

WASTEWATER TREATMENT OF SMALL AND MEDIUM-SIZED COMMUNITIES



Minutes of workshop, 8th of February 2018 _ Beirut

PART 1: WASTEWATER TREATMENT OF SMALL AND MEDIUM-SIZED COMMUNITIES

QUESTIONS AND ANSWERS

Question:

To select a treatment methodology, do we have to take into account the type of contaminants which are in the wastewater such as detergents, chlorine, wastewater from slaughterhouses or hospitals?

Pascal Molle:

We have very few data about these specific contaminants as there is no law in France regarding the micro-pollutants and new pollutants.

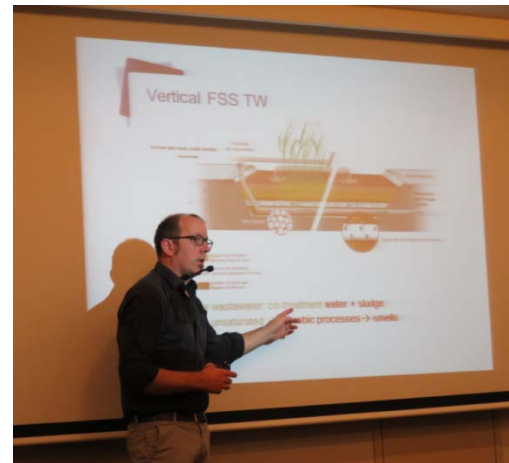
Question:

Before starting, do you have to consider the various components of your water to determine the treatment methodology?

Pascal Molle:

You have to take into account inhibitors for biological activities such as salt use unfreeze roads, metals... Wastewater from hospital will not have an impact on biological activities.

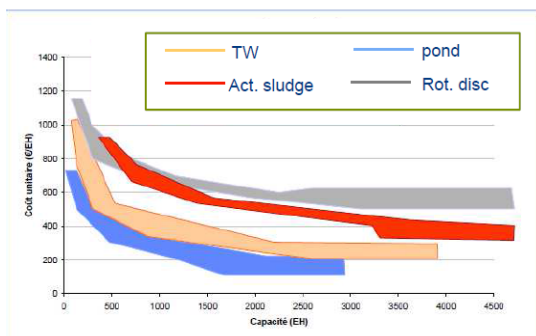
Nevertheless, all treatments are based on biological activities so such kind of inhibitors will affect all types of technologies. The impact will be more or less the same. There are technologies which are more robust usually because there is more retention time and in that case you will have less impact on biological activities. The concentration of metal has to be taken into consideration in case of valorization of the sludge as well.



Question:

It seems that, the cost of the land has not been taken into account in this graph and this has to be taken into consideration as some processes requires more space such as treatment wetlands.

Investment costs



Pascal Molle:

Yes, but if you want to compare systems to make a choice, you have to include:

- The cost of the sewer
- The cost of the land
- Cost of the treatment plant
- Cost of 30 years of operation (expiry life of the system)

PART 2: TREATMENT WETLANDS



Question:

What is the diversity of bacteria that you can have?

Pascal Molle:

If you implement a system in which you have saturated water into the filter, that means your system is globally anoxic but near the roots the

oxygen production, which is not used for the respiration of the plants, remains near the roots. It is nothing compared to the oxygen that we need for the treatment but it means that near the roots you have a local zone that can be aerobic. So you can have a succession of zones with anoxic and aerobic condition that can help for total removal of nitrogen.

If we do measurement of the type of bacteria we have in the system, we will find more or less the same bacteria we have in others biological systems. But, the diversity and the density of bacteria are higher when your system is planted than when it is not planted.

Question:

For the vertical subsurface flow, how do you introduce water from the bottom?

Pascal Molle:

By natural convection of air because you have a difference in temperatures.

Question:

All the plants used are reeds?

Pascal Molle:

Usually yes, they are phragmites. You can use all the plants but it depends on which system you plant.

