UNDERSTANDING WASTE WATER TREATMENT

BACTERIAL DIGESTION OF WASTE

AN INSTRUCTIONAL GUIDE ON THE FUNCTION OF BACTERIAL DIGESTANTS AND HOW THEY WORK TO DIGEST WASTE

Bacterial digestant products contain three necessary components:

1. **BACTERIA CULTURES**
2. **ENZYMES**
3. **ESSENTIAL NUTRIENTS**

Read on to see how these three components work in harmony to digest organic waste QUICKLY and EFFICIENTLY, with NO ODOR or NOXIOUS GAS.

The following discussion outlines the biological process of BACTERIAL DISGESTION. This process is responsible for the digestion of organic waste, no matter where it occurs. With minor variations, this same process digests waste in:

Grease Traps, Drains & Plumbing, and Septic Systems
Hog, Cattle, Chicken Manure Pits, Leaf and Grass Mulch
Municipal Sewer Treatment Operations including Digesters, Oxidation Tanks, Trickling Filters and Ponds.
Also, Industrial Wastewater, Food Processing Wastes and other Waste Disposal Systems.

WHAT IS BACTERIAL DIGESTATION?

Bacterial digestion is the process of bacteria consuming organic matter. The bacteria feed on the organic waste, deriving nutrition for growth and reproduction. Using complex chemical reactions, the organic waste is metabolized down to water and carbon dioxide (the final metabolic waste products), providing the bacteria with energy to sustain their life. It may be simply shown by the following equation:

$$\text{Organic Waste} + \text{Oxygen} \xrightarrow{\text{Bacteria}} \text{Water} + \text{Carbon Dioxide}$$

Organic waste is consumed by the bacteria, used as nutrients by the bacteria, and is no longer present to produce clogs, odors, sludge, pollution, or unsightly mess.

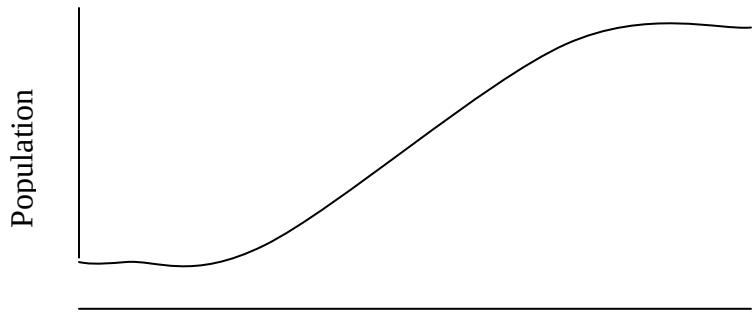
BACTERIA CULTURES

Thousands of different types of bacteria exist everywhere in our world, and most of them carry on bacterial digestion in some way. However, some of them are found only in a particular place (environment) and require specialized types of food and/or have very unique biological roles (niches).

Bacteria are single cell life forms – each individual cell is a separate, unique organism. Bacteria often grow into colonies that appear as jelly-like masses, but each cell remains an independent, individual life. Bacteria reproduce by a process called cell division. Mature bacteria reproduce by dividing into two daughter cells, each identical to each other and the parent bacteria. Under ideal conditions, bacteria can reproduce very rapidly, producing a new generation every 20 to 30 minutes.

Following this reproduction process, we see that the number of individual bacteria doubles with each generation. The population explodes as the number of organisms increases logarithmically. This population boom begins soon after the bacteria are introduced into a favorable environment, after a short lag time when the bacteria become acclimated to the new conditions.

Obviously, this population cannot increase forever. At some point, the food source will be depleted, waste products will accumulate, or some other change in the environment will cause the population to level off or decrease (such as change in the pH, temperature, or oxygen content of the environment). Also, introduction of any poisons into the environment may have negative effects on the population, as well as competition from other types of bacteria. This is demonstrated by a population growth chart for a typical bacteria culture.



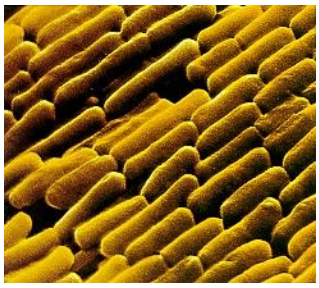
Population Growth Curve

Bacteria can be classified into different types:

- Aerobic types (which require oxygen to live) and
- Anaerobic types (which can live without oxygen).
- Facultative types can thrive under both aerobic and anaerobic conditions.

For waste digestion, we can identify several beneficial characteristics that we desire in our chosen bacteria. The "good" bacteria that we choose must do the following:

1. Consume (digest) a wide variety of organic material that is present in wastes.
2. Digest waste quickly and completely, without producing significant odors or noxious gas.
3. Not cause any disease in man or animals – they must be non-pathogenic.
4. Grow and reproduce quickly and readily in the environmental conditions found in waste disposal systems.



Certain bacteria belonging to the Bacillus species have these desirable characteristics. They consume organic waste thousands of times faster than the bacteria that are naturally present in the waste. They grow and reproduce easily, are non-pathogenic, and do not produce foul odors or gas as they digest waste.

These "good" bacteria are cultured (grown by artificial means) on a liquid or dry nutrient medium. These cultured bacteria are then freeze dried to put them in a state of suspension. They remain alive, ready to swim, eat, and reproduce as soon as they are activated (re-hydrated) and put into the proper environment.

The proper environment needed for rapid growth and reproduction of these "good" bacteria must have these characteristics:

1. A water medium containing food (organic waste) for them to eat.
2. Dissolved oxygen (for the aerobic types that require it) in sufficient quantities.
3. Proper pH – not too acid or too alkaline (between 6 and 9 on the pH scale).
4. Moderate temperatures, between 50°F and 110°F.

BACTERIA STRAINS IN BIO-FLOW PRODUCTS SELECTED ATTRIBUTES

	Bacillus amyloliquefaciens	**Bacillus licheniformis**	**Bacillus subtilis**	**Bacillus megaterium**	**Bacillus pumilus**
Growth	Facultative	Facultative	Aerobic	Aerobic	Aerobic
pH range	6-10	5-10	4-10	5-10	6-10
Temperature (ºF)	10-50	10-55	10-50	4-45	10-50
Protease	**	**	****	***	***
Amylase	**	**	****	*	*
Lipase	**	**	****	***	***
Esterase	**	**	****	***	***
Cellulase	**	*	****	***	****
Xylanase	**	*	****	***	****
Urease	***	**	**	***	**

**** = Excellent *** = Very Good ** = Good * = Moderate

Bacillus megaterium, under laboratory conditions, germinates in one hour or less. Most Bacillus strains require a minimum of four hours to germinate.

ENZYMES

What is an enzyme and how does it aid digestion? An enzyme is a chemical catalyst that breaks up long, complex waste molecules into smaller pieces, which can then be digested directly by the bacteria.

Enzymes are simply chemicals – they are not living things, and they cannot grow or reproduce themselves. Enzymes are manufactured and used by the bacteria in order to digest waste. The extra enzymes that are mixed into digestant products are actually produced by special bacteria, extracted from them in dry form, and blended into the digestant mixture.

Enzymes are added to digestants to help them go to work faster. When added to the organic waste, the enzymes immediately go to work breaking down the waste. The large, complex molecules of starches, proteins, carbohydrates, and cellulose are broken into smaller, simpler pieces. These enzymes act like chemical "knives", chopping the large molecules of waste into smaller pieces of "prepared food" for the bacteria. The growing bacteria will then start to produce more enzymes on their own, creating a continuing cycle of enzyme production.

The following four types of enzymes are often incorporated into digestant products:

LIPASE ⟶ breaks down fats and greases.
PROTEASE ⟶ breaks down proteins.
CELLULASE ⟶ breaks down cellulose.
AMYLASE ⟶ breaks down carbohydrates and starches.

Enzymes are specific, so that one type of enzyme can work on only one type of molecule. Thus, protease enzyme will break down complex proteins into simple pieces, but will have no effect on fats or greases. Likewise, lipase will attack animal fats and grease, but will not work on paper or wood (cellulose).

ESSENTIAL NUTRIENTS

Special nutrients are added to supply the vitamins and minerals required for the fastest growth and greatest activity of the bacteria. These vitamins and minerals may not be present in the waste, and a lack of any one of them may seriously inhibit the growth, reproduction and waste digesting performance. They must be added to the digestant product to assure the fastest, most efficient digestant action.

