U S Chemical

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Enzymes vs. Bacteria in Drain Treatment

What are the Differences?

Among the ways of treating waste systems, biological products have gained a strong niche in recent years. Whether the application is a restaurant on a municipal sewer system or a hotel on a private septic tank and drain field, biological products offer some distinct advantages over chemical treatments. The first generation of these products contained only crude enzymes. Next came products with only bacteria in them. More recently, enzyme and bacteria blends have been introduced. While each generation of products has distinct advantages, this brochure will explain why products with only bacteria (generation 2) are recommended by U S Chemical for drain maintenance.

SYSTEM BASICS

When pipes in a waste system are new, they pass all kinds of objects with ease to the end of the line. Over time, small bits of organic matter build up on the pipe walls. Eventually, the water flow in the pipe is restricted to the point that people using the system notice how slowly the wastes are draining. In some cases, the pipe becomes so plugged that the system backs up and wastewater overflows onto the floor from a drain or up out of a toilet. When this happens, there are several options available to the owner of the facility.

TREATMENT OPTIONS

1. Chemical Treatment
2. Mechanical Treatment
3. Biological Treatment

Chemical drain opener products often contain strong acids, such as sulfuric acid or strong alkaline chemicals, such as sodium hydroxide (caustic soda). The chemical reacts with the organic matter and dissolves enough of it to allow wastewater to flow once again. Mechanical action involves using an auger, often called a “snake”, to clear the line. A flexible piece of metal with a special attachment on the end is fed down the drain line until it reaches the clog. By using a crank, the metal snake turns and the head of the snake breaks up the obstruction so that wastewater can flow again.

Both chemical and mechanical treatments are most appropriate for emergencies, not routine maintenance. Chemical treatment works fine if there is a plug to stop the flow of water long enough for the chemicals to work. If the water is flowing, the chemicals pass right by the organic matter that is building up on the pipe walls. Even with regular use of a chemical treatment, the pipes continue to have organic buildups that will plug the pipe, stopping wastewater flow. Mechanical treatment is very uneven and time consuming in removing organic matter. Much like chemicals, mechanical treatment works well if there is a plug in the pipe, but does not remove all of the wastes present. Pipes continue to build up just as before the treatment. Biological treatments were developed to handle this problem.

As we go through this discussion, we want to distinguish between drain openers, defined as products designed to open a completely plugged drain, and maintenance products, which are designed to be used routinely to improve water drainage rates by consuming wastes from the pipe walls. The U S Chemical biological product described herein is a drain maintenance product, not a drain opener.

BACTERIA

Let’s consider the various types of biological products by contrasting the shape of the two major components. Bacteria are microorganisms (extremely small) that can be found in straight or curved rods, spheres or spiral structures. These organisms are living cells about 1/25,000 of an inch in length. Roughly 50 billion bacteria can be grown in 1 cubic inch. Bacteria are self-sustaining as long as they have food and water. Oxygen may or may not be required for bacterial growth. Bacteria that require oxygen are called aerobic, while those that do not are called anaerobic. Bacteria that can survive both with and without oxygen are called facultative. Bacteria are very pH sensitive, with the pH range of 4 - 9 being the best for bacterial growth. Therefore, anything that drastically changes the pH (such as a high alkaline drain opener) kills the bacteria as effectively as chlorine bleach.

Under favorable conditions, bacteria can reproduce every 15 to 20 minutes. This means that the total number of bacteria present can double every 15 - 20 minutes. One bacteria can become one million in 8 hours. Overnight, bacteria put into a pipe can become a huge army of bacteria. These bacteria will eat most of the organic matter found on the pipe walls. To do this, the bacteria secrete enzymes and reproduce. The bacteria do not directly digest the wastes. They release enzymes to do this for them. As the bacteria population is growing, more and more of the wastes on the walls of the pipes are digested. Eventually, either the bacteria run out of waste to eat, some chemical is poured down the drain that kills the bacteria, or the bacteria are flushed out of the pipe.

Either way, the bacteria start to die. It is very important that the bacteria be injected into the part of the pipe with the organic buildup. Simply dumping the bacteria down the drain does not get them close enough to the waste to be effective. The bacteria do not swim down the drain to the wastes. U S Chemical drain cleaner dispensers use a product discharge tube that can be fed down a drain to allow product to be injected where it is needed.

If the bacteria die or get flushed away, the waste can start to build up on the pipe walls again. The bacteria never remove all of the waste from the pipe wall. There will always be a thin layer of waste left on the pipe walls. This also is true in a grease trap. If a bacterial product is injected in a grease trap to digest the wastes present, the bacteria will consume large amounts of waste, but will never completely clean a grease trap. The bacteria don't last long enough to eat all of the waste, but they really don't have to in order to keep the system operational.

There are bacteria naturally occurring in pipes, a grease trap or in a septic tank. The naturally occurring bacteria do a poor job of digesting the wastes, but still compete with the bacteria from a biological product. This is why we inject high numbers of bacteria, so that our bacteria can overwhelm the naturally occurring bacteria and thrive. If this wasn't a problem, we could inject small numbers of bacteria and wait for the population to grow. What research has shown is that the bacteria in the product need an artificial boost in numbers to get going. However, if the drain is discharged into a drain field instead of a municipal waste treatment system, it may not be acceptable to use a bacterial product. If the bacteria from the drain treatment compete with and kill off the naturally occurring bacteria, then other wastes which the naturally occurring bacteria would have digested will remain undigested. This can lead to plugging of the pores in the drain field.