Question:

You said that the plant can take 1% of BOD?

Pascal Molle:

No, 1% of nutrients, it is nitrogen and phosphate. The carbon production is done by respiration; the plant will not take carbon into the water. You have to keep in mind that the degradation is done by bacteria not by the plants.

Question:

What is the role of the plants? Is it minor?

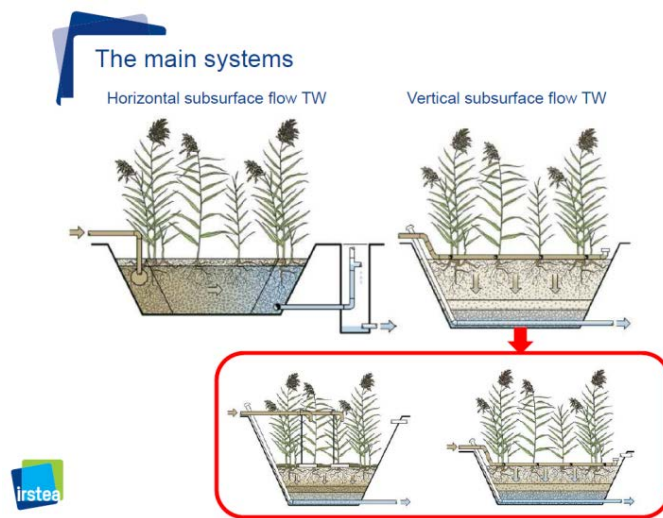
Pascal Molle:

It could appear as minor, but in some cases you can have row wastewater in the system and you will have deposit on the top that can clog the system. If you do not use plants, it will clog. If you use plants, the stems will allow making holes around the stems and water will pass through; and when there is no water, the air will go inside. It is a mechanical effect and it is the same when you are treating sludge.

When you have no deposit, the effect is more for the bacterial activity. When your system is planted you have higher density and diversity of bacteria.

Question:

Do you have the problem of sludge discharge with treatment wetlands?



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Pascal Molle

No, but we can have the problem of clogging.

Question:

Pre-treatments are required before?

Pascal Molle:

Depends on the system, with horizontal flow systems, you have to have pre-treatment such as sedimentation tank. With systems

which are using sand, you have to install a pre-treatment before. But you can design systems with row water arriving on the top of the filter and that way you will treat wastewater and sludge at the same time. Depends on what you want to do and how you want to manage the sludge.

Pascal Molle

You can design systems depending on what you want to do and how you want to manage the sludge.

Question

How do you define storm water?

Answer

The storm water that goes to a sewer network could go to a separate network with only rainwater or it can go to a combined sewer with domestic water and rain events. In that case, the network can be overloaded and you can have overflow. Then you have different options, you can build a bigger sewer and bring the rain event later but you have to manage the event anyway. Plus, it can be very costly to build a bigger sewer. Or you can decide to let the overflow and treat it online with a treatment wetlands.

Question:

The problem in Lebanon is that everything is going directly to the sewer, including oil. Is it also the case in Europe?

Answer:

In Europe, everything goes to the sewer as well, including oil.

Question:

We are facing problems at the municipal level for wastewater. We have layers of grease on the top of each treatment plant, in the septic tank. In the treatment plant station of a small village, we have about 50 centimeters layer of oil and then it goes to the secondary treatment with aeration. So anyway, we need to remove the grease.

Answer:

When you are working with the septic tank you have anaerobic conditions with the low flow of the septic tank and thanks to the gas and the anaerobic production you will put all the greases on the top and in the septic tank you can collect the water below the surface to avoid having all the floating materials.

With the treatment wetlands, it is an aerobic condition and you have a degradation of the greases. In the case of villages with many restaurants in touristic areas, you can have greases which are fixed on the wall in the feeding system. So the operator needs to go to clean it and then there is not anymore a problem.

