JULY 2020

SEPTIC SYSTEM ADDITIVES

Why additives are harmful for System O)) septic installations

Among all the advantages offered by the Advanced Enviro))Septic pipes within System O)) wastewater treatment systems, it is its completely passive operation that is most remarkable. A system that is designed, installed and used in compliance with our guides requires no maintenance or component replacement.

Knowing that System O)) solutions require little to no maintenance to operate at peak efficiency, why would we want to spend money on additives for septic systems?

These additives, principally a mix of enzymes and bacteria, specifically promise a septic tank sludge reduction and a better global performance of septic installations. Although these products can look interesting, a survey of their relevance and their true impact is required.

WHAT ARE ENZYMES?

Enzymes are catalytic proteins, that is, they significantly accelerate the rate of specific chemical reactions. All living beings can produce enzymes; they are essential to all maintenance and survival mechanisms. An enzyme's function is simple: the protein associates itself to a specific molecule called substrate. The substrate links to the enzyme to create a complex. The enzyme can then proceed to dividing the substrate, which generates products that are less complex molecules. These products can then become the substrate for the next enzyme, or simply be assimilated if it is the final element in a metabolism.

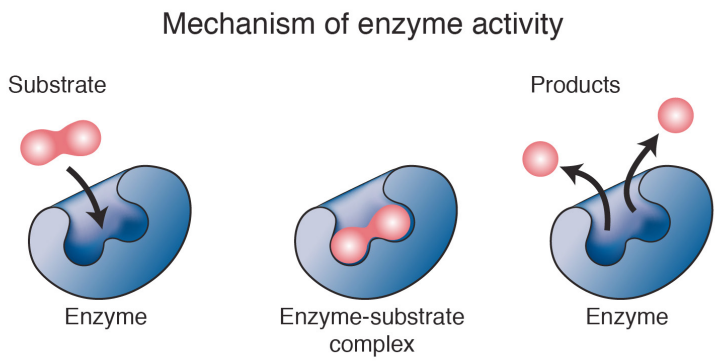


Figure 1. Enzymes mechanism[1]

In the context of biological water treatment, we associate pollutants to substrates, which are degraded following many division cycles, until they become rudimentary enough to be easily solubilised as a nutrient. It is when it is assimilated that the pollutant is finally treated.

There exists a great variety of enzymes. Each type of enzyme has its very own active site that allows it to recognize only very specific substrates. Considering the different types of pollutants in domestic wastewater, different types of enzymes are required. These are lipases for lipids, proteases for proteins, amylases for starch, cellulases for cellulose (polymer of plant walls, present particularly in toilet paper), etc.

NATURAL PRINCIPLE

In nature, organisms produce the enzymes they need to survive. For example, in the presence of starch, an organisme tends to synthesize more amylase to extract the glucose molecules that are much more soluble and assimilable than starch:

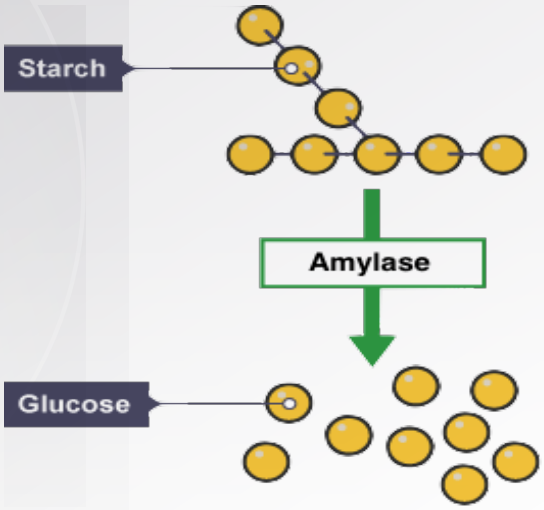


Figure 2. Starch enzymatic degradation to glucose[2]

The exact same thing occurs with wastewater treatment: the microorganisms present in the septic tank secrete the enzymes they need to transform the pollutants to less complex nutrients that are more soluble and therefore easier to assimilate. It is important to note that microorganisms usually produce their enzymes in direct proportion to their need and ability to assimilate the nutrients[3]. This means that microorganisms don't waste energy in producing excessive enzymes that will only be used to degrade molecules that will not be assimilated.