CASE HISTORY: THE PROVERBIAL "BUCKET OF WASTE"

Now that we have a basic understanding of the process of bacterial digestion, let us follow what happens when digestant is added to a hypothetical bucket of organic waste. Our bucket contains several gallons of liquid, a slurry of water with several pounds of cow manure. Note that this waste bucket environment may be compared to conditions that exist in a septic tank, a sludge digester, or even a clogged drain.

First, the digestant product is re-hydrated with warm water, about 100^{o}F. This warm water will re-activate the dried bacteria cultures, preparing them to go to work (hot water, above 180^{o}F

would *kill* the bacteria!) At the same time, the enzymes are dissolved and ready to begin the initial breakdown of the waste.

When the slurry of digestant is added to the waste, the enzymes go to work immediately. The protease begins to split the large protein molecules, and cellulose begins to break down grass and hay fibers. Cow manure contains no significant fat or grease, so the lipase does little or no work. But if this was a grease trap …!

The re-activated bacteria have a short latent period to get acclimated to the new environment, giving the starter enzymes time to produce many small fragments of food that can be immediately consumed by the bacteria. Under these favorable conditions, the bacteria soon begin to multiply, doubling their number every 20 to 30 minutes. This population explosion results in a tremendous number of bacteria living in the waste within a short time. The huge number of bacteria is able to digest large volumes of waste quickly. Remember that these bacteria were specifically chosen for their ability to digest waste quickly and efficiently, without odors or gas!

As digestion continues, the bucket of waste will change in appearance. The solid particles are liquefied, and the whole bucket will turn to a black liquid. As the process moves toward completion, the bucket would eventually clear up as all the organic matter is digested, with only a small amount of indigestible (inorganic) matter remaining. In real life, the process is a bit more complicated.

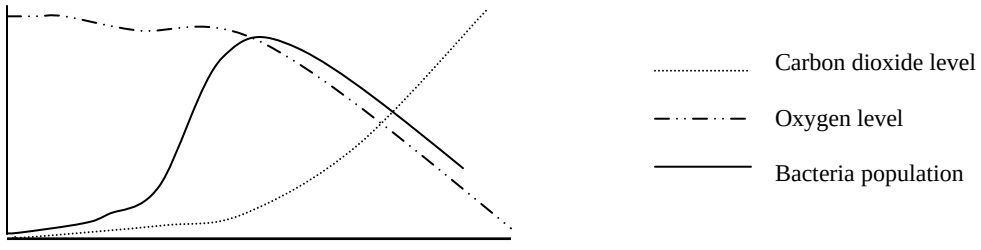
CLOSED VERSUS OPEN SYSTEM

In this example, we have treated the bucket of waste as a *closed system*. That is, nothing is taken out or added into the system other than what was there to start with. The consequences of this are important to consider, because this does occur in nature. A closed system tends to work against an efficient digestion process. We will look specifically at three occurrences:

1. The build-up of metabolic waste.
2. The depletion of dissolved oxygen.
3. Completion from other types of bacteria.

Because nothing is removed from the closed system, the end product of the digestion process (carbon dioxide) will build up in the system. This carbon dioxide is the *metabolic waste* of the bacteria. As carbon dioxide waste builds up in the water, it lowers the pH of the water (makes it more acidic). As more and more carbon dioxide is produced, the water becomes more acidic – and the environment becomes less and less ideal for the bacteria. In this closed system, the bacteria are "poisoned" by their own waste product (carbon dioxide), so the growth and reproduction rates are drastically reduced.

In a similar manner, the available oxygen is used up. As the aerobic bacteria consume the dissolved oxygen, the environment becomes less conducive to growth and reproduction. Because we cannot add more oxygen into this "closed system", the growth and reproduction rates decline faster. Note that anaerobic or facultative bacteria will continue digestion after the oxygen is gone!



Population growth curve in a Closed System

Just like other living organisms, different types of bacteria compete with each other for food and living space. In a particular environment, certain bacteria species may be more successful than all the others, and will eventually become "dominant" in that environment.

For example, there may be hundreds of different types of bacteria naturally present in the cow manure in our bucket of waste. Some types of these naturally occurring bacteria may not grow and reproduce in the system, while others may grow prolifically. As the conditions change, a particular type of natural bacteria may grow better than the ones we have artificially introduced with the digestant product. These competing bacteria may be more successful, and overpower our desirable bacteria. However, these successful bacteria may not digest the waste as well, or produce foul odors, or even be pathogenic.

These and other possible changes in the environment may drastically slow the process of digestion. In fact, it may take many times longer to digest the last 20 percent of the waste as it did to digest the first 80 percent.

CONTINUOUS DIGESTION: THE OPEN SYSTEM

We can clearly see the problems that a closed environment causes with the process of bacterial digestion. Fortunately, most real waste systems are open systems. With an open system, we can add or remove things to maintain the environment in a condition that is most favorable to the growth of our beneficial bacteria. Let us consider the bucket of waste if a little bit of attention is paid to it:

1. The pH of the water may be adjusted to maintain conditions that promote the growth of the desirable bacteria. As the carbon dioxide builds up, we can add a small amount of caustic soda or another alkaline chemical to adjust the pH back up to the best range.

2. The bucket could be stirred or otherwise aerated to replenish the dissolved oxygen supply. The added oxygen would encourage continued bacterial growth and rapid digestion, because we are maintaining the most favorable growing conditions for our beneficial bacteria.

3. Additional doses of digestant could be added to bolster the population of the desirable bacteria. This is done to insure that our "good" bacteria will remain plentiful in the face of tough competition from all the naturally occurring bacteria.

As you well know, these techniques are often used in large sewer treatment plants. By actively working to maintain a healthy environment, the growth of the desirable bacteria can be maximized. The conditions may be monitored and adjusted to keep the process of bacterial digestion going full speed, with an absolute minimum of gas or odors, and resulting in the fastest, most complete digestion of the organic waste.

This introduction is designed to help you understand some of the principles involved in bacterial digestion. While the process is the same for almost all waste systems, the actual conditions will vary greatly from system to system. Each type of system will have its unique problems to be overcome. By understanding the way digestants work, and what makes them work best, you can fine-tune the treatment program to produce the best results – while minimizing the cost of treatment.

MUNICIPAL SEWER TREATMENT PLANTS

All municipal sewer treatment plants use bacterial digestion to treat wastewater. There are many methods and devices used to do this, but they *all* use bacterial digestion to remove organic waste from wastewater.

Oconomowoc, WI

Raw sewage coming into the treatment plant (called the *influent*) contains:

1. **WATER**.
2. **GRIT** – stones, sand coffee grounds, cigarette butts, pieces of rubber, plastic and cloth, and other non-biodegradable matter.
3. **SUSPENDED SOLIDS** – particles of organic waste that can be settled out of the water.
4. **DISSOLVED SOLIDS** – particles of organic waste that are very fine and soluble, and cannot be settled out of the liquid.

The job of the treatment plant is to remove as much of the grit, dissolved and suspended solids as possible. When these are removed, the cleaned-up water (the *effluent*) is discharged into a lake, river or ocean or simply allowed to trickle down into the ground.

All sewer treatment plants are regulated by state and Federal agencies, and the performance of every treatment plant is measured by testing the treated effluent as it is discharged from the facility. The most important measurement of water quality is the **Biological Oxygen Demand**, usually referred to simply as "BOD".

BOD is an indirect measurement of the amount of organic matter in the water. This test shows how much oxygen is required (demanded) by bacteria if they were to digest all the organic material in the water. This test is based on the fundamental chemical reaction that describes bacterial digestion:

$$\text{Organic Waste} + \text{Oxygen} \xrightarrow{\text{Bacteria}} \text{Water} + \text{Carbon Dioxide}$$

BOD is expressed in parts per million, or "ppm". When the BOD of water is high, it means that the water has a lot of organic matter in it – and that bacteria would demand – or use – a lot of oxygen to digest that amount of organic material. Likewise, a low BOD measurement shows that most, or all, of the organic material has been removed from the water.

