since the water resulting from the first phase could be applied to irrigation fertilizer.



From this process we obtain 3 products that are the following:

- Solid Fertilizer
- Semi-Liquid Fertilizer
- Osmotized water

1st water phase / Osmotized / Concentrate

Solid obtained

The management of these products can be done as follows:

- Manage the solid product as organic fertilizer of high quality. The quality of this product can be enriched with the contribution of semi-liquid fertilizer, in which an important part of the nutrients contained in the digestion is concentrated.
- This product has a very interesting market option in order to make it profitable
- Manage the semi-liquid concentrate fertilizer as a liquid fertilizer incorporated into an irrigation system or enrich the solid fertilizer, as mentioned previously.
- Utilize of the osmotized water for reuse for washing, irrigation or, if necessary, pour it into public water (with the corresponding authorization).

In case of interest, the product resulting from the solid and semi-liquid fertilizer can be processed by incorporating a drying system and subsequent granulation, which increases its value significantly.

Once this process is completed, we will have eliminated the manure and the organic products used in the production of biogas and we will have valued them for possible commercialization.

This process has the advantage that it does not produce any type of contamination and provides an environmental improvement to the territory from which the slurry and waste from the agro-food industry comes from, given the contamination of the territory by nitrates from the slurry used in the agricultural use of fertilizer of the fields and that, in some occasions, cause a contamination of the aquifers.

Economically, it is a very viable solution since its cost of treatment is maintained in parameters that the livestock industry can assume and that in addition, the commercialization of the resulting products can bring an economic income that can reduce said cost of treatment.

Below we briefly describe the equipment installed in a treatment plant with a capacity of between 4 and 5 m^3/h.

The main equipment of the treatment plant of the digestion are:
The manure or the digested is pumped through a labyrinthine mixer where the flocculants are added to the belt filter press, where a first separation of the solid fraction from the liquid is carried out. The solid fraction of output will be sent to a collection vessel, to be either treated for marketing or retired to fertilize the fields.

Product inlet/feeding in the Belt Filter Press

Outlet of the solid product

The liquid fraction of the outlet of the belt filter is sent to the feeding regulator tank and from there to the flotation unit. From this buffer tank it is passed to a mixer which homogenizes it with the flocculation regulation products added above, which liquid product is then treated in the flotation unit.

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Flotation Unuit

1st phase (liquid)

The outlet liquid product of the flotation unit is sent to a buffer or resting tanks and from there to the installed security filters that will retain the larger particles to the desired one; after going through these filters, the liquid product enters the regulating deposit to be treated in the first osmosis.

Belt Filter Press filtrate tank

Security filter

Storage deposit

The reverse osmosis feeding tank is equipped with a pH value correction system in order to condition the product before entering the osmosis membranes.

The reverse osmosis equipment consists of membranes contained in the membrane carriers, and is designed in order to be able to perform the reverse washes and the necessary chemical washes.

From this process three products are obtained: osmotized water, remaining water still containing salts, and the rejected product.

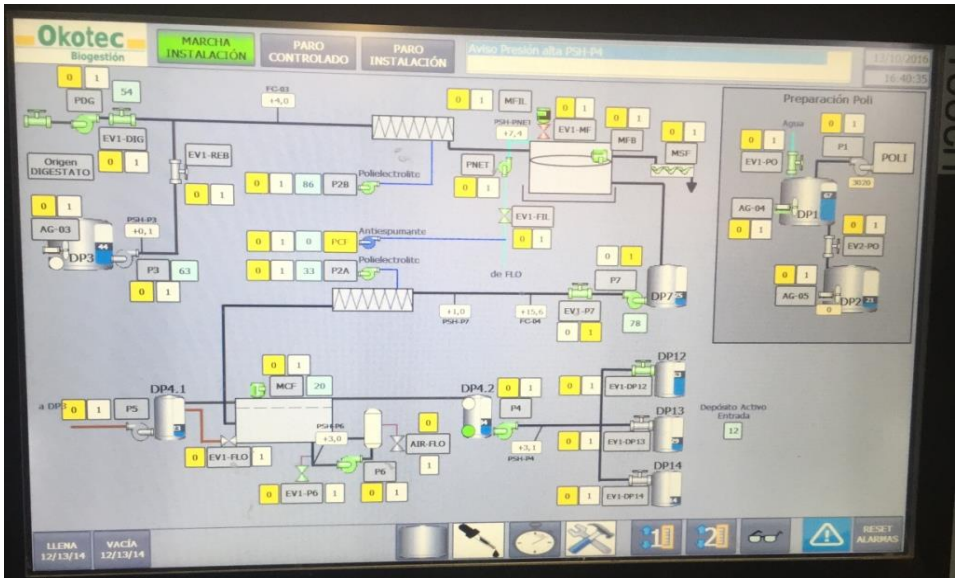
The osmotized water is stored in a tank located next to the final treatment vessel and will be used for cleaning, irrigation or it will be added in the public sewage system (with appropriate permits).

