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nature called. we answered.

Biological Questions and Answers

1. Why is SludgeHammer so unique? or How is it different from all the other similar units, ATU's in general?

SludgeHammer is unique in several respects. First, the SludgeHammer is not an Air Treatment Unit (ATU). It is an Aerobic Bacteria Generator (ABG). It functions by efficiently converting organic matter in a septic tank into a rich colony of specific bacteria introduced and grown within the SludgeHammer unit. The species of bacteria in the SludgeHammer Blend™ have an aggressive appetite not only for the organic material within the tank, but also for the mucous coating that clogs the biomat that forms in a standard leach trench. Installation of a SludgeHammer System in septics that are failing because of this type of clogging are quickly restored to full function as these bacteria digest the slime in the biomat.

These bacteria differ from those in a conventional ATU by being "facultative" organisms. This means that they can survive both aerobically (with oxygen) and anaerobically (without oxygen). Unlike the strict aerobes of an ATU, which die when they get into the anaerobic zone of a leach trench, the SludgeHammer bacteria survive while they move out into the aerobic zone of the soil where they continue to thrive.

The SludgeHammer device itself is unique by being an accessory rather than a system. A SludgeHammer converts any existing septic system to an advanced treatment unit capable of meeting most of the performance parameters associated with ATU's. It goes beyond ATU's, however, in the active behavior of the bacteria downstream of the device.

2. How does it deal with: Nitrate, Ammonia, and Pathogens?

The SludgeHammer is completely different from typical ATU's in nitrogen dynamics. Even with high DO's (dissolved oxygen in the water) and extensive aeration, the ammonia in the tank cannot be converted to nitrate because the SludgeHammer Blend™ keeps nitrifying bacteria from the system through competitive exclusion. All nitrogen stays in ammonia form until it reaches the soil surrounding the leach field. There, a unique and unprecedented reaction occurs which results in an almost complete denitrification of the effluent as it passes through the SludgeHammer soil biomat. Concentrations of ammonia, nitrite and nitrate all are typically less than 1 mg/L after passage through just 6-12" of the SludgeHammer biomat in the soil.

Pathogen removal is amplified by virtue of a two-stage biomat in a SludgeHammer system. The first is the dense 150 sq.ft. biomat existing as a fixed film within the SludgeHammer device itself. The contents of a septic tank are passed through this highly aerobic biomat as many as 20-30 times a day before the effluent leaves the tank. Experiments have shown a 2-log reduction in fecal coliform levels in the septic tank, even where no trash tank exists in front of the SludgeHammer to settle pathogens, as is the case with NSF-40 approved ATU's.

The second biomat is the facultative bacterial community that settles the soil of the leach system. Testing at the Buzzard's Bay ETV test site in Massachusetts has shown a SludgeHammer system has the same level of pathogen removal in the soil that a standard septic control tank with a typical clogging anaerobic biomat even when operated with 4 times the loading to the trenches. This despite the fact that the SludgeHammer Blend™ had restored soil porosity to the point where no ponding occurred in the trenches, as was the case with the control tank. The widespread notion that the clogging biomat in a standard leach trench is essential for pathogen removal is no longer valid.

3. What is the chemistry or methodology of the reactions that occur in a standard septic tank, ATU, and a SludgeHammer?

The chemicals of most concern inherent in septic effluent are three compounds: ammonia, nitrate and phosphate. Ammonia and nitrate, relating to the SludgeHammer system, are discussed in section (2) above. With conventional ATUs, bio-filters, mounds or sand filters ammonia will be converted almost completely to nitrate. The removal of the nitrate then becomes a serious and problematic issue.
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The phosphates become incorporated into the bodies of the SludgeHammer Blend™ bacteria. A portion of the SludgeHammer Blend™ bacteria become entrained in the effluent to the disposal area. When they die in the disposal area, the phosphates are released and bound up in the soil. This process removes a portion of the phosphate load in the tank. Phosphate is a mineral so it cannot be digested to a gas like nitrate can. However, phosphate is easily bound to the soil and is not an issue with on-site systems, except where failed leach lines allow effluent to reach the surface where phosphate can then wash into streams and lakes. The restoration of soil percolation is how the SludgeHammer prevents phosphate pollution.