THE TREATMENT PROCESS

As raw sewage influent enters the treatment plant, the first step is to filter out any sand, grit, stones, cigarette butts and other hard, insoluble matter. This is normally accomplished with a mechanical filtering system, screen assemblies and settling basins.

The next step in the process is to separate the suspended organic solids from the water. This is done in a device called a primary clarifier. In this clarifier, the suspended solids are settled to the bottom, sometimes with the aid of flocculating agents. After settling out as much of the suspended

solids as possible, these solids are pumped out of the bottom of the primary clarifier as sludge. This process removes most of the organic waste from the water. However, the liquid portion that remains behind is still far from clean. It still contains all the dissolved solids, and so further processing of this liquid is required.

After this point, the sludge and the liquid portions of the waste are treated separately. First, we will follow the liquid portion through the remaining treatment processes until it is clean and ready for discharge.

The remaining liquid contains dissolved organic matter that must be removed by bacterial digestion before the water is actually clean. This is done in another device, often called the oxidation tank (or pond). This device is easy to identify by its bubbling and gurgling action, caused by air being forced through it (aeration). This aeration promotes the bacterial digestion process, and within several hours, the bacteria will digest most of the remaining dissolved solids.

When the digestion is deemed to be complete, the liquid waste then goes into a "final" clarifier or finishing pond. Here, the liquid is held motionless, and any remaining solids (including the bacteria) are settled to the bottom to be pumped off and treated with the sludge. The remaining liquid will be quite clear, as almost all of the organic matter has been removed from it. At this point, the water must meet stat and Federal guidelines and be clean enough for discharge.

Often, the water receives one final treatment before it is discharged to a lake, ocean, stream, river, etc. The final treatment is a disinfection step to kill any and all the bacteria that might remain in the water. This is required to prevent any pathogenic organisms from being discharged into the environment. There are several different methods of disinfection, but chlorination (using chlorine gas) is the most common disinfection process used in this country today.

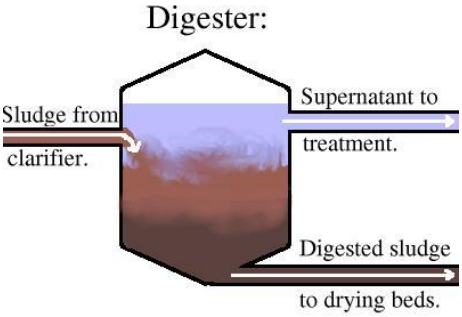
The sludge that was separated out in the primary clarifier is pumped to a *digester*, where it is also treated by bacterial action. This sludge must eventually be disposed of by some method, such as land filling, incineration, ocean disposal or application to farmlands as fertilizer. The purpose of treating the sludge is to:

1. Reduce the weight and volume of the sludge.
2. Transform the sludge into a liquid or solid cake form that can be processed, handled, transported and disposed of easily and economically.
3. Reduce any odors as much as possible.
4. Kill all pathogenic organisms before sludge is returned to the environment.

As you can imagine, processing of the sludge is designed to accomplish these goals at the lowest possible cost. Thus, the sludge treatment process used in a particular treatment facility will vary according to how the sludge will finally be disposed of. For example, if the sludge will be incinerated in a high temperature furnace, the main objective of sludge treatment will be to reduce water content so it burns better. The actual incineration will take care of the other concerns.

Today, much of the sludge from sewage treatment plants is returned to the environment. That is, the treated sludge is applied to farm fields as a fertilizer/soil amendment. When this is done, the sludge must be treated carefully so that it does not pose a pollution or other environmental threat to people, animals, crops, or groundwater.

Digesters has proven to be the best treatment process to prepare municipal sewage sludge for land application. Digestion produces a treated sludge that is perfectly suited to land disposal, *all thanks to bacterial digestion!*



A digester system can be designed for either aerobic or anaerobic operation. In either case, it is very important that the proper types of bacteria be present to obtain the fastest, most complete digestion. You can see how important the bacteria are by examining the cause of a common digester failure.

An aerobic digester may be functioning well for a long time. Then, within the space of a few days, the operator will notice drastic changes occurring. The temperature in the digester drops, the sludge takes on an unusual appearance, and the normal bubbling and churning slows – then stops completely. The digester has gone *septic*, and is not functioning at all. No bacterial digestion is going on to break down the sludge.

This type of failure can have several causes, such as wastewaters that contain toxic heavy metals, pesticides, or petroleum. But the most common cause is simply a lack of the proper types of bacteria. The digester stops working because there are not enough good waste-digesting bacteria in it. Instead, naturally occurring organisms have taken over, out-competing and displacing the desirable bacteria. The only way to fix this situation is to kill *all* bacteria present. This is done with very powerful disinfectant chemical called hydrogen peroxide.

The process of restarting a digester is laborious, time consuming, expensive, and involves handling very hazardous chemicals. It may take days to accomplish, holding up all other operations, and the treatment plant will not be able to properly treat the influent wastewater. Because the flow of waste water cannot be stopped, the treatment plant may be forced to discharge raw, untreated sewage – violating permit limits, state and Federal laws and causing dangerous pollution of the receiving waters.

The best way to keep a digester working smoothly, efficiently and without disruption is to add daily or weekly doses of a good digestant product. This will ensure that there is always enough of the good waste-digesting bacteria present to prevent any disruption of the digester.

In addition, the specially cultured bacteria and enzymes in a digestant will make the whole treatment process work better. Digestant should be added to the digesters, oxidation tanks, trickling filters, settling tanks, and polishing ponds.

- Bacterial oxidation of the liquid phase will be faster and more complete.
- Digesters will operate evenly and uniformly, easier planning and routing of waste.
- Sludge volume will be reduced more, as more solids are digested.
- Sludge will be easier to pump, process and dewater, and have fewer odors too.
- The capacity of the system will be effectively increased, because more waste can be processed, more completely, in less time.
- The whole system will be better able to absorb the shock of toxic influent.
- Effluent water quality standards will be met more consistently, helping to maintain a clean environment and safe drinking water for the whole population.

COMMON QUESTIONS ABOUT DIGESTANTS

WHERE DO I ADD THE DIGESTANT INTO MY SYSTEM?

Digestants should be activated by mixing them in a bucket of warm (NOT HOT) water for several minutes before adding. Pour this slurry into the system at a point where normal water flow will disperse it evenly. The best way is to pour it into the waste stream inside the plant, or just before it flows out into the pond. If this is not possible, pour it directly into the middle of a pond, or around the perimeter.

HOW LONG BEFORE I SEE RESULTS?

Bad odors and sludge accumulations take months and years to build up, and it will take some time to get rid of them. Begin the treatment program with double the normal weekly dosage for a period of 8 to 12 weeks. After this start-up period, you will begin to see significant improvements, and you can cut back to the normal weekly dose. Severe accumulation of sludge may take one or more years to eliminate.

IF THE BACTERIA GROW AND REPRODUCE, WHY DO I HAVE TO KEEP ADDING MORE DIGESTANT?

The bacteria in these products are very efficient at digesting waste – many times better than the naturally occurring bacteria. However, they are not as "strong" as the natural bacteria. If treatment is stopped, the natural bacteria will eventually overpower and replace the good bacteria. These naturally occurring bacteria are undesirable because they work slowly, produce odors, and can be pathogenic.

DO THE BACTERIA WORK IN COLD OR FREEZING WEATHER?

These bacteria work best in warm weather, when the water is 50^{o}F to 100^{o}F. In colder temperatures, they continue to work (but more slowly) even in the frigid waters under a crust of ice. For the best results, begin the treatment program (with double doses for the first 8 to 12 weeks) in the warmer summer months.

DO DISINFECTANTS & DETERGENTS AFFECT BACTERIAL DIGESTION?

Most detergents, soaps, and cleaners will not seriously affect the bacteria. However, chlorine bleach and other disinfectants and sanitizers will inhibit the bacteria. If these products are used heavily or frequently, increase the treatment rate to compensate for their effects.

WHERE DO I ADD DIGESTANTS INTO DRAINS & TRAPS, AND HOW MUCH DO I USE?