The rejected osmosis product is treated in the same process by membranes that purify this product. Two products are also obtained from this process: the filtered product, with a salt content that is treated in a second osmosis, and the rejection that will be sent to the beginning of the system or mixed with the solid fertilizer of the separation of solids.

The salt-containing water is sent to a buffer tank to be treated in a second osmosis, from which we obtain again an osmotized water and a liquid with a high salt content, which will be used as semi-liquid fertilizer, stored in a tank.

The digestion treatment plant also has:

- Cabinet for the electrical and control panel
- Electrical Installation
- Program of control and manoeuvre of all the equipment



COST OF PRODUCTS AND ELECTRICAL ENERGY:

ELECTRICAL POWER INSTALLED IN 1st PHASE	34,5 kW
ELECTRICAL POWER INSTALLED IN 2nd PHASE	39,9 kW
TOTAL ELECTRICAL POWER INSTALLED	74,4 Kw

During the process different products are used as:

- Polyelectrolyte
- Ferric sulphate
- Sulfuric acid
- Products for the washing of membranes (caustic soda, acids, etc.)

The cost of processing the products can be estimated roughly as follows:

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COSTS IN DIGESTIVE TREATMENT

COSTS 1st PHASE

Product

Flocculated Product	1,08 Kg/ m³ of treated matter
Total amount of flocculated product	1,79 € kg ⟶ **1,93 €/ m³ treated**

Electric consumption

Installed Power 35 kW to treat 4,3 m³/hr so the consumption in 1 m³ is 8,14 kW.

8,14 kW at 0,11 €/kW ⟶ **0,8954 €/m³ treated**

Total amount explotation 2,83 €/m³

COSTS OF SEPARATION AND OSMOTIZATION

Products

Flocculated Product 1st phase	1,08 Kg/ m³ of treated matter	
Flocculated Product 2nd phase	0,06 Kg/ m³ of treated matter	
Amount flocculated product 1,79 € Kg	⟶	**2,04 €/ m³ treated**
Sulfuric Acid for pH correction	0,89 L/m³ of treated matter	
Amount sulfuric acid 0,21 €/L	⟶	**0,19 €/ m³ treated**
Caustic Soda for membrane washing	0,88 kg/m³ of treated matter	
Amount caustic soda 0,48 €/Kg	⟶	**0,42 €/ m³ treated**
Anti-foam agent	0,005 L/m³ of treated matter	
Amount anti-foam agent 2,72 €/L	⟶	**0,013 €/ m³ treated**

Electric Consumption

Electrical consumption per treated m³ 16,63 kW at 0,11 €/kW ⟶ **1,83 €/m³ treated**

Total amount explotation 4,49 €/m³

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COSTS IN THE MANURE TREATMENT

COSTS 1st PHASE

Product

Flocculated Product 0,13 Kg/ m³ de materia tratada

Amount flocculated product 1,79 € Kg ⟶ **0,23 €/ m³ tratado**

Electric Consumption

Installed power 35 kW to treat 4,75 m³/hr so that makes the consumption of 1 m³ - 7,37 kW.

7,37 kW a 0,11 €/kW ⟶ **0, 81 €/m³ tratado**

Total Operating Cost 1,04 €/m³

COSTS OF SEPARATION AND OSMOTIZATION

Products

Flocculated Product 1st phase 0,13 kg/ m³ de materia tratada

Flocculated Product 2nd phase 0,06 kg/ m³ de materia tratada

Flocculated product cost 1,79 € kg ⟶ **0,34 €/ m³ treated**

Sulfuric Acid for pH correction 0,80 L/m³ of treated matter

Sulfuric acid cost 0,21 €/L ⟶ **0,17 €/ m³ treated**

Caustic Soda for membrane wash 0,76 kg/m³ of treated matter

Caustic soda cost 0,48 €/kg ⟶ **0,37 €/ m³ treated**

Anti-Foam Agent 0,005 L/m³ of treated matter

Anti-foam agent cost 2,72 €/L ⟶ **0,013 €/ m³ treated**

Electric Consumption

Electric consumption per m³ treated 15,63 kW at 0,11 €/kW ⟶ **1,72 €/m³ treated**

Total Operating Cost 2,61 €/m³

These prices are subject to the purchase value of the products, since the existing difference if they are bought in bulk quantities or packaged is very important, as also has its influence the concentration of the different products.

All this information is based on tests performed with digestion and pig slurry (manure). Given that the characteristics of these materials may vary according to their composition and origin, these estimates are adjusted but indicative.