Nitrogen dynamics are where the SludgeHammer differs most importantly from conventional septic treatment, or conventional aerobic treatment in ATU's, sand-filters, fiber filters, etc. A comparison of the systems is necessary to understand the SludgeHammer process:

a. Anaerobic (without air) Septic System (standard septic tank and leach field);

Tank - Nitrogen stays in ammonia form;

Soil - Ammonia oxidized to nitrite (NO2) by Nitrosomonas species, Nitrite oxidized to nitrate (NO3) by Nitrobacter species;

Denitrification - Some denitrification will occur in the mixed aerobic-anaerobic biomat as the effluent passes through, however, typically no more than 10-30% is converted to nitrogen gas through denitrification.

b. Aerobic (with air) Treatment Unit (ATU, Sand Filter, etc.);

Tank - Over time spores of aerobic bacteria will enter the liquid with the air pumped into the tank. Ammonia in tank will kill most species except Nitrosomonas which use ammonia for energy. Nitrosomonas will grow and begin to oxidize ammonia to nitrite. Nitrobacter will then be able to survive and start converting nitrite to nitrate. When these combined bacteria have converted all ammonia to nitrate, other carbon consuming bacteria can begin to grow in the tank. It takes about 3-6 months to develop this type of colony in an ATU.

Soil - There is too little carbon left in the effluent for any denitrification to occur so virtually all nitrate is released. Nitrate migrates over long distances and causes health and environmental problems in ground water and receiving waters.

Denitrification - The only way any denitrification can occur in ATU's is by recirculating a portion of the treated effluent back to the anaerobic trash tank in front of the aeration chamber. This is very inefficient because you are completely treating the effluent all over again, several times where 2-3 recycles are necessary to get below the Federal 10 mg/L drinking water standard.

c. SludgeHammer

Tank - Bacillus species introduced in the SludgeHammer Blend™ culture prevent ammonia oxidizers or nitritifiers from surviving. Proteins and urea are converted only to ammonia, even though the system has high DO and aggressive aeration.

Soil - When SludgeHammers are installed in failed existing systems there will already be an established colony of Nitrosomonas and Nitrobacter in the soil. SludgeHammer effluent sends out the ammonia along with a dense colony of Bacillus. The Nitrosomonas do not compete with Bacillus so they will convert ammonia to nitrite. Bacillus does compete with Nitrobacter, because they want the oxygen that is now on the nitrite molecule. Our effluent contains so many more Bacillus that they overwhelm the Nitrobacter and that species dies out. In the process the Bacillus strips the oxygen from nitrite producing nitrogen gas that escapes harmlessly to the atmosphere.

Denitrification - The denitrification with the SludgeHammer typically occurs in the soil, without and almost total conversion to nitrogen gas within the first 3-6 inches of percolation through the new SludgeHammer enhanced biomat. Where desired, the denitrification can take place in the SludgeHammer tank itself. This is done by modifying the sequence of introduction of bacteria into the tank when the system is started. To date, the SludgeHammer is the only system in the world demonstrated to reduce nitrogen in a septic tank by over 95%.

4. What is the difference between the clogging biomat and the biomat that our bacillus leaves?

The clogging biomat, typical of conventional septic systems, is an anaerobic biomat composed primarily of a mucus slime. The intestinal bacteria that dominate the load to a septic tank need to produce this mucus to protect themselves in the intestinal tract. This mucus eventually fills the pore spaces between the soil particles, retarding the absorption of liquid into the soil. At some point the soil becomes so restricted that the system fails. The SludgeHammer Blend bacteria are facultative soil species capable of surviving anaerobically as they pass through the leach trench. When they colonize the aerobic zone of the soil they are "back home". These bacteria will actually consume the excess mucus removing the barrier that retards absorption of liquid into the soil.

5. Is the bacillus biomat self-regulating or will it eventually clog the field or trench also?

Within the SludgeHammer unit, the SludgeHammer Blend™ bacteria consume the basic organic load of the septic system. There is little organic material (food) in the effluent leaving the septic tank for the disposal area to maintain a clogging anaerobic biomat. The SludgeHammer Blend™ bacteria will also digest the mucus in the anaerobic biomat. If the amount of organic material (food) increases and decreases in the effluent to the disposal area, the aerobic biomat will increase and decrease in thickness with these changes in available food. Even with this change, the aerobic biomat will not clog the soil.

6. How long do our microbes live anaerobically?

The SludgeHammer Blend™ bacteria are able to survive periods up to 4 days in the absence of air. They can multiply under anaerobic conditions but are more vigorous with air. In anaerobic conditions where there is a significant amount of nitrate (or other oxygenated molecules) present, the SludgeHammer Blend™ bacteria will strip the nitrate of the ionized oxygen and use it aerobically. The reproductive capacity of the SludgeHammer Blend bacteria in this environment is very near that of fully aerobic conditions.