Liquid digestants are ready-to–use and may be poured directly into drains. Dry digestants may be scooped directly into the drains, or may be activated by mixing them in some warm (NOT HOT) water for several minutes before adding. To treat grease traps, you can add the digestant directly to the trap through the clean-out opening, or flush them down the nearest toilet. When treating multi-floor buildings, always begin by treating the lower floors first. This way, organic matter that breaks loose on the upper floors will not cause clogs as they travel down and out the building. For use rates, simply follow the label directions. Remember that any drains receiving a heavy loading of organic waste need a double dose of digestant.

HOW LONG BEFORE I SEE RESULTS?

Organic accumulation that closes pipes and causes odors takes months and years to build up, and it will take some time to get rid of it. Begin the treatment program with double or triple dosage for the first several weeks or treatment periods. After this start-up period, you will begin to notice improved flow and fewer odors, and you can cut back to the normal weekly dose.

IF THE BACTERIA GROW AND REPRODUCE, WHY DO I HAVE TO RE-TREAT WITH MORE DIGESTANT EVERY WEEK?

The bacteria in these products are very efficient at digesting waste – many times better than naturally occurring bacteria. However, they are not as "strong" as the natural bacteria that may be present in the waste. If the treatment is stopped, the natural bacteria will eventually overpower and replace the good bacteria. Additionally, plumbing lines, grease traps and septic tanks are very harsh environments that do tend to inhibit these desirable bacteria. In order to keep a large bacteria population available at all times, we need to re-treat.

IF THE BACTERIA DIGEST ALL THE WASTE, WILL I EVER HAVE TO PUMP-OUT THE GREASE TRAP OR SEPTIC TANK AGAIN?

These bacteria can only digest organic matter. They can do nothing to the sand, ash, metal shavings, dirt, cigarette butts, petroleum products, or other non-organic matter that gets into the system. Thus, there will always be some accumulation of undigested matter. Septic tanks and grease traps must still be pumped out occasionally, but with much less frequency than before.

HOW DO DRAIN OPENERS, DISINFECTANTS & CLEANERS AFFECT BACTERIAL DIGESTION?

Most detergents, soaps, and cleaners are partially or completely degradable, and will not harm the bacterial digestion process. However, caustic or acid drain openers, chlorine bleach and other disinfectants and sanitizers will kill or severely inhibit the bacteria. If these products are used heavily or frequently, increase your treatment rate to compensate. Even when used infrequently, they kill bacteria. Always re-treat 1 or 2 days after use of these harsh chemicals.

ARE YOU SEEKING A MIRACLE CURE FOR YOUR WASTEWATER DISPOSAL PROBLEMS?

Digestants can't offer you overnight miracles. They can, however, provide all the benefits that modern science has to offer. The results may *seem* like a miracle to you – *if* you give your system the time and attention it needs. These scientific miracles take several weeks or months to occur, but the results will astound you.

DRAIN & SEPTIC SYSTEM MAINTENANCE

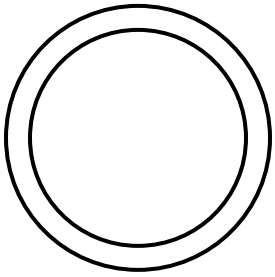
Operators of commercial kitchens, schools and institutional cafeterias, restaurants, bakeries, delicatessens and butcher shops have a very real concern about the maintenance of their drains and grease traps: **stopped up plumbing can cause a disaster!** It can cause flooding, stop workflow, contaminate food, cause odors, and jeopardize the sanitary condition of an entire facility. And many dollars and hours of hard work must go into cleaning, sanitizing and restoring the facility.

Preventative maintenance with a digestant treatment program can greatly reduce the risk of such a disaster. The goal of a digestant treatment program is to reduce the risk of such a disaster. The goal of a digestant treatment program is to reduce the frequency of clogs and grease trap pump-outs. At the same time, the program will provide better results at less cost than the local sewer and grease trap service. A few dollars worth of digestant, used properly, can save many dollars worth of aggravation, inconvenience and service calls.

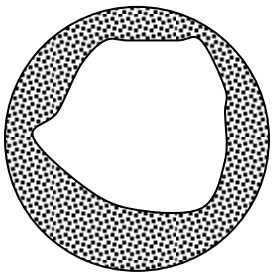
DRAIN AND SEWER CLOGS

Just about any drain, sink or toilet will become clogged if a roll of paper toweling is stuffed into it. But lets be honest – this is not a normal occurrence! Clogs are caused by things that *should not* clog – a clump of cold mashed potatoes or beet tops or meat trimmings. *Why is this?*

The answer can be discovered by looking into a sewer pipe. When the sewer pipe is new, it has an inside opening the full diameter of the pipe (4 inches for many sewer lateral pipes). Over time, bits of food and grease cling to the walls of the pipe. As this "normal accumulation" builds, it slowly closes up the pipe. Eventually, enough accumulation will build up to reduce the effective pipe size to a fraction of what it should be. A 4-inch pipe will easily handle a clump of cold mashed potatoes, but when it has been closed up to only 2 inches, the potatoes can cause a clog.



New Pipe



After Accumulation

Thus, we can prevent most clogs by keeping the sewer pipe at its maximum diameter. To do this, we need to introduce the bacterial digestant into the pipe. The bacteria will become established within the accumulation on the walls of the pipe. They grow and reproduce in this layer of organic matter, while continuously carrying on their *normal digestion* process. We realize that they will never clean it down to the bare metal or plastic, and that there will always be a thin layer of organic accumulation on the walls of the pipe. The bacteria will continue to live and grow in this layer, and they will always be present to continuously digest organic matter that might cling to the walls of the pipe – eliminating the cause of most clogs!

TREATING DRAINS AND SEWER LINES

A drain treatment program is quite simple, but must be followed religiously for the best results. This treatment must be done weekly (or more often). Treat just before kitchen will be closed for the longest possible time. For instance, if the kitchen will be closed all weekend, the digestant should be added at the closing on Friday night. If a facility does not close for more than a few hours, or never closes completely, add digestant when the water flow will be lowest for several hours.

The specific amount of digestant to be used depends on the size and type of drain. Drains that receive heavy loading of organic material (dishwasher drains, garbage disposals, vegetable peeling sinks, floor drains) should get more treatment. Also, give the extra treatment to drains that have a history of clogging.

Use the "Drain/Grease Trap Maintenance Survey" to identify treatment needs, and the "Recommended Maintenance Program" to spell out the program.

Use Areas	Normal Weekly Dose of #502 DIGESTASE APD 900	Normal Weekly Dose of #534 LIQUIDASE 250
Normal sink drains	2 tablespoons	2 ounces
Clogged or Slow Drains	5 tablespoons	Recommend #528 Bio-Action
Drains – heavy organic loading	4 tablespoons	4 ounces
Garbage disposals	4 –6 tablespoons	4-6 ounces
Dishwasher drains	4 –6 tablespoons	4-6 ounces
Laundry Drains	4-6 tablespoons	4-6 ounces
Maintain Grease Traps	½ lb/ 20 cu ft weekly	1 pint /20 cu ft weekly

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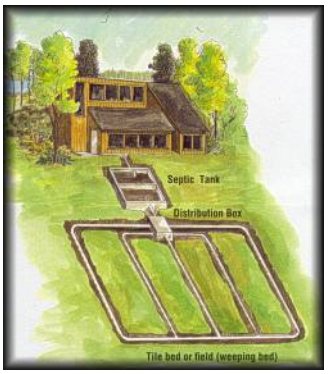
SEPTIC TANKS AND DRAIN FIELDS



A septic tank is a very simple and small sewer treatment plant. It contains baffles that are arranged so that all solid matter falls to the bottom of the tank. This solid matter is held in the tank where bacterial digestion will break it down. There must be sufficient numbers of beneficial bacteria in order for this digestion process to take place. Many household chemicals (strong cleaners, drain openers, laundry bleach) will kill the bacteria, and the digestion process is interrupted. A digestant product should be added to the system regularly to keep the entire process working properly.

Liquid waste flows out of the tank and into the drain field. In the drain field soil, bacteria work to purify the liquid waste as it percolates into the ground.

As you may suspect, the septic tank will not function properly if there are no bacteria to digest the waste. We add a bacterial digestant to ensure that there are large numbers of bacteria present to digest the waste that is held in the tank. Remember, these bacteria are specially grown for their ability to digest waste QUICKLY, WITHOUT ODORS or NOXIOUS GAS.

