XL PLUS

QUESTIONS & ANSWERS

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1.

QUESTION:

Why do I need to add the XL PLUS bacteria? Don't I already have enough of the right kinds of bacteria in my system?

ANSWER:

Keep in mind, the type of influent determines to a large extent, the bacterial make-up of your activated sludge. Furthermore, influent shock can kill existing bacteria causing a return to a "start-up" situation. (e.g. – bacterial composition of various types of wastewater).

(1)
Industrial Only (no restrooms)

Bacteria determined by influent (sometimes nearly sterile). Variation in product will cause changes in sludge population.

Why add XL PLUS? Besides removing stubborn organics, **XL PLUS** will increase removal of BOD and TSS. Routine addition of XL PLUS increases resistance to, and recovery from upsets. High concentrations of versatile XL PLUS organisms provide quick response to changes in influent composition due to variations in production schedule. Furthermore, XL PLUS often will degrade stubborn or toxic organics that native organisms cannot degrade.

(2)
Domestic Wastewater Only

Contains Mostly - intestinal bacteria
Some are - strict anaerobes(grow only without O_2)
- facultative anaerobes(grow with or without O_2)
- aerobes (need O_2, complete oxidations)
- fermentors (don't need O_2, incomplete oxidation)

Some soil bacteria types due to water infiltration into the collection system. Other bacteria deposited by airborne dust particles.

Why add XL PLUS? Since the XL PLUS bacteria are highly oxidative, they are very efficient at using available O_2 for degradation of organic matter. This increased efficiency will result in reduced secondary sludge, along with enhanced BOD and TSS removal. Furthermore, routine addition will permit fast recovery from upsets.

(3)
Domestic Wastewater with Significant Industrial Contribution

Mostly intestinal bacteria
- some soil types (infiltration)
- some industrial origin

XL PLUS – Provides enhanced removal of low concentrations of industrial compounds (intestinal bacteria don't usually see these compounds). High levels of XL PLUS degraders are required to insure removal of these compounds. XL PLUS will also provide enhanced removal efficiency of common wastewater organics.

(4)
Industrial & Domestic

(Industry with restrooms feeding into sewer line) Bacterial types are determined by the influent. Low numbers of intestinal bacteria will be included.

XL PLUS – Intestinal bacteria don't really contribute much to industrial degradation (they don't usually see these types of waste, therefore have limited capability). XL PLUS will aid in removal of stubborn industrial organics as well as increase the overall efficiency of total organic removal.

2.

QUESTION:

Why is it necessary to add such high numbers of XL PLUS bacteria?

ANSWER:

The success of any bacterial inoculation for wastewater treatment systems depends on two important factors. (1) First, the bacteria must have the special capability to respond to the wastewater problem(e.g. high BOD, stubborn organics, upsets). (2) Second, the bacteria must be present in high concentrations to force them to use their special capabilities. Bacteria are very conservative in terms of the amount of work they like to do to get their nutrition. If there are lots of easy foods to degrade surrounding them, they'll use those foods in preference to the tougher organics you'd like to have removed. When only the tough foods are left, they can attack those, only if they have that capability. High numbers of sophisticated degraders (XL PLUS) are necessary to insure that the tough organics are attacked. In high populations, the competition for simple nutrients will force them to use their unusual degradation techniques.

3.

QUESTION:

Once I add the XL PLUS bacteria (inoculate), why do I have to keep adding them on a regular basis? Shouldn't the XL PLUS bacteria multiply in my system without continuous inoculation?

ANSWER:

XL PLUS bacteria do multiply in the wastewater treatment system, however, without routine inoculation, several factors slowly reduce their numbers over time.

3. (continued)

For example, in domestic systems, the influent contains significant numbers of native bacteria (mostly intestinal) which because of sheer #'s slowly crowd out the XL PLUS bacteria when the (XL PLUS) bacteria are not added on a regular basis. Hydraulic flow will contribute to constant dilution of the XL PLUS bacteria, even with carefully monitored sludge return. Our research has shown that 10-14 days after XL PLUS addition is stopped, the number of XL PLUS bacteria begin to drop slowly and may disappear completely in six weeks. Although they have remarkable degradation capabilities, without regular addition, they can be out-competed in a wastewater treatment system.

