

# SYSTEMIC Living Lab conversations: Separation technologies

20/11/2020 13:00h CET – 13:45h CET – TEAMS online meeting

**Moderator:** Marieke Verbeke (VCM, SYSTEMIC project)

*Extra information inserted in this summary after the discussion.*

**Expert Panel:**

SYSTEMIC Demonstration Plants, Outreach Locations and Associated Plants

For more information check out:

<https://systemicproject.eu/plants/demonstration-plants/>

<https://systemicproject.eu/plants/outreach-plants/>

<https://systemicproject.eu/plants/associated-plants/>

## *How did you choose the technology supplier?*

### Biogas Plant in Germany

In most cases it is not necessary to separate the digestate before stripping; an impurity separator and sieves are sufficient, a screw press is also possible. The solid-liquid separation after stripping or from the storage tank is done with a screw press. To separate P from the liquid phase, a decanter or sieve like filters were successfully tested with different advantages and disadvantages. Small amounts of iron salts and / or biological starch polymers were tested as support in decanter. However, we want to avoid any chemicals if possible.

### Biogas Plant in Flanders, Belgium

Separation technology's performance really depends on the input material. So try to experiment with different technologies for separation by for example renting a press to do some tests so you can see if it working on your product.

### Biogas Plant in Croatia

We bought a screw press, but never really considered improving the separation efficiency with polymers. Does anyone have experience on how to start with this?



## *Does anyone use polymer in screw press? What is the quality of the digestate and the liquid fraction?*

*For more detailed technical information on the use of polymers in separation of digestate, check out the [SYSTEMIC webinar on youtube](#):*

### Biogas Plant in Flanders, Belgium

Our liquid fraction has a TSS as low as possible and preferable less than 15 ml/l after 30 minutes.

### Biogas Plant in Germany

The effect of the polymers can only be determined empirically, as the properties of the digestate are very different.

The screw press has a good performance on input (digestate, manure) with a higher dry matter content, like fibre rich digestate, even without adding polymers.

Polymers are added more frequently to improve the performance of centrifuges, because they are better suited for inputs with a lower dry matter content or with less fibres.

At our biogas plant, a centrifuge was only able to produce a solid fraction with 1 or 2% dry matter higher than the input digestate. Addition of polymers could improve this. However, it is anyway better to use polymers that are biodegradable, when you take into account that the end products will be applied on land.

We did some experiments with biodegradable starch polymers, however they are not always the most optimal solution because you need to apply more and the price is the same as conventional polymers.

### Biogas Research Centre, University of Linköping, Sweden

I was involved in a work with Kemira a 5-6 years ago, and we compared starch polymers with conventional polyacrylamide polymers on separation of digestate of household green waste. It really didn't work at all. The consumption was higher, performance was not that good.

### Biogas Plant in Germany

We have used them in lab scale and also in full scale. More consumption and also difficult to fine the right dosing, combination with iron salts. We have now some biodegradable polymers that are fit to use at our site (digestate chicken manure and corn).

We also do ammonia stripping on our digestate and we see that we need less polymers for separation of the digestate after stripping than we do before stripping.

We also want to start doing tests on polymers based on seafood shells (*chitines*)

### Biogas Plant in Flanders, Belgium

Our solid fraction from the screw presses does have fibres from grass, it does give structure. But for us, working the screw presses without polymer does not work, because then we have too much suspended solids coming in the liquid fraction.

If we use polymer, we need to use powder polymer because liquid polymer solutions contain mineral oils, and these cannot go into the end product because they are seen as



petrochemical mineral oil which is not allowed in the soil in Flanders. The powder polymers can be used, because they disintegrate after the screw press.

#### Biogas Plant in Finland

Polymer use is an art on itself.

Some polymer manufacturers have courses or trainings on how to use polymers. I would really be interested in this.

*Marieke Verbeke, SYSTEMIC project, VCM (BE)*

*Webinar on the use of polymers for optimisation of digestate separation took place at 22 April 2021. You can [rewatch it on youtube](#)*

#### Biogas Plant in Flanders, Belgium

We have a centrifuge and when we change the feedstock of the digesters, the composition of digestate alters, and this also impacts the performance of the centrifuge and therefore you need to change your polymer or finetune the amount added.