If the septic tank is not functioning properly, solids may be washed out of the tank into the drain field. Here, they clog the pores of the drain field. The drain field has been specially

constructed of sand and fine gravel, to allow the effluent from the septic tank to filter slowly into the ground. If the pores of the drain field are clogged up with solids, the liquid effluent will not filter (percolate) properly, creating puddles of standing wastewater and causing the whole system to back-up.

TREATING SEPTIC SYSTEMS

Like all the other systems, it should be re-treated 24 to 48 hours after the use of any strong disinfectants or drain openers. This will replace any bacteria that may have been killed by the chemicals.

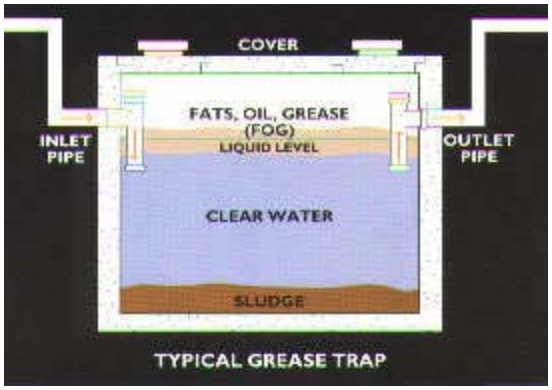
Use Area	#502 DIGESTASE APD 900	#534 LIQUIDASE 250
500-gallon tank (5 people)		
Initial heavy dose	½ to 1 pound	2 to 4 quarts
Maintenance dose	½ pound monthly	1 pint weekly
2500-gallon tank (up to 40 people)		
Initial heavy dose	4 to 8 pounds	4 to 8 gallons
Maintenance dose	4 pounds monthly	½ gallon weekly

Bacteria *make* the septic system function properly. Without this bacterial action, a septic tank is useless. However, mechanical and design problems can also cause a septic tank is useless. However, mechanical and design problems can also cause a septic system to malfunction even when there are plenty of good bacteria. All the bacteria in the world cannot make broken, poorly designed, or improperly constructed system work! For instance, if the septic tank baffles are broken, a digestant cannot fix the problem.

We can also introduce bacteria into the drain field to digest any organic matter that might clog the soil pores in the drain field. To treat drain fields, you must find the distribution box or drain field vent. Pour the digestant product in here, so that it flows directly into the drain field. Repeat treatment as necessary, or at least 4 times per year.

Here again, digestants will provide an excellent preventative maintenance program. However, a foot of water standing over the drain field in the middle of a hot summer indicates that there is a severe problem with the system – one that cannot be fixed quickly or properly by the bacteria alone.

GREASE TRAPS



The walls of the sewer pipe are intentionally made smooth, to inhibit the accumulation of organic matter as much as possible. On the other hand, the sole purpose of a grease trap is to catch and hold the grease, and prevent it from traveling down the pipe into the sewer main lines.

Thus, a grease trap fills up with grease because it is doing its job properly. It has stopped and held the grease, preventing it from reaching the sewer treatment plant. While this makes the treatment plant operator happy, it is little consolation to the person who has to pay good money to have the grease trapped pumped out!

It is very important that we remember the purpose of the grease trap. If we try to get rid of the grease with a product that simply flushes the grease out into the sewer line, we have defeated the whole purpose of the grease trap. On the other hand, the bacteria we add with a digestant product actually *digest* the grease, turning it into harmless water and carbon dioxide with their biological digestion process. The bacteria do not defeat the purpose of the trap; they work in harmony *with* the trap.

When we add bacteria to the grease trap, they become established within the layers of grease that float on the top and coat the walls and baffles in the trap. They live and reproduce there – they are not flushed away with the flow of water – and are always present to *continuously* digest more grease as it comes along.

GREASE TRAP TREATMENT

It is clear that you can introduce many bacteria into the grease trap simply by treating the drains. In fact, the easiest way to get digestant into the grease trap is to add them through the floor drain or toilet nearest to the trap. They can be added to any drain the eventually leads to the trap, keeping the drain lines clean and odor-free at the same time. Be sure to use a large enough treatment so that plenty of bacteria get to the trap.

Direct treatment of the grease trap gives the fastest, most complete digesting action, and is always necessary in large establishments, or ones that generate large amounts of grease. Automatic metering pump dispensers have proven to be ideal for dosing grease traps. Many can be programmed to meter in the correct dosage of liquid digestant every day at the same time of lowest flow.

A typical small restaurant grease trap is a box approximately 3 feet on each side, with a capacity of 20 cubic feet. Larger kitchen facilities will have traps from 40 to 80 cubic feet. Major problems occur in facilities if the trap is too small for the operation. In this case, the trap will fill up very quickly and require a pump-out every 4 to 6 weeks. Remember that the digestant will not totally eliminate all pump-outs. The goal of this treatment program is to reduce the frequency of pump-outs by ½ or more.

Use Areas	# 511 DIGESTASE GTD 655	# 543 BIO-FLOW	Interval between 5 gallon pail changes*
20 ft^3. (150 gallons) trap			
Initial heavy dose	1 pound		
Weekly maintenance dose	½ pound		
Daily Dosage Rate			
Less than 100 gallons		10 ounces	60 days
101-250 gallons		21 ounces	30 days
251-500 gallons		42 ounces	15 days
501-750 gallons		64 ounces	10 days
751-1000 gallons		86 ounces	7 days

Keep in mind the size of the trap and the amount of grease put down the drain. For the fastest results, begin treating the trap immediately after it has been pumped out, using a *double dose* for the first few weeks. If the trap is clogged up initially, repeat the double dose treatment every three days until flow is smooth. The Bio-Flow liquid grease trap maintenance system can be easily added using the #9154 BIO-PUMP. This is a battery powered dispensing system that fits on a five gallon pail of #543 BIO-FLOW and can be set to dispense calibrated doses of bacteria conveniently.

Regular treatment is important to keeping the bacteria supply large in the trap. Grease is difficult to digest, so the more bacteria in the grease trap, the faster the grease will be broken down into water and carbon dioxide.

Add the digestant treatment directly to the trap or through a nearby drain or toilet. Repeat the treatment at weekly intervals, at a period of low flow. Remember that strong chemicals such as drain openers and disinfectants will harm the bacteria, so add the digestants when these are NOT in use – and be sure to re-treat the system 24 to 48 hours after the use of these products.

SELLING DIGESTANTS TO COMMERCIAL KITCHENS AND FOOD PROCESSORS

Help your customers identify and recognize where they can save money and improve their process with a bacterial digestant maintenance program. Ask your customer these questions:

ARE YOU FORCED TO PAY SEWER SURCHARGES BECAUSE YOUR WASTE HAS A VERY HIGH BOD CONTENT?

Digestants can make your pre-treatment process work more quickly and more efficiently to reduce the BOD of your wastewater. This will reduce or even eliminate the surcharges you pay to your local sewer authority.

DO YOUR NEIGHBORS COMPLAIN ABOUT FOUL ODORS FROM YOUR TREATMENT PONDS?

Digestant products are highly effective at permanently eliminating odors caused by your treatment process. Remember that it takes several weeks to get results.

ARE YOU USING DEODORIZERS AND PERFUMES THAT GIVE YOU ONLY TEMPORARY RELIEF AT BEST?

Why pay such a high price for deodorizers when they provide only temporary relief, and often don't work at all in the hot summer? Digestants offer you permanent odor *elimination* and so much more, for a lot less money.

ARE YOUR PONDS FILLING UP WITH SLUDGE, DECREASING YOUR CAPACITY AND REDUCING RETENTION TIMES?

Heavy accumulations of sludge are expensive to dredge and dispose of, and new ponds cost a fortune these days. Use the *natural* disposal process that will give you sure results year after year.

Help your customers identify and recognize where they can save money, work more efficiently and improve the sanitation in their commercial kitchen facilities. Ask questions and use the SURVEY FORM to show all the benefits a properly designed maintenance program has to offer them.

Ask The Customer These Questions:

HOW OFTEN DO YOU CALL THE PLUMBER TO OPEN A CLOGGED PIPE, AND WHAT DOES THIS SERVICE COST YOU PER YEAR?

Digestants cannot guarantee that you will never again have a clogged drain or pipe. But they can keep your plumbing as open and free-flowing as possible, and drastically reduce the number of clogs that occur – saving you money every time.