As mentioned earlier, maintaining high numbers of the XL PLUS bacteria is essential for enhanced treatment. Furthermore, maintaining high concentrations is essential for enhanced treatment. Maintaining high concentrations of XL PLUS in the return sludge insures optimum resistance to devastation of the system by shock loading.

4.

QUESTION:

I've tried enzyme products, but they didn't seem to work. Why should your product be any different?

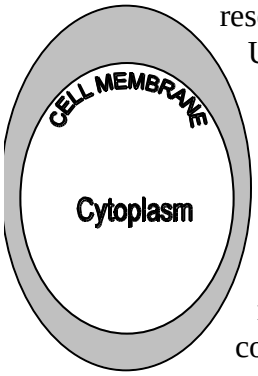
ANSWER:

First, XL PLUS is a patented bacterial product, not an enzyme.

Enzymes are proteins that speed up reactions.

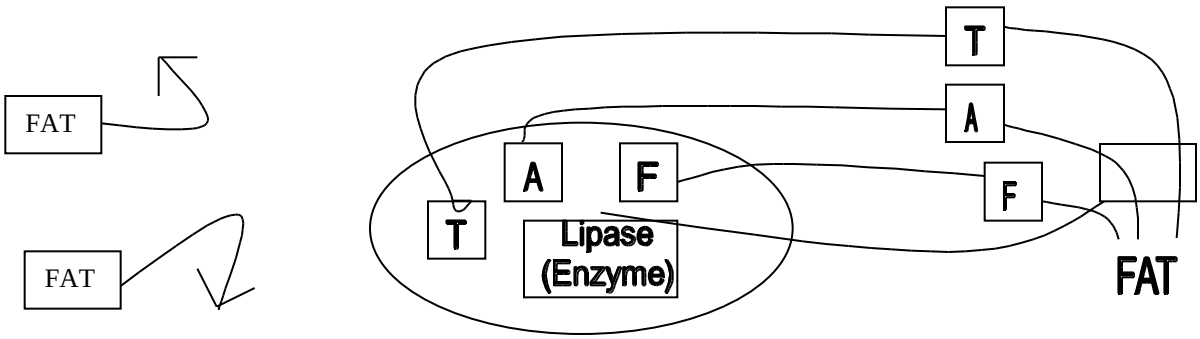
Enzyme products contain proteins usually produced by microorganisms that enhance some specific degradation. The enzymes may be separated from the microbes that produced them – at any rate, they are usually the only beneficial component in the enzyme product. In order to compare the effectiveness of enzymes versus bacteria for enhanced wastewater treatment, you have to know something about how bacteria degrade organic matter.

Bacterial Cell



Simply stated, bacteria are composed of cells within an outer wall. Bacterial bodies resemble automobile tires with inner tubes. The inner tube represents the actual bacterial cell. Unlike a tire casing, the bacterial cell wall is porous, allowing most molecules access to the cell body. The outer casing with tread represents the outer bacterial cell wall. Bacteria don't have mouths. The outer membrane of the actual cell allows smaller molecules easier access, while keeping larger molecules out. Nutrients must therefore be converted to relatively small molecules, which can pass through the porous wall to get absorbed into the cell body.

Many of the nutrient molecules that bacteria see in wastewater influent are large ones that need to be broken down before they can get them into the cell. (These same molecules constitute much of the influent BOD) Bacteria carry out this breakdown by


FAT
FAT
T
A
F
T
Lipase
(Enzyme)
A
F
FAT

5. (continued)

ANSWER:

Because of the broad diversity of degradation capability of the XL PLUS bacteria, systems with high numbers of acclimated bacteria are more resistant to upset and recover faster. Regular addition of XL PLUS insures the level of bacteria will be optimum for enhanced operation.

For the long term, routine XL PLUS addition will provide the best overall organic removal and the most effective resistance to, and recovery from, upsets.