It would be nice if there would be a list of all kind of polymers possible, because sometimes you need to call 3-5 suppliers and they all have different products. And sometimes different suppliers have products that are similar but differ in price.

#### Biogas Plant in Flanders, Belgium

The feedstocks of our digesters are green waste from households.

The composition of our digestate also changes with the seasons and therefore we needed a specific polymer in summer and another one in winter.

In winter we do not have as much fibres in our digestate (from for example grass cuttings). Some polymers have only a small dosing range: meaning that dosing too much or too little makes that the separation is not working well.

Since 3 years we have a polymer that is working all year round, and it is not influenced by overdosing. This makes sure that the operator does not have to spend too much time finetuning the dosing of the polymer.

Therefore, when choosing a polymer: make sure that it is not too sensitive to overdosing.

When we want to test a new polymer, the polymer suppliers can come and do some tests on my digestate in the lab with several polymers. They have to produce a report showing the performance of the polymer addition, the amount to be added to reach sufficient separation and the price for their polymers.

For me, in the end I want to know if the proposed polymer is cheaper than the one I am currently using, with the same or even better performance.

If it is working ok and the price is reasonable, they can bring 100kg of polymer to do a trial on full scale. And based on that trial, we decide if we will use the polymer or not.

#### Biogas Plant in Croatia

We have a screw press, but we didn't use polymers 'till now.

It would indeed be interesting to have a data sheet with information on separators from the biogas plants involved in SYSTEMIC.

Who uses which type of separation, on which type of digestate (which feedstock) and which polymers they already tested or used (and suppliers).

This way we can find maybe plants with digestate similar to ours and see which polymers they use.

Does anyone know how much difference would be when using or not using polymer in a screw press? Currently our screw press without polymer addition has a DM content of 25%.

Marieke Verbeke, SYSTEMIC project, VCM (BE)

We are compiling this type of information for the NUTRICAS Tool we are developing within SYSTEMIC. This Tool will calculate theoretical mass balances for technology cascades implemented on digestate. The following table includes values we found in literature and practice (other biogas plants).

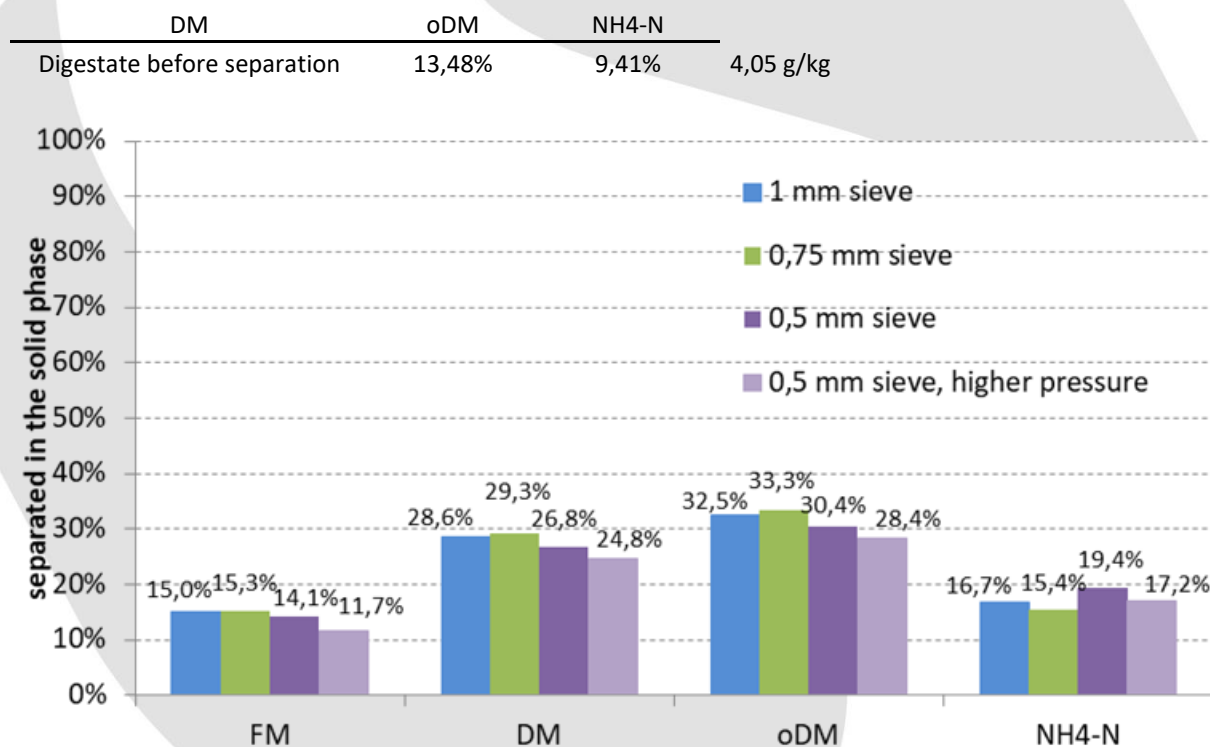
Separation efficiency (%)= % of (component) from the input of the separator that ends up in the solid fraction.