HOW OFTEN IS YOUR GREASE TRAP OR SEPTIC TANK PUMPED OUT, AND AT WHAT COST?

Again, a digestant maintenance program is designed to cut your grease trap cleaning costs significantly, because you will be able to go much longer between pump-outs.

For septic systems, a digestant maintenance program will make the system operate properly and as efficiently as possible for you. Pump-outs can be reduced to once every year or two. You can relieve your worries about overloading the system, back-ups, or puddles of raw septic tank water standing over your backyard drain field, too.

ARE YOU USING CHEMICAL DRAIN CLEANERS THAT ARE HAZARDOUS TO HANDLE, VERY EXPENSIVE, AND UNPLEASANT TO USE?

Powerful chemical drain openers will usually open a stubborn clog, but at a very high cost in terms of employee safety as well as dollars and cents. Why pay such a high price for products that provide only temporary relief – when you can use a non-hazardous maintenance program that is so much more effective – for a lot less money.

ARE YOUR EMPLOYEES LESS PRODUCTIVE BECAUSE OF DELAYS AND CLEAN-UP DUE TO BACKED UP PLUMBING?

The labor of yourself and your own employees may be a little less expensive than a plumber, but it isn't cheap and the job is unpleasant! You want to put your time – and your employee's time – running the kitchen, preparing food, and generating a profit – not on mop-up detail! A proper preventative maintenance program will help you achieve that goal.

FOOD PROCESSING WASTE

Organic wastes and wastewater from food processing operations are usually in a "pre-treatment" process before being discharged into the sewer. This is to reduce sewer charges by lowering the BOD of the wastewater. BOD stands for "Biological Oxygen Demand", and is a measurement of the amount of organic material in the wastewater. Food processing wastes are the water discharged from operations:

Vegetable Processing:	Wash water, skins rinds, pulp, and other organic waste from fruit and vegetable cleaning, processing, cooking and canning.
Meat Processing:	Grease, fats, oils, wash water, cooking waste, drippings, hair and feathers from slaughtering, butchering, cooking and packaging of fish, chicken, beef, pork and all other meat products.
Dairy & egg Processing:	Wash water, and process waste from egg and milk processing, drying, bottling and packaging, also cheese making processes and packaging.
Miscellaneous Food Processing:	Waste water from soda or juice bottling, bakeries, breweries, distilleries, sugar & grain processing, and animal food productions.

The pretreatment facility is usually quite simple in design. Its main purpose is to hold the wastewater for a sufficient period of time while the bacteria do their job. The bacteria digest suspended and dissolved solids, actually functioning like a simple miniature wastewater treatment plant. It can be a holding tank or retention pond or a series of tanks and/or ponds.

Unless the ponds or tanks are properly treated, they can give off foul odors, severe accumulation of solids on the bottom, and fail to lower the BOD as much as desired. This is because the naturally occurring bacteria are not efficient waste digesters. To make this type of pre-treatment process operate properly, the right types of bacteria must be introduced by the use of a bacterial digestant product.

Food processors want to reduce the BOD of their wastewater as much as possible *before* it is discharged into the municipal sewer system. Commercial users are required to pay surcharges to the sewer system authority if their waste has a high BOD. This is done because the high BOD waste puts an extra burden on the municipal treatment plant, making it work harder than normal. When you consider the many thousands of gallons of water that a food processor can use every day, even a small "per gallon" surcharge can add up to big dollars. Proper pre-treatment of the waste – before discharge into the sewer system – will reduce or eliminate costly surcharges.

Food processing waste can be more difficult to treat than many other types of waste. This is because the food processing waste is fresh organic material. It is not already partially degraded, like many other types of waste. It is often acidic, and contains few naturally occurring bacteria to aid in digestion. It also contains a large amount of cellulose material, which requires extra time and effort for the bacteria to digest. Finally, the typical pre-treatment facility is very simple and unsophisticated in design – unlike most municipal sewer treatment plants.

Such a system can, however, do its job very well. If the operator is able to pay a little bit of attention to his system, it will do a good job of reducing the BOD wastewater. In most cases, a good treatment program will be as simple as adding digestant at regular intervals and monitoring the pH of the wastewater – adding chemical pH adjustors as required to maintain the pH in the proper range.

The key to proper operation of this type of pre-treatment is *time.* The special bacteria in digestants work much faster and more efficiently than ordinary bacteria, still require time to digest the waste. The longer the retention time, the more matter will be digested, and the lower the BOD of the effluent water. Thus, time is the must critical factor in determining how much digestant must be used in a regular treatment program.

We can calculate the retention time of a particular system by knowing:
How much water is discharged daily (look at the water meter)?
How much holding capacity there is (calculate from pond or tank size)?

Retention time is the storage capacity divided by the daily flow. For a flow of 50,000 gallons per day with storage capacity of 1,000,000 (one million) gallons, we would use this calculation:

$$\text{Retention Time} = \frac{\text{Storage Capacity}}{\text{Daily flow}} = \frac{\text{1,000,000 gallons}}{\text{50,000 gallons per day}} = \text{20 days}$$

To determine the storage capacity, multiply the pond area times the average depth. Thus, a 1 acre (43,500 square feet) pond with an average depth of 8 feet is:

43,500 square feet x 8 feet = 348,000 cubic feet

and to obtain gallons, remember that 1 cubic foot of water contains 7.5 gallons:

48,000 cubic feet x 7.5 gallons per cubic foot = 2,610,000 gallons

TREATMENT PROGRAM FOR FOOD PROCESSING WASTES

The following treatment program is designed for a "model" retention pond. We can set up a treatment program for other ponds by comparing them to this model, which has the following characteristics:

BOD range:	150 to 250 parts per million (ppm)
Retention time:	5 to 7 days
Water pH:	6.5 to 7.5
Sludge layer:	1 to 3 feet
Pond depth:	No greater than 9 feet

To treat this model pond, use 1 pound of #515 DIGESTASE KFP 585 *per week* for each 10,000 gallons of daily flow. For the best results, use double the normal treatment rate for the first 8 weeks, to give the digestion process an extra boost at start-up. The user should begin to see results appearing by the end of the 8 weeks – less odor, reduction in solids accumulation, clearer, effluent water, and greater reduction of BOD.

When a specific pond has characteristics that are different from the model pond, you will need to increase or decrease the treatment rate as follows:

BOD range	150 to 250 ppm is the average for our model. For every 50 to 100 ppm over the model, increase treatment rate by 10%.
Retention time	5 to 7 days is the average for our model. For every 2 days shorter retention time, increase treatment rate by 10%. For every 5 days longer retention time, decrease treatment rate by 10%.
Water pH	6.5 to 7.5 is the average for our model. If the water pH is over 7.5 or under 6.5, increase the treatment rate by 10%. For best results, use caustic soda to raise pH or muriatic acid to lower the pH into the recommended range.
Sludge layer	1 to 3 feet on pond bottom is the average for our model. For every 1 to 2 feet over the average, increase treatment by 10%.
Pond depth	No greater than 9 feet is the average for our model. For average pond depth greater than 8 feet, increase treatment by 10%.

EXAMPLE 1

Viking Fruit Company processes and cans cherries and apples. Their water meter shows that they use 110,000 gallons of water per day, of which 90% (or 100,000 gallons) is discharged as wastewater. They have two treatment ponds with a total capacity of 750,000 gallons. We have:

Daily flow:	100,000 gallons	BOD:	200 ppm average
Pond capacity:	750,000 gallons	Sludge layer:	1 to 3 feet
Retention time:	100,000/750,000 or 7.5 days	Pond depth:	12 feet
		Water pH:	Ranges from 5 to 6

Ordinarily, we would recommend 1 pound per week per 10,000 gallons of daily flow (a total of 10 pounds per week) in this situation. However, we note two factors that will call for additional treatment: pond depth greater than the model and water pH lower than the model. Each factor calls for an additional 10% treatment, so the normal weekly dosage would be increased to 12 pounds. For

best results, caustic soda should be added to the waste stream to bring the water pH up to the 6.5 to 7.5 range. Of course, use *double* this normal weekly dosage for the first 8 weeks.