6.

QUESTION:

How is your product different from Joe's Superbugs?

ANSWER:

There are a number of differences between our products and others on the market.

VIABILITY

First, our product will contain live bacteria at high concentration levels when you use it. Bacteria are the main active ingredients in any biological wastewater product. If they are mostly dead in the product when used, the product itself is useless.

XL PLUS is the only non-spore, live vegetative microbial product which is lyophilized, then liquid stabilized. All of the other products are basically either liquid or pan dried. Any microbiologist will tell you that freeze-drying is the best way to keep bacteria alive during extended storage.

XL PLUS is not only freeze-dried, it is liquid stabilized through a proprietary patented process. If the only thing that will help your system is the live XL PLUS bacteria, we will make sure they're alive when you use them.

EASE OF HANDLING

Most powdered bacterial products mix pan dried bacteria with bran carriers and required presoaking of up to 4-12 hours to revive those bacteria. They are not recommended for addition directly without presoaking. Our XL PLUS product is soluble and ready to go to work. There is no need for presoaking or decanting to remove any insoluble carriers.

SPEED OF ACTION

The speed of action of bacteria added to a wastewater treatment system depends on the physiological state of those bacteria.

6. (continued)

The XL PLUS bacteria are harvested at what we call the optimum stage of their growth cycle. They are at their healthiest stage, which will insure fast action when added to the system. They are harvested at this stage and quickly lyophilized & liquid stabilized to hold them at this stage until inoculated into the wastewater treatment system.

Pan dried or liquid spore products have less control over the maintenance of the physiological state of the bacteria which means that besides presoaking to revitalize the bacteria, once revived they may not be at the proper growth state to insure maximum performance.

XL PLUS requires no presoaking it is ready to go to work when added to the system.

CAPABILITY:

The XL PLUS blend of bacteria has broad degradative capabilities and has shown efficacy in a wide variety of wastewater treatment systems.

The XL PLUS blend is so versatile, that new applications continue to be uncovered which weren't considered in the development of the product. The XL PLUS product continues to undergo developmental efforts to make it even more effective. As a result, XL PLUS is the most viable, most versatile, and fastest acting wastewater inoculant available on the market today. XL PLUS performance from lot to lot is the most reproducible of any product on the market.

7.

QUESTION:

I've always heard that secondary treatment is most effective when you have mixed microbial populations. What's going to happen to my system when I add all these XL PLUS bacteria?

ANSWER:

Even with XL PLUS addition, the receiving wastewater system will maintain a mixed population. In order to be effective, we want the XL PLUS blend of organisms to become a significant portion of the overall population, not all of it. As mentioned earlier, significant numbers of XL PLUS bacteria are necessary to insure that they use the sophisticated appetites they possess. Routine addition of XL PLUS will replace some less efficient aerobes, and will swell the overall microbial population somewhat. In a domestic wastewater system, regular addition of the recommended dose of XL PLUS might only result in its comprising 10% of the total population. However, the proper 1 in 10 can make a significant impact – like a Barry Bonds on a baseball field, or a Michael Jordan on the basketball court, or a Marshall Faulk on the football field.

XL PLUS may make up a more significant portion of the total population in an industrial system where the influent contains fewer negative bacteria.

The goal of XL PLUS inoculation is to supplement, (not completely replace) a wastewater system with significant numbers of versatile bacteria with sophisticated appetites. The end result will be more efficient overall operation and increased resistance to upsets.

8.

QUESTION:

Where should the XL PLUS product be added to the system to insure maximum effectiveness?

8. (continued)

ANSWER:

As a general rule of thumb – XL PLUS should be added into a wastewater treatment system at the earliest point in that system where biological conditions exist. This answer requires some clarification.

Since XL PLUS is a biological entity, made up of viable bacteria, great care must be taken in choosing the proper point of inoculation to attain maximum benefit. In general, benefits will be greater – the sooner one can get the XL PLUS bacteria in contact with the problem wastewater. The longer the period of contact with the materials in that wastewater, the greater reductions one can expect to see. XL PLUS should be added at a point of low stress – that is, a location which does not suffer from poor pH stability, periodic anaerobiosis, or high temperatures.