The database can be found on <https://systemicproject.eu/bdp/technologies-and-mass-balances/> →SYSTEMIC database

Biogas Plant in Germany

I have some balancing data from Benas digestate from a screw press test at different sieves and pressures (2016). Is not possible to fill it in the given table, so I give you the data separate.

the feedstock 2016 was 26% chicken manure (solid) and 74% different crops.



solid phase	FM	DM	Organic DM	NH4-N
1 mm sieve	15,0%	28,6%	32,5%	16,7%
0,75 mm sieve	15,3%	29,3%	33,3%	15,4%
0,5 mm sieve	14,1%	26,8%	30,4%	19,4%
0,5 mm sieve, higher pressure	11,7%	24,8%	28,4%	17,2%

## How much maintenance required for the different separation technologies?

### Biogas Plant in Flanders, Belgium

Maintenance for centrifuge is important. For a centrifuge sand is abrasive, but also other things can cause wear or damage like struvite.

We've experienced it ourselves that if you don't do maintenance every 6 months, you will see the performance of the separator going down. When restarting it after maintenance, there was a big improvement in performance.

## Which aspect influence the performance of the separator?

### Biogas Plant in Flanders, Belgium

Changes in digestate composition, in a way that you need to adapt your polymer or polymer dosing to these changes.

### Biogas Plant in Flanders, Belgium

Some things need to be monitored by operators, for example the floc formation and mixing energy for polymer with digestate.

For certain polymers extra mixing energy is needed, for others mixing needs to be done very gently.

### Marieke Verbeke, SYSTEMIC project, VCM (BE)

*Indeed, mixing too hard can sometimes break the flocs again.*

## What are the costs for separators?

### Marieke Verbeke, SYSTEMIC project, VCM (BE)

*We are we are compiling this type of information for the NUTRICAS Tool we are developing within SYSTEMIC. This Tool will calculate theoretical mass balances for technology cascades implemented on digestate. The following table includes values we found in literature and practice (other biogas plants).*

<https://systemicproject.eu/bdp/technologies-and-mass-balances/> →NUTRICAS Tool

### Centrifuge

ton/h	ton/year	CAPEX (€)	Maintenance (% of the CAPEX)
2	16000	60,000 – 110,000	3
5	40000	60,000 – 110,000	3
7	56000	100,000	
8	64000	81,535	
12	96000	81,535	
15	120000	100,000-150,000	
30	240000	150,000	
50	400000	200,000-300,000	5
90	720000	300,000	7

### Screw press

ton/h	ton/year	CAPEX (€)	Maintenance (% of the CAPEX)
2	4000	12,500	
3	6000	17,000-50,000	3%
4	8000	50000	
5	10000	17,000-50,000	
6,5	13000	20,000-50,000	
8	16000	25000-50,000	3%
9	72000	44,400	
10	80000	25,000-30,000	
13	104000	44,400	
20	40000	55,000	
24,75	49500	15,000	
31,5	63000	25,000	
50	100000	52,500-75,000	

### Belt press

ton/h	CAPEX (€)
2	70,000-150,000
5	70,000
10	75,000
40	150,000

### Biogas Plant in Flanders, Belgium

Prices of polymers depend on type of product:

Cationic product: towards 3 EUR/kg

More branched or woven polymers: is more expensive, 3.5-4.5EUR/kg