The bacteria used in U S Chemical products are all from the strain bacillus. Within this strain, there are 5 different types of bacteria used to produce a number of different enzymes. This allows the bacteria to be efficient in digesting a wide variety of wastes.

Bacterial Products

Biological treatment products formulated strictly with bacteria have several important features:

1. They are stable in a broader pH and temperature range than products made with only enzymes.

2. Bacteria "sense" the type of wastes around them. The bacteria release different enzymes automatically to attack the different types of waste.

3. The bacteria produce their own enzymes, so the bacteria release more enzymes than a customer could ever afford to purchase when compared to an enzyme product.

4. Bacteria actually consume the wastes present, so there are no chunks of waste breaking free to plug the pipes further down the line or to plug the drain field pores. If used properly, when the bacteria finally start to die, only a thin film of waste is left on the walls of the pipe.

Products made solely with bacteria have a drawback: The bacteria are sold in a spore form. This means that they have a hard outer shell to help protect them. Therefore the bacteria need to "wake up" and shed the shell before they can attack the wastes. This causes a lag period from when the bacteria are injected until they have built up a population to effectively digest the wastes. If the product is being injected during the night to maintain a pipe or septic system, it's not a problem. However, if a drain is completely plugged, it is a problem because the rate at which the bacteria shed the shell and start digesting the wastes is too slow to help unplug the drain quickly. Several hours may be needed before there are enough enzymes produced to digest enough wastes to open the drain.

ENZYMES

Enzymes are a group of proteins which do the actual digestion of the wastes. They are fairly specific in the type of organic soil that they will digest. Some enzymes like fats, others like protein, still others like starches. Unlike bacteria, they do not reproduce because they aren't alive. The basic distinction between enzymes and bacteria is that bacteria secrete enzymes to digest waste. Bacteria are living organisms, while enzymes are organic compounds (proteins), but not an organism. When enzyme products are used, large numbers are injected to liquefy the wastes. This is because the enzymes don't reproduce and each enzyme can only consume a certain amount of waste. In order to do an effective job, large numbers of enzymes are needed.

Enzymes are often referred to by the general class of organic matter they are attracted to and consume. Some of the more important general classes are:

Proteases - Attack protein based wastes such as grass, blood, feces and meat products.

Lipase - Attack fats, greases and oils such as salad oil, butter and cooking oil.

Esterase - Attacks fats like a lipase but doesn't attack greases and oils.

Amylase - Attack starches such as potatoes, pasta, rice, grits and porridge.

Cellulase - Attack cellulose such as from paper products.

Xylenase - Attacks plant material, such as vegetables.

Urease - Attacks urea.

The U S Chemical drain maintenance product uses a bacteria blend that produce all of these enzymes.

Enzyme Products

Biological products formulated strictly with enzymes have several important features:

1. They are very specific in the wastes they attack. If the waste is starch, specific enzymes can be picked that digest the starch.

2. They are relatively fast acting. When an enzyme is in the presence of a soil, it will attack it quickly. Enzymes do not need time to build up a population like bacteria.

Enzyme products have several drawbacks:

1. Because enzymes are specific in what they attack, they don't work well for general waste digestion. Most waste is a mix of starch, fats, proteins and other things, not just one type of organic material. If the enzyme product is a mix of different types of enzymes, then it may work better, but this feature will significantly increase the cost of the product.

2. Enzymes are difficult to manufacture, so they are very expensive. High quality enzyme products are rare because of this.

3. Enzymes are consumed by digesting a waste, so each unit of product can only liquefy a certain amount of waste. Enzymes do not reproduce. This makes it difficult for enzymes to completely digest a waste because high numbers are needed.

4. Because enzymes only partially digest a waste, they are prohibited for industrial use in many municipal water treatment systems. The enzymes tend to break off chunks of waste. This allows the waste to travel further down the pipes where it can cause a clog that is more difficult to remove. This can also be a problem for septic fields as chunks of waste then clog the drain field. Enzymes used in laundry products are different, because small numbers of enzymes are injected and most of the enzymes are consumed by the time the wastewater is discharged to a sewer or septic field. Large amounts of water accompany the discharge of laundry wastewater, minimizing the effects the enzymes have on the pipes.

5. Enzymes are difficult to stabilize. By the time an enzyme product is used, some of the enzyme activity is lost due to this instability. Laundry products are different because smaller numbers of enzymes are present and high surfactant levels make the enzymes much more stable.

Bacteria and Enzyme Blends

Biological products formulated with both enzymes and bacteria have one advantage over the other types of biological products. Because of the enzymes, they start digesting the wastes immediately. But because of the bacteria, they can continue to produce more enzymes to digest the waste. So this type of biological product would work as a drain opener instead of just being a maintenance product. However, they work slower than chemical drain openers.

The main drawback to the blended products is that they cannot be used in some areas, because local regulations prohibiting enzyme use in drain treatment don't distinguish between enzyme/bacteria blended products and enzyme-only products. If a blend of bacteria and enzymes is used to clear a plugged pipe, the enzymes may break free chunks of waste which can clog the pipe further downstream. Although this type of product is faster acting than bacteria-only products, they may cause other problems. Hence, U S Chemical recommends the use of bacteria-only based products.