The point of inoculation should not be a site of severe pH fluctuations. It should preferably be a site where initial mixing of XL PLUS with the wastewater is enhanced. It should be a site where the wastewater contains modest amounts of DO so that the XL PLUS organisms can get to work as soon as possible.

Putting the XL PLUS organisms into a pH shock or low DOL site is a little like hitting them on the "head", just as they are reviving to get to work. The "stun" of the pH or DO shock causes them to come around more slowly, thus losing valuable degradation time they might otherwise be using.

The temperature of the wastewater at the site of addition and/or treatment is also an important consideration. Although the XL PLUS organisms won't necessarily be killed by brief exposures to temperatures as high as 110^{o}F, they will be "stunned" and react as suggested in the preceding paragraph. The XL PLUS organisms produce the most growth and activity in a temperature range from 75^{o}F to 86^{o}F. Although the XL PLUS organisms will grow at refrigerator temperatures (40°F), their activity will be reduced. As a general rule of thumb, for every 10-degree drop in temperature below 55°F, there will be a halving of biological activity. Temperature above 95°F may also slow activity.

If you keep in mind that XL PLUS contains living bacteria which have many of the same requirements for a productive existence that we do, e.g. moderate temperature, adequate oxygen, etc., it will become easier to visualize the critical importance attached to the site of inoculation.

9.

QUESTION:

What are other considerations for optimum performance of XL PLUS in my system?

ANSWER:

Besides pH, dissolved oxygen and temperature preferences mentioned in the previous question, another important consideration in XL PLUS performance is nutrient composition.

All bacteria require nitrogen (N) and phosphorous (P) in significant amounts and smaller amount of substances like iron (Fe), sulfur (S) and others in lesser amounts. They use these "nutrients" as essential components to the health and welfare of the bacteria, therefore their absence can severely limit their activity.

Domestic wastewater operators will usually already contain the necessary "nutrients", however industrial wastewater systems may be lacking and should be examined on a case by case basis.

9. (continued)

Another important consideration for optimum performance of XL PLUS is presence of inhibitory substances. Poor treatment performance must address the question of presence of inhibitory substances, as part of any system evaluation.

The specific parameters for optimum performance will vary considerably from one situation to the next, therefore awareness of the right performance questions to ask will allow a knowledgeable approach to problems.

10.

QUESTION:

Where did the XL PLUS bacteria come from and are they harmful?

ANSWER:

The XL PLUS product contains a blend of naturally occurring soil bacteria. This means that you could find organisms like the ones in XL PLUS in most soils. The thing that makes the XL PLUS organisms special is that they have exceptional degradation talents.

Scientists have isolated XL PLUS organisms after examining hundreds of soil samples. They were selected because they are the cream of the degradation crop – with the greatest talent. The best of the best degraders were made even better by selective mating. Think of it as a marriage between Venus Williams and Tiger Woods. The offspring of such a marriage would have exceptional talents in both golf and tennis, not just one or the other like the parents.

Natural selections followed by selective mating have resulted in a XL PLUS product with extensive degradation capability. No artificial mutation or genetic engineering has been employed in the development of XL PLUS, therefore reducing concerns over putting them into the environment. The use of XL PLUS returns a naturally occurring organism to the environment – a little like "dust to dirt".

The XL PLUS bacteria are not harmful. The literature has been searched extensively for evidence that any of the XL PLUS strains have been implicated in the production of plant or animal disease.

RESULTS: - There are none. XL PLUS handling recommendations are based on common sense suggestions, not worries concerning disease production. If we draw an analogy between XL PLUS and soil (remember XL PLUS comes from soil), you wouldn't store soil with food, you wouldn't inhale it, and you'd probably wash your hands after handling it. Common sense – that's all.

In summary, XL PLUS is composed of carefully selected, naturally occurring soil bacteria which have not been associated with animal or plant disease.