Question:

What about the industrial wastewater or even the hospital wastewater? Can you apply this system? Isn't it risky?

Answer:

For hospital wastewater it depends if your question is about trouble in meeting the requirement objectives settled on global parameters. That means that hospital pollutants will have some inhibitors for biological activity. Hospitals are not a real challenge. We have other kind of industries which produce some inhibitors but hospitals don't.

If your question is, can we treat the micro-pollutants or emergent pollutants, this is another topic.

Question:

Is it better to have another system before the treatment wetland?

Pascal Molle:



We did many studies about different technologies for the treatment of micro-pollutants or emergent pollutants. Globally, you have kinds of pollutants that are hydro-phobic and you will store them on the stories and not collect them at the outlet. Some pollutants are not hydro-phobic and will go with the water. Another question is, are these pollutants biodegradable or not? If it is biodegradable, we can reach a high removable rate. Otherwise, it will pass through the system which is not designed for that. This is true for all kinds of wastewater treatment.



If you want to put very high and intensive treatment, you can have a tertiary treatment at the end. In this case, you can go further in the treatment. Globally, the higher the retention time the better it will be.

Question:

What about denitrification?

Pascal Molle:

This system is aerobic with low rates of denitrification; it is not designed for this. For small communities, the impact on water bodies is not so high, so the minimum is to avoid releasing ammoniac in the water bodies because it is very toxic. The minimum is to reach nitrification but sometimes you need denitrification. In that case, we need to implement a system with saturated layers which could be horizontal or vertical but it has to be saturated. But the classical design, for small and medium-sized communities in France, is only to make aerobic degradation.

Question:

Denitrification is not required in France?

Pascal Molle:

It is sometimes, but if we are talking about small systems (500 or 1,000 PE) you have to keep in mind that you are in rural areas so you will have to ask people to put money to do denitrification while for agriculture they are using fertilizers everywhere. So the main source of nitrates comes from agriculture. So you will ask the community to put a lot of money for an impact which is zero. Sometimes, the water body is really sensitive or sometimes politically you need to show the farmers that the community has done something. But it is not so common.

When the water agencies try to manage the pollution in rural areas, they have to see if it is more efficient to put one euro on the treatment or one euro on the environment to do political pressure.

Question:

Does it depend on the receiving area? If the area is really sensitive to nitrates?

Pascal Molle:

If you have a sensitive water body for eutrophication, it can be important to do denitrification. But if we are talking about 500 PE, you will have denitrification and phosphor removal which will be costly. The question is, will it be efficient and realistic? If it is wetland, I will need a large surface or activated sludge. For activated sludge of 500PE, the system can do it but I will have sludge with an impact on the environment and it will be worse. If I want to make phosphor removal I will put iron precipitation. But we are speaking about 500PE, which means that there is no operator on the system most of the time. When I visit stations of 500PE with iron removal, the product is missing or the pumps are not working and it is very often. We can invest in that but maybe it is more efficient to invest on renaturing the stream to have a treatment of diffuse pollution arriving to the stream because of agriculture.

Question:

Does the sludge need any treatment?

Pascal Molle:

No, it is well mineralized. If there is an industrial activity which produce a lot of metal you will store the metal in the sludge and as you mineralize a lot of sludge you will produce a low amount of the sludge but with a high concentration of metals.

This system is interesting for small communities as you do not need to manage the sludge for 10 to 15 years. Then, sludge can be used for compost application.

Question:

Can the treatment wetland be used for cow or goat farms?

Pascal Molle:

Yes, we have guidelines for this. When it is biodegradable, it is not problematic. We have also designed for water from airport which is a little bit specific because in winter there are using glycols in plane.



Question:

Can we do the same for the sludge instead of drying bed?

Pascal Molle:

Yes, we can do it for sludge from activated sludge or other kind of biological systems as well for septage from septic tank. The design is not the same; the roots are not the same. You can find all the guides on the website of EPNAC.