RELEVANCE OF ENZYMATIC ADDITIVES

First, it's important to question ourselves on the relevance of including enzymatic additives to a septic tank upstream from a System O)) wastewater treatment system.

One of the claims of these products is the reduction of sludge build-up in the septic tank. In Canada and several U.S. states, a septic tank used year-round should be emptied every 2 to 5 years to ensure the proper functioning of septic installations. In Quebec, for example, article 13 of the Regulation respecting waste water disposal systems for isolated dwellings, chapter Q-2, r. 22 of the Environment Quality Act, requires that septic tanks be emptied every 2 years. The stated advantage of enzymatic additives is then completely useless for home owners who use their septic installation normally; the septic tank must be emptied every 2 years regardless of the sludge level.

Another frequently heard claim is the fact that adding enzymes and bacteria accelerates the biodegradation process of pollutants, resulting in a better treated effluent and increasing the life of the septic installation. In sufficient quantities, these additives allow for faster and more effective biodegradation of organic matter in the pre-tank. The question on the relevance of these additives is simply this: for a System O)) treatment system, the primary function of a pre-tank is to retain solids following their settling. While anaerobic fermentation has already begun in the tank, it is not what is sought but rather a secondary reaction due to the presence of microorganisms. A tank is first and foremost a decanter, not a bioreactor. The addition of enzymes to the tank would improve an undesired process for an advanced treatment system[4].

So, biological additives are irrelevant since septic tanks should be emptied regularly, regardless of the sludge level, and that the primary role of a septic tank is to act as a decanter and not as a bioreactor.

REAL IMPACTS

As discussed, adding biological additives accelerates the conversion of complex pollutants to more soluble and easily digestible particles for microorganisms. Although this is the method to use to treat water biologically, this process can have important consequences when it is done in excess in a septic tank upstream from an advanced treatment system.

By adding microorganisms and enzymes to septic tanks, an improvement in the anaerobic fermentation process would be observed. This said, it would also be possible to observe a greater degradation of pollutants that would normally have been retained by the septic tank, specifically decanted solids as well as grease and floating oils. Consequently, an increased solubilisation of organic matter occurs, increasing the concentration of the effluent moving towards the following treatment unit[3, 5].

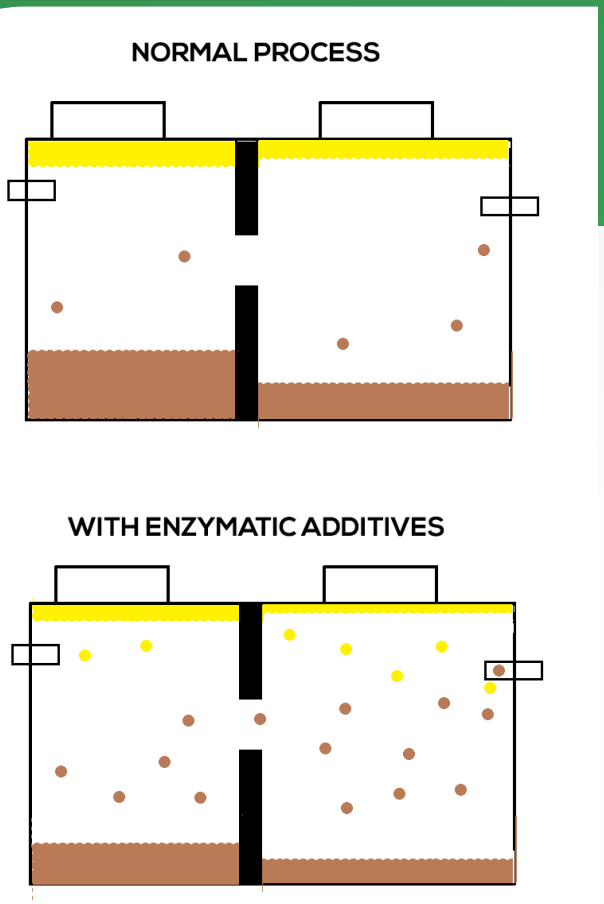
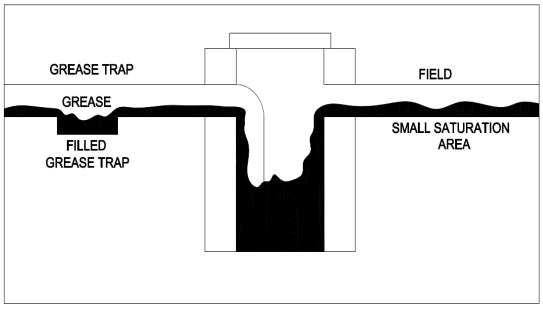
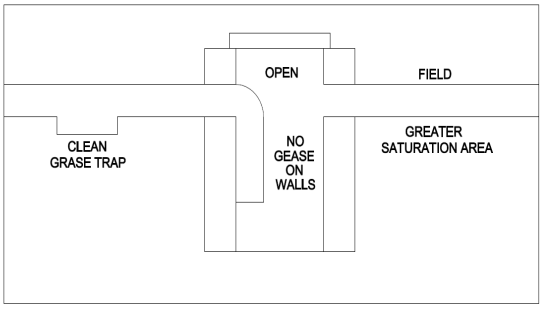