7. What is the shelf life of our inoculants when in the envelopes?

When properly stored as per the supplier's instruction, the SludgeHammer Blend™ bacteria stick should have a reasonable shelf life of up to 24 months. The SludgeHammer Blend™ bacteria sticks should be stored in a dark, cool, dry environment.

8. What is the tank life of our inoculants if food is present?

The first SludgeHammer units were installed in the latter part of 2000. These systems were part of our R&D program. To date, unless we had toxic materials (chemotherapy by- products , prolonged periods on strong antibiotics) introduced into the septic tanks, we have not had to re-inoculate these early systems. The SludgeHammer Blend™ bacteria should maintain a viable colony within the SludgeHammer unit indefinitely. We do, however, recommend replacing the SludgeHammer Blend™ bacteria stick on an annual basis to insure that the bacterial community stays healthy, and to encourage routine site inspection by a qualified installer.

This conservative approach is not costly and guarantees a vigorous SludgeHammer Blend bacteria community.

9. What do the enzymes that pumpers put into the tanks for clogged fields do? Positives and Negatives. How are we different?

Enzymes are proteins produced by living cells that catalyze biochemical reactions. The enzymes that pumpers use are artificially produced and introduced in concentrations that will break down and dissolve (make soluble) the organic material in waste. The organic load is changed in form but not removed from the system by digestion. This includes the solids that are referred to as "scum" in septic tanks.

This may clean a tank of some organic material but the problem is passed down stream to the disposal area where it will hasten the failure of the disposal area. Standard septic tanks are designed to store organic material for future removal by pumping. Enzymes defeat this purpose. In commercial grease traps tied to municipal waste plants enzymes may help reduce the fat, oil and grease (FOG) load in grease traps, requiring less frequent and costly pumping, but the now soluble FOG will pass out of the grease trap and clog the sewer lines. If the grease trap is part of an onsite waste disposal system enzymes are guaranteed to dramatically shorten the life of the disposal area. The SludgeHammer is different because enzymes are being produced by living bacteria. Any food that is hydrolyzed by these enzymes is immediately consumed by the bacteria. In fact, these living bacteria pass with the effluent downstream to digest residual organic material that may have built up in the past.

10. At what temperature do the bacillus stop ramping up or become inert in the tanks?

Temperatures of 40 degrees F and below will significantly reduce the biological activity of all bacteria. A properly functioning septic tank maintains an inside temperature ranging from 48 to 52 degrees in northern climates during the winter. Although the bacterial activity deceases in the winter it does not stop. The temperature of the input effluent and the activity of the bacteria in the tank maintain functional temperatures.

11. How do we know when the microbes have 'taken' in the tank?

Within 24 hours of installing the SludgeHammer unit, with the SludgeHammer Blend bacteria stick properly placed within the SludgeHammer, there will be a dramatic reduction in odors commonly associated with septic tanks. The common odor that replaces the septic tank odor is one usually associated with wastewater plants. This odor is comprised of the various “musks” found in the many perfumed products we use in our modern daily lives. (soaps, deodorant, perfume and cologne, shampoo etc.) This “new” odor is very light and is normally not unpleasant. Very few residents notice this odor unless they open the septic tank. Within this time frame, there should be a measurable decrease in any scum layer if the SludgeHammer unit is placed in the inlet chamber of a septic tank. Should the SludgeHammer unit be placed in the outlet chamber of a septic tank, the effluent quality will be noticeably higher and the clarity of the effluent will be markedly improved. Additionally, there should be some evidence of bacteria colonization on parts of the piping and other accoutrements of the SludgeHammer unit.

12. Drugs: which kind and how much will affect the function of the SludgeHammer? How long do we wait before we replace the inoculants?

Any ongoing pharmaceutical drug treatment (10 days or more) by any occupant of a residence being served by the SludgeHammer System should be brought to the attention of the local SludgeHammer representative. This includes houseguests. Pharmaceuticals create toxic compounds after being utilized in the human body. They are typically excreted in the urine. When allowed to remain in sufficient concentrations within a septic tank, these compounds can kill the entire bacteria community. These compounds will seriously diminish the capacity of any bacteria community within the septic tank. We have found chemotherapeutic drugs, antibiotics and immune suppression drugs to be the most toxic. Combinations of many different pharmaceuticals can also be toxic. When confronted with this situation, the installer should discuss the problem with the occupants of the residence immediately. The names and purpose of the pharmaceuticals should be obtained. With this information we can develop a program to overcome the toxicity of the drugs. Some experimentation may be necessary but we have never failed to find a solution. The most important thing to remember, the longer the problem exists without correction, the time and costs to correct the problem typically increases. A point should be made at this time that the toxicity of these drugs affect every system. SludgeHammer enables early detection and correction.