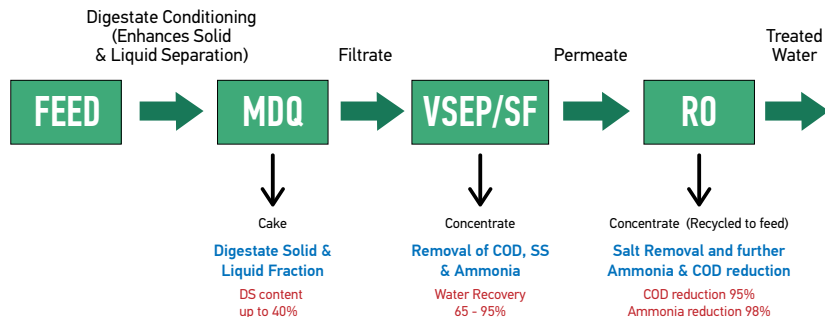


CASE HISTORY

DIGESTATE TREATMENT APPLICATION

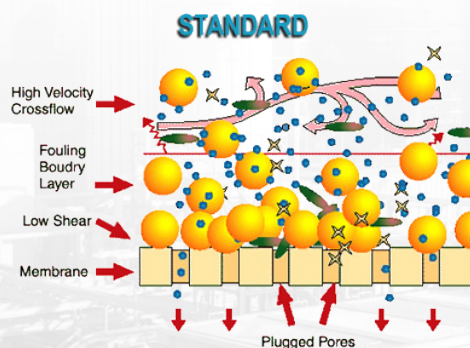
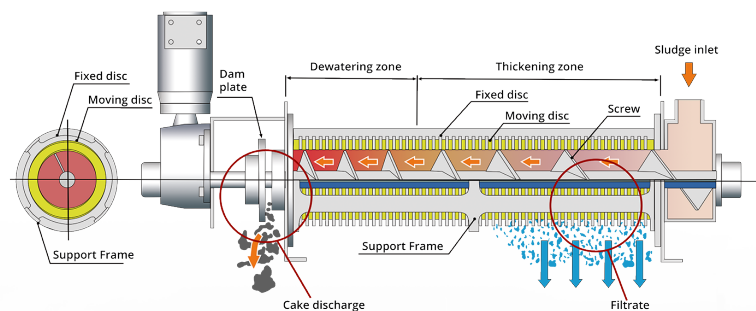
Esmil and our Partners have gained vast experience in the field of digestate treatment. From bench scale studies, right the way through to full scale size plant we strive to offer BAT (Best Available Technology) using **state of the art membrane separation and dewatering processes**.



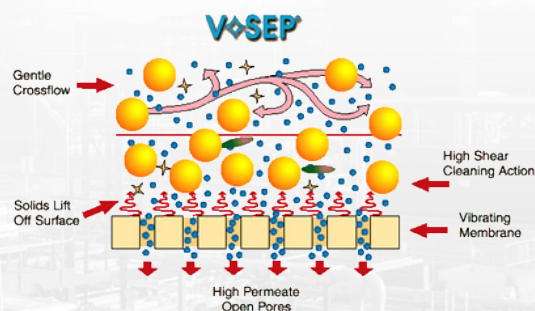
Process description

Our digestate treatment system consists of 3 major process units and is able to produce a dry solid cake and a highly quality treated water suitable for process reuse or disposal and a high nutrient concentrate.

The first stage in our digestate treatment process is the separation otherwise known as digestate treatment. For this we employ our highly effective sludge conditioning and dewatering multidisc screw press (MDQ) which is able to remove the majority of solids from the liquor (sludge volume reduction of 6-10 times) and produce a highly nutritious valuable dry product (cake) with a dry solids content up to 40%.



Traditional Approach



Innovative VSEP Solution

For the second stage, we use special membrane technology such as vibratory membrane system VSEP (Vibratory Shear Enhanced Processing) and SF (Superfiltration) depending on the applied pre-treatment method. This effectively works in the challenging feed conditions.

Although the MDQ is able to remove the majority of the dry solids, some will remain along with other soluble contaminants. The dry solids may cause serious issues for standard membrane systems as they are highly susceptible to fouling. VSEP or SF technology however, greatly reduces the risk of fouling. Expected water recovery in this stage can be between 65 - 95% depending on the membrane type.

Our final stage of digestate treatment is a **spiral-wound reverse osmosis membrane** technology. This acts as a polishing stage further treating the permeate (treated water) from the previous stage. Results have shown that a 95% reduction in COD concentration and 98% reduction of Ammonia can be achieved over the 2 passes of membrane treatment.

Process efficiency

Parameters	Units	VSEP (Pass-I)			RO (Pass-II)		
		Feed	Conc.	Perm.	Feed	Conc.	Perm.
Total COD	mg/l	13,080	12,800	7,990	7,990	31,960	600
pH	-	5.68	5.6	5.7	5.7	6.1	5.9
Ammonia	mg/l	5,150	11,300	1,760	1,760	7,425	100
Conductivity	us/cm	40,400	-	15,400	15,400	73,100	1,389

Projected Operating Costs - \$/m³ feed

Item	Cost - \$/m ³
Power	0.66
Polymer	2.5
Cleaning Chemicals	3.0
Membranes	1.8
TOTAL	7.96

Permeate/concentrate use:

- Anaerobic digester feed dilution;
- Plant washing/ cleaning operations;
- Boiler feed (may require additional polishing);
- Discharge to sewer at a very low cost;
- Low volume, high nutrient digestate product for soil conditioning.

Digestate Treatment Design Philosophy

As no two digestates are equal, it is essential to follow a number of steps to ensure that your tailored digestate treatment process performs as well and economically as possible to achieve your treatment goals.

- Chemical testing to achieve best flocculation at lowest dose rate.
- Lab scale dewatering and membrane trial and selection to ensure process feasibility.
- Long term site pilot trial to allow for feed variation and data gathering.
- Extensive plant design and operating expense calculations.
- Build, Installation and Commissioning.
- Comprehensive service support including maintenance and system upgrades.



References

- 2013 - Kurana UAB, Grain Bioethanol, Lithuania (VSEP, RO).
- 2018 - Quasar Energy Group LLC, Municipal Sludge, USA (MDQ).
- 2018 - Renergy Inc., Wastewater Treatment Plant, USA (MDQ).
- 2018 - KB BioEnergy Inc., Wastewater Treatment Plant, USA (MDQ).
- 2021 - Biogas Distillery Plant, UK (VSEP, RO)
- 2023 - Comprehensive Study for Digestates of Different Feedstock, Northern Ireland, UK (MDQ, VSEP, SF, RO).