EXAMPLE 2

A meat packing plant processes pork from slaughter to packaged product and their wastewater contains a lot of fats and grease. They discharge 500,000 gallons of wastewater per day, which runs into a series of 7 holding ponds with a total capacity of 10,000,000 (ten million) gallons.

Daily flow:	500,000 gallons	BOD:	400 to 500 average
Pond capacity:	10,000,000 gallons	Sludge layer:	1 to 2 feet
Retention time:	500,000/10,000,000 or 20 days	Pond depth:	6 to 8 feet average
		Water pH:	6.5 to 8.0

In this system, the BOD is very high, indicating that it requires 30% extra treatment. On the other hand, the retention time is longer than usual, allowing a 20% reduction in the normal treatment rate. The net result is a requirement for 10% high treatment. Thus, the flow of 500,000 gallons per day requires about 55 pounds of digestant per week. Please note that this is a very large processing plant, using a lot of water, and thus requires large amounts of digestant.

EXAMPLE 3

The Middleton Cheese Company operates a small cheese manufacturing plant in a rural town. They discharge about 8,000 gallons of wastewater per day, but have no holding tanks or ponds. Their wastewater has a BOD of 300 to 350, and they pay surcharges to the local sewer district because of this. They would like to reduce the BOD to lower the sewer charges.

Because they have no tanks or ponds, the retention time is very short – only a matter of several minutes as the wastewater flows through the sewer lines in the plant and out to the main sewer pipe under the street. It will be difficult to obtain a large reduction in BOD in this case, but the proper use of a digestant will help the BOD and other problems.

The digestant should be added into the sewer line inside the plant, at the point farthest upstream from the discharge point. They will need to use ½ to 1 pound per *day*. The *daily* addition is necessary because there is no retention time. For best results, treatment should be made at the end of the day, just before closing. This treatment will help reduce odors and eliminate sewer blockages, as well as reduce the BOD or their wastewater.

FARM MANURE WASTES

Modern farming techniques have made the proper handling and disposal of animal manure very important. Waste handling practices have changed to meet the demands of large-scale commercial farming. Good sanitation is essential to keep animal herds healthy. The nutrient value of manure should be returned to productivity in the soil. Run-off must be minimized to prevent non-point pollution of surface waters. Steps to reduce odors will help to keep the neighbors happy.

Special manure holding and pumping systems have been designed to meet these requirements. These systems also hold down labor costs and help to reduce the hazards of toxic pit gas.

In these systems, bacteria and enzymes will actively digest the organic waste. They work to reduce the build-up of solids in the pit, to increase the pit's effective storage capacity. At the same time, this digestion process will substantially reduce the generation of odors and dangerous pit gas. The organic waste is converted to a free-flowing liquid that can be pumped out, hauled and spread quickly and easily. This treated tankage has excellent fertilizer value when applied to the land.

Regular use of the proper digestants will establish thriving colonies of waste-digesting bacteria to provide continuous, uninterrupted digestion of organic manure waste. The organic matter will be converted to harmless carbon dioxide and water as the bacteria work. As with any other waste system, chemicals such as disinfectants will harm the bacteria. The pH level of the liquid may have to be adjusted to help maintain the best growing conditions for the bacteria.

TREATING MANURE SYSTEM

While manure handling systems can vary widely in design and construction, all systems will benefit from the use of a proper bacterial digestant product. When treating a system, it is important to add the digestant regularly to ensure that an adequate supply of the desirable bacteria is always present.

The most common manure handling systems are simple pit systems. The pits hold hog, cattle, or chicken manure for a period of time, while the bacteria work to liquefy the solid waste. This liquefied waste is then pumped out and applied to cropland as fertilizer. When beginning a treatment program for this type of system, treat each individual pit every week.

After the digestion process is underway, treatments may be reduced to once or twice per month. Adjust the amount and frequency of addition considering the past build-up of solids, and amount of waste material and water entering the pit. Treatments should be heavier or more frequent if feed, hay bedding materials or detergents, disinfectants, and water hardness are entering the pit. If possible, make an initial treatment immediately after the pit is pumped out. For pits that contain more than 3 feet (1 meter) of solids, double the treatment amount for the first 8 weeks.

Within a few days after the initial treatment, foam and/or solids will appear to float to the top. Crust on the top of the pit will begin to wet and eventually sink. Significant reductions in odor will be noticed after one or two weeks, as the bacteria and enzymes go to work digesting solids at the bottom and in the slurry.

During this period, pockets of hazardous pit gas (methane and hydrogen sulfide) will be broken open and dispersed safely. As the process of digestion continues, production of this gas will

be minimized. Also, gas pockets will no longer accumulate in the liquefied waste. Instead, any gas will be released evenly and safely.

Solids that have been accumulating for months or years will take some time to digest. A regular treatment schedule will get the system operating properly, and the solids will be reduced over time. The living bacteria will function continuously to keep the accumulation of solids and odors to a minimum.

Pits should normally be pumped 2 times per year, in the spring and fall, after the bacteria and enzymes have liquefied solids and made uniform, free-flowing slurry. Pumping of the pits will be faster and easier.

Note that digesting activity is decreased during freezing winter periods. To compensate, heavier applications may be necessary to ensure adequate digestion.

SURFACE ODOR CONTROL

Many times, odors that come from rugs, carpets, and hard surfaces in bathrooms are caused by decaying organic matter. The natural bacteria that are present on these surfaces will begin to digest organic matter that is present. Many of these natural bacteria are inefficient, and cause odors as they digest the organic matter that is on the surface or embedded in the carpet fibers and backing.

Introducing selected strains of enzyme-producing bacteria can often eliminate these odors. These special strains of bacteria are very efficient at digesting organic waste *without producing any odors!* They consume organic matter to eliminate odors at their source on most kitchen and bathroom surfaces, toilets, urinals, rugs and carpets. These desirable bacteria will displace the natural, odor-causing bacteria, and thus eliminate the cause of the odors.

This natural odor elimination technique will work on many odors caused by spoiled food, vomit, urine, feces, mold and mildew, or other organic spills. In order for the process to work most effectively, we must make an environment that promotes fast action by the bacteria. To see how this works, look at a typical example.

In a community nursing home, the wall-to-wall carpeting gives off bad odors in areas where food, vomit or urine have entered the carpet. Although the staff cleans up such spills as quickly as possible, organic matter is left in the carpet fibers and backing material.

Over time, the natural bacteria that are present in this environment will begin to digest the organic waste. Because these bacteria do not digest the waste completely, odors are created. The odors will persist as long as there is organic matter for them to consume. Treating the area with disinfectants will temporarily kill the bacteria, and stop the odors. However, more bacteria will move in again, and the odors will soon return.

The executive housekeeper may have tried many cleaners and methods to get rid of these odors, with little success. A new, biological method using LIVE MICRO 535 is now available. This product is a liquid suspension of bacteria spores that is safe to use on all surfaces not harmed by water. A quick test will determine that the carpeting is colorfast, and will not be affected by the use of this product.

ODOR ELIMINATION TREATMENT

To eliminate odors on hard surfaces such as vinyl flooring, porcelain tile and concrete floors in kitchens and bathrooms, the first step is to prepare the surface. Remove as much organic matter as possible by scraping, brushing and vacuuming. Detergent and water may be used to aid in this process on water-safe hard surfaces.

Dilute the LIVE MICRO 535 1:1 with tap water. Spray a heavy mist to wet the entire surface and allow penetration into the surface. Odors will subside as the bacteria digest the organic matter that is held within the pores of these hard surfaces.

Re-treat the surfaces as required to keep odors under control.

To eliminate odors in CARPETS and UPHOLSTERY, the process is very similar. Use conventional cleaning techniques to remove as much soil and organic matter as possible. Then spray the fibers thoroughly with LIVE MICRO 535 diluted 1:1 with tap water. Brush this solution into the material so that it penetrates into the fibers and backing material. Lay a damp towel over the area to keep it moist for at least 24 hours.

Carpet fibers and backing material can hold a great deal of organic matter. To provide a proper environment for the bacteria to grow and work most effectively, lay a damp towel over the area to keep it moist for at least 24 hours. For severe odor problems, repeat the daily treatment for up to 10 days, or until the odors are completely gone.

In many cases, stains will be removed, or loosened to the point where more conventional cleaning techniques will effectively remove them.