Question:

What about the weather conditions? Are they suitable for everywhere?

Pascal Molle:

Yes. Even if you have snow, the upper part of the plants can die but not the rhizome. We need to harvest the reeds before snowfall, otherwise everything goes down. In the spring, the plants start growing. The worst period is winter when there are no reeds. That is why we design the system to be sure that in the worst period, the system will work well and maintain performance. That is why we can increase the load in summer because we know that the system would be working better.

Question:

Do we have to take into consideration the type of aquiferous? Whether you have a high infiltration rate or high water table?

Pascal Molle:

The filter is waterproof, with a geomembrane. But at the outlet, you have the pipe so if the water table decreases you can have water which comes back to your outlet and saturates your system. So you have to keep in mind that that can happen but you are feeding your system with wastewater. So finally, you saturate your system but the saturation of the system is not the water from the outlet. In that case, you will not have sludge lost that will happen is you will stay good with BOD, TSS and COD but the denitrification that will decrease because your system is saturated without oxygenation. The nitrification will go down after two or three days if it is longer than that the denitrification will be low but BOD, COD and TSS will stay good.

Question:

What is the advantage of using a siphon? Can't we have an ordinary pipe?

Pascal Molle:

You need to produce some batches which means you need to reach 0.5 cubic meters/hour/square meter of feeding doing batches. So that means you cannot do it continuously otherwise you will not distribute the water. You need to store a certain volume and make a flush. It can be made with a pump or by gravity if you can, so it would save electricity.

Question

Concerning the treatment of sludge, which system produces less smell? Drying bed or treatment wetland?

Pascal Molle:

There is no smell when both are designed and maintained correctly. In reality, for reeds bed filters you have to consider if the constructor is able to design it correctly and the operator is able to do so. But you can have smells in both cases. All methods are good when they are well designed and operated. The question is that, for such kind of capacity, is it possible to maintain correctly?

BIBLIOGRAPHY

Treatment Wetlands is the seventh volume in the Biological Wastewater Treatment series, which gives a state-of-the-art presentation of the science and technology of sewage treatment.

[English version](#)



Guide technique: Systèmes extensifs pour le traitement et la gestion des eaux usées en temps de pluies.

[French version](#)



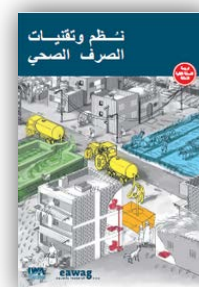
This guide is addresses to designers, builders and owners. It presents the processes implied in SDRB, treatment strategies as well as the design and management rules to guarantee final dry matter content of 25% and 30% minimum for activated sludge and septage respectively. SDRBs allow a sludge reduction of about 50% of dry matter as well as a decrease of operation task in sludge treatment lines.

[French version](#)



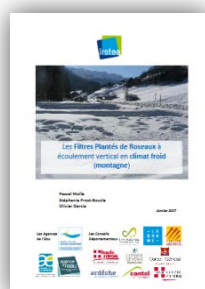
This second, revised edition of the Compendium presents a huge range of information on sanitation systems and technologies in one volume. By ordering and structuring tried and tested technologies into once concise document, the reader is provided with a useful planning tool for making more informed decisions.

[Arabic version](#) _ [English version](#) _ [French version](#)



Les filtres plantés de roseaux à écoulement vertical en climat froid (montagne)

[French version](#)



Ouvrage de traitement par filtres plantés de roseaux_ Guide d'exploitation

[French version](#)



Natural lagooning

This technical data sheet is a brief presentation of natural lagooning treatment system that works well for small municipalities in Lebanon.

[Arabic version](#) _ [English version](#) _ [French Version](#)



Reed bed filters

This technical data sheet is a brief presentation of reed bed filters treatment system that works well for small municipalities in Lebanon.

[Arabic version](#) _ [English version](#) _ [French Version](#)



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