Figure 3. How the addition of enzymes impacts the solubilisation of the organic load

This is an important dilemma since the System O)) installation downstream from the septic tank is designed and tested for typical concentration ranges. The use of biological additives increases this concentration of pollutants, which can result in a significant increase in the organic charge in the treatment unit. In other words, the pollutants, even partially degraded, are simply transferred to the purifying element. This ad for enzymatic additives perfectly explains this phenomenon:



Solid waste clogs pipes, tank and drain field.



Solids are digested and liquefied and are absorbed in open drain fields.

This organic overload in the effluent, over the long term, will inevitably lead to an excessive growth of the biomass throughout the treatment unit and in the water's infiltration site. This excessive growth, called biomat, is responsible for the clogging of the classic purifying elements and therefore responsible for their limited lifespan. This will contribute to the abnormal clogging of the system sand and can lead to water infiltration problems.

To resume, adding additives to pre-tanks can lead to a degradation of pollutants that should normally remain in the tank and be eliminated when it is emptied. This degradation leads to an increased solubilisation of organic matter in the clarified water of the pre-tank, which is then routed to the treatment unit downstream. This organically overloaded water has then a higher risk of clogging the system sand.

CONCLUSION

A System O)) wastewater treatment system that is designed, built and used correctly should never need an additive to ensure its proper functioning, and in fact, these additives can impede the system's proper operation.

DBO Expert recommends avoiding the use of additives, be it through the plumbing or directly in the septic tank. As a System O)) installation owner, the best prevention method will always be to respect the user guide, maintain the effluent filter twice a year and ensure the system is inspected regularly!

Miguel Almassy Génie biotechnologique
Brydon Rodd, Biologiste environnementale
Cheikh Mor Mbacké, Génie chimique

[1] National Human Genome Research Institute, "Enzyme". https://www.genome.gov/genetics-glossary/Enzyme

[2] IGCSE Biology 2017, "Understand the Role of Digestive Enzymes". http://igcse-biology-2017.blogspot.com/2017/06/229-understand-role-of-digestive.html

[3] Ip, I., Dobri, B. (2006). "A Case Study in Designing for High Strength Wastewater: Using A Holistic Approach". Presented at 7th Annual OOWA Conference and Exhibition, March 20 and 21, 2006, Kitchener, ON.

[4] Centre for Alternative Technology. Sewage Treatment - Centre for Alternative Technology. [online] Available at: https://www.cat.org.uk/info-resources/free-information-service/water-and-sanitation/sewage-treatment/.

[5] "Septic Tank Additives". Small Flows Quarterly, Winter 2002, Volume 3, Number 1, p.26. National Environmental Services Center. https://www.nesc.wvu.edu/files/d/39a22099-e56f-4213-99fe-08a9aed6210c/sfqw02.pdf