DRAIN/GREASE TRAP MAINTENANCE SURVEY

Customer: _____ Date: _____

Address: _____

Supervisor: _____ Phone: _____

Type of Business: _____

Kitchen Areas: Location, Size, and History of Problems

Normal sink drains: _____

Drains receiving heavy organic loading: _____

Garbage disposals: _____

Dishwasher drains: _____

Floor drains: _____

Toilets and hand wash sinks in immediate area: _____

Kitchen Areas (continued): Location, Size, and History of Problems

Location of clean-out plugs: _____

History of clogged or slow drain lines: _____

Type of clog removal: __mechanical __sulfuric acid __liquid caustic __caustic granules

Heavy grease loading? Yes __ No __

Heavy loading of eggs, vegetable greens? Yes __ No __

Pipe size of sewer lateral as it leaves building: _____ inches

Plumbing material: __iron __copper __clay __asbestos/cement __plastic

Outflows into septic system: _____ municipal sewer system: _____

Grease Trap:

Grease trap capacity: cubic feet or gallons: _____

Location of clean-out access to trap: _____

Frequency of trap pump-out: _____

Date of last pump-out: _____

Location of nearest toilet: _____

Special problems to be noted: _____

Septic System:

Septic tank size: cubic feet or gallons: _____

Number of people using the system: _____

Location of access cover: _____

Frequency of tank pump-out: _____

Date of last pump-out: _____

Location of nearest toilet: _____

Standing water/sogginess in drain field? Yes __ No __

Location of field distribution box or vent: _____

Equipment:

Chemical dispenser/metering pump available? Yes __ No __

Mechanical snake or high pressure water jet? Yes __ No __

RECOMMENDED MAINTENANCE PROGRAM

Customer: _____ Date: _____

Address: _____

Supervisor: _____ Phone: _____

Type of Business: _____

Kitchen Drains: Maintenance Product to be Used: _____

Number Of		Ounces/Tablespoons Per Week		Total Per Week
_____	Normal sink drains	x	_____	_____
_____	Drains with heavy organic loading	x	_____	_____
_____	Garbage disposals	x	_____	_____
_____	Dishwasher drains	x	_____	_____
_____	Floor drains	x	_____	_____
_____	Toilets/hand wash sinks	x	_____	_____

Use double dose treatment for the first 2 weeks. Treat lower floors first.

Grease Trap: Maintenance Product to be Used: _____

Point of addition to grease trap: _____

Amount to be used for initial treatment: _____

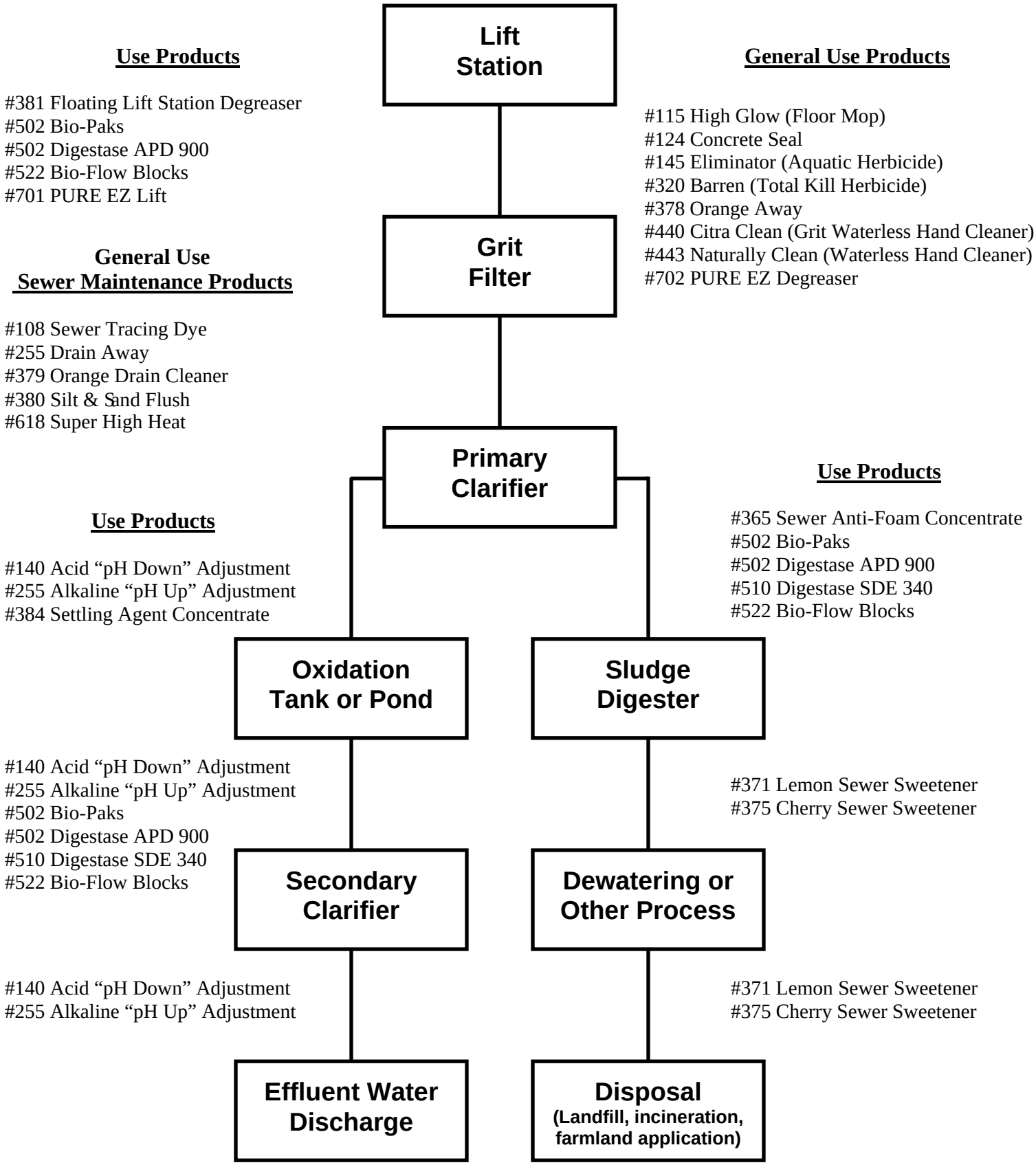
Amount to be used for weekly treatment: _____

Septic System: Maintenance Product to be Used: _____

Point of addition to septic tank: _____

Amount to be used for initial treatment: _____

Amount to be used for weekly treatment: _____


Lift Station
Use Products
#381 Floating Lift Station Degreaser
#502 Bio-Paks
#502 Digestase APD 900
#522 Bio-Flow Blocks
#701 PURE EZ Lift
General Use Products
#115 High Glow (Floor Mop)
#124 Concrete Seal
#145 Eliminator (Aquatic Herbicide)
#320 Barren (Total Kill Herbicide)
#378 Orange Away
#440 Citra Clean (Grit Waterless Hand Cleaner)
#443 Naturally Clean (Waterless Hand Cleaner)
#702 PURE EZ Degreaser
Grit Filter
General Use Sewer Maintenance Products
#108 Sewer Tracing Dye
#255 Drain Away
#379 Orange Drain Cleaner
#380 Silt & Sand Flush
#618 Super High Heat
Primary Clarifier
Use Products
#140 Acid "pH Down" Adjustment
#255 Alkaline "pH Up" Adjustment
#384 Settling Agent Concentrate
Use Products
#365 Sewer Anti-Foam Concentrate
#502 Bio-Paks
#502 Digestase APD 900
#510 Digestase SDE 340
#522 Bio-Flow Blocks
Oxidation Tank or Pond
Sludge Digester
#140 Acid "pH Down" Adjustment
#255 Alkaline "pH Up" Adjustment
#502 Bio-Paks
#502 Digestase APD 900
#510 Digestase SDE 340
#522 Bio-Flow Blocks
#371 Lemon Sewer Sweetener
#375 Cherry Sewer Sweetener
Secondary Clarifier
Dewatering or Other Process
#140 Acid "pH Down" Adjustment
#255 Alkaline "pH Up" Adjustment
#371 Lemon Sewer Sweetener
#375 Cherry Sewer Sweetener
Effluent Water Discharge
Disposal
(Landfill, incineration, farmland application)