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An Installer's Best Friend

Understand the biomat and you hold a key to building onsite systems that perform for the long term

By Jim Anderson, Ph.D., and David Gustafson, P.E.

With more emphasis being placed on managing onsite treatment systems to promote better performance and increase system life, it becomes all the more important to understand the biomat.

If you understand the role of biomat in effluent distribution and how to build management into the system, you will improve the performance of the systems you install and increase your bottom line.

When septic tank effluent is introduced to soil by gravity distribution, interesting and important processes occur. A layer begins to form along the bottom of the drainfield trench. It consists of the organic material contained in the effluent and the living and dead colonies of soil bacteria and other microorganisms.

How it works

The biomat is somewhat permeable to water. As it forms at the interface with the soil, it induces unsaturated flow through soil, slowing the rate of movement and allowing time for treatment to occur. The thickness of the biomat and the ultimate long-term acceptance rate of the soil depend on the type of soil and the strength and amount of wastewater.

In the past, the formation of the biomat was considered a negative because it reduced the rate of water movement into the soil. Today we recognize the formation of the biomat as a positive characteristic that slows the movement of wastewater through soils to provide better treatment.

So our goal, if we are using gravity distribution, is to use the positive treatment characteristics with the desire to move water through the soil. Misunderstanding of the functions of the biomat leads to such terms as "creeping failure," "progressive failure," and "clogging mat."

Biomat has formed in a fine sandy soil and has reduced the infiltration rate.

System sizing

If the biomat is not in place, flow through soil is predominantly saturated, and all the soil pores are filled with water. This means that aerobic (oxygen-using) soil bacteria that are most efficient at breaking down the organic components of wastewater will not be present, and treatment will occur less efficiently.

At least three feet of suitable, undisturbed, well-aerated soil should lie between the effluent entering the soil and any limiting layer, such as saturated soil or bedrock. This condition coupled with the biomat, ensures effective treatment. The size of the system should take into account the soil conditions and the development of the biomat.

As an installer, you should know that the factors used to size soil treatment systems are based on a domestic (household) quality wastewater with septic tank pretreatment. So typically, we assume that if the septic tank is properly maintained, then septic tank effluent levels of organic loading as determined by biochemical oxygen demand (BOD) are approximately 175 to 200 milligrams per liter (parts per million) as determined by a five day test.

If you see that the residence or business you are working with will generate waste significantly higher in BOD, you should discuss that with the designer and decide on additional pretreatment measures that should be taken before the effluent is discharged to soil. Effluent screens can help the soil treatment system, because even though research shows they don't have a large impact on the BOD, they do ensure that other large solids don't make it to the drainfield, plugging soil pores permanently.

Spread the wealth

One of the keys to management is to provide access to different parts of the onsite system. For the septic tank part of the system, this is as simple as bringing manhole access to the surface and making sure you provide proper access to remove and clean the effluent screens.

Use of drop boxes to distribute effluent between trenches allows numerous

A bed being constructed with a sand liner on a fine textured soil.

management options. A drop box is constructed of concrete, fiberglass or plastic, 12 to 18 inches in diameter, or square, and about 18 inches deep. A drop box should be installed at the head end of each trench. The inlet pipe to a drop box should be one inch higher than the outlet pipe leading to the next drop box.

Septic tank effluent flows into the first trench until the biomat is fully developed and water ponds in the trench to a level set by the drop box. Wastewater then flows from the first trench into the second, and so forth. The drop boxes give you a place to look and see if there is evidence of any excessive solids being passed to the soil treatment part of the system. It also provides the ability to cap off a trench after it has been used for a while, allowing effluent to bypass that trench so it can rest. This results in a reduced biomat and recovery of some infiltrative capacity.

The same sort of management can be conducted using caps and levelers of different types in distribution boxes. However, in climates where freezing is a potential problem, pipes between parts of the system using drop boxes always run empty.

With distribution boxes, this is not the case, so there is an increased freezing risk associated with distribution boxes. This is due to the presence of standing water in the pipes. Obviously, in areas where freezing is not a problem, this is not as critical. It is important, though, to understand how water moves through the system so that one trench doesn't receive all of the effluent while other parts of the system go unused.

As an installer, you can encourage the use of other flow-splitting devices, which result in systems being split into different parts. This allows you to direct flow to one part of the system at a time, while the other parts are rested.

By using these distribution techniques, and by following our other keys to construction in the soil – Keep It Shallow (KISS), Keep It Natural (KINN), and Keep It Dry (KIDD) – you can build onsite systems that will operate well for years to come. ■