



Green N Clean

Bioremediation Science

Eco Smart Solution

**Process
Issue and Problem
Mode-of-Action & Solution
2010**



Bioremediation

Bioremediation is the process of altering one molecule of organic compound into another molecule or molecules through the reaction of microorganisms. The degree of alteration determines whether it is biotransformation or mineralization. Biotransformation refers to the simple conversion of one molecule into another whereas mineralization refers to the breakdown of an organic compound into molecules like carbon dioxide, water, and inert organic molecules.

Green N Clean's manufacturing partner, Bio-Solutions, has developed a formulation composed of non-pathogenic strains of microorganisms that work synergistically to combat the different polluted materials. This product is a combination of microbes specifically selected, adapted, and mixed to eliminate special wastes. These products have been designed to digest common organic wastes such as starches, proteins, fats, oils, and grease. The formulation is the result of 18 years of research and developmental work by Bio-Solutions' staff and PHD scientists and has been developed to digest waste effectively and in an environmentally safe and responsible manner. When complex substances and compounds, like grease and food waste, are digested and broken down into simpler elements by the microbes, the noxious odors associated with sulfides, ammonia, nitrates, etc., are virtually eliminated and reduced to simpler elemental substances that flow out as effluents. These effluents have more acceptable and less harmful levels of Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), and Fats, Oils, Solids (TSS), and Fats.

Bioremediation Process Targeting Sewers, Grease Trap & Lift Stations

Issue and Problem

Green N Clean believes that the best solution to reduce grease build-up in the collection system, reduce maintenance and disposal costs, and reduce odors, is an integrated treatment program – treatment at the source (grease traps), treatment throughout the collection system and treatment at the sewage treatment plant (STP). Because of this, Bio Solutions has created formulations that treat three separate, yet equally important, waste collection systems: grease traps, lift stations, and septic systems.

The discharge of FOG (Fats, Oils and Grease) into the sanitary sewer system by the food service industry is a major concern facing both restaurants and municipalities. Grease interceptors, commonly known as grease traps, are installed for the purpose of capturing the FOG prior to entering the sewer system. When grease traps are not functioning properly and excessive amounts of FOG are discharged into the sewer system, accumulation of hardened grease in the sewer can lead to sewer blockage and backups. Costs to clean the sewer can run into the thousands of dollars; typically, a cost passed on to the offending restaurant(s). Excessive FOG entering the wastewater treatment process can cause damage to equipment and cause operational difficulties.

Odor is also a serious problem with malfunctioning grease traps. This obnoxious odor is the result of a "sour" grease trap caused by bacteria that dominate at low pH (below 7.0). Odor problems also exist in the collection system, most notably hydrogen sulfide, which has numerous detrimental effects.

Grease traps are most often maintained by pumping the trap. Pumping is generally done on a predetermined schedule, typically no more than once per month. This can lead to neglect on the part of the restaurant owner or manager. It is necessary to the function of the grease trap that it be monitored on a regular basis. If it is not monitored, pumping may be necessary before the scheduled date and FOG could be released into the sewer system. Problem grease traps typically require pumping several times a month, and pumping of this frequency is usually not performed until it is made a part of enforcement action by the municipality operating and maintaining the collection system.



Issue and Problem...continued

Due to this cumulative range and array of problems associated with pumping grease traps, the use of microbial products to improve the functioning of the grease trap has become a cost-effective method of controlling the discharge of FOG into the collection system. Microbial products are typically specialized formulas of bacterial strains that have been acclimated to the environment of the grease trap. These products function by increasing the dissolved oxygen in the trap, stabilizing the pH, and creating an active community of bacteria within the trap and collection system that consume the FOG, leaving carbon dioxide, water, and cell mass as the end products. These bacteria intentionally are not restricted to the environment of the trap, providing a fringe benefit to the operator of the collection system by providing digestions of accumulated materials in the downstream collection system piping.

Many traps are either undersized or not pumped frequently enough, and grease plugging of the sanitary sewer collection system and grease problems in the wastewater treatment process itself, are major problems for many North American Cities. The problem can be particularly severe in areas of high population densities and fast-food restaurants.

Green N Clean and Bio-Solutions Mode-of-Action and Solution

Products used to treat grease traps and lift stations consist of blends of specialized microorganisms and nutrients. All the microbial strains used are non-pathogenic (will not cause disease) and are strains of Pseudomonas, Streptococcus, Lactobacillus, and Saccharomyces.

Green N Clean's Bioremediation Products are designed to reduce contaminants through microbial action. Bio-Solution's microbial systems have been shown to reduce the following:

1. Fats, Oils, and Grease (FOGs)
2. Total Suspended Solids (TSS)
3. Biochemical Oxygen Demand (BOD)
4. Sludge/Sediment
5. Hydrogen Sulphide (H₂S) and other odors.

Bio-Solutions Research and Development Team created "Substrate Specific Systems" by using microorganisms, that are naturally occurring and non-pathogenic, to target different types of organic pollution. All these types of organic pollution require energy both to create and to degrade. Nature has already established microbes that have adapted to release particular strains to digest larger organic molecules. **Once the larger organic molecule is broken down, it will not reform later.**

1. Mode-of-Action & Solution in Reducing FOGs

Fats, oils, and grease are organic compounds that are called triglycerides. They are insoluble in water. Bio-Solutions microbial systems are specifically designed to digest these types of molecules. The products also offer systems to provide for a more suitable environment for microbial activity as well as making the FOG more soluble in water.

FOGs → Fatty acids and glycerol → carbon, hydrogen, etc.

2. Mode of Action in Reducing TSS

Total suspended solids are un-dissolved waste particles in water. TSS of wastewater in grease traps and lift stations typically consist of proteins and starches. Bio Solutions microbial systems include various microorganisms that will digest these solids.

Protein (polypeptides) → **Peptides** (chains of amino acids) → **amino acids** → **carbon, hydrogen, nitrogen, etc.** → **Starch** (polysaccharides) → **simple sugars** (monosaccharide) → **carbon, hydrogen, etc.**

3. Mode of Action in Reducing BOD

Biochemical Oxygen Demand is a condition that occurs when there is undigested organic matter in water. Large organic molecules, such as fats, oils, grease, and un-dissolved solids attribute to BOD, causing depletion of oxygen. Bio Solutions microbial systems accelerate the process of the break-down of organic matter, while also providing conditions to overcome the oxygen demand.



Green N Clean and Bio-Solutions Mode-of-Action and Solution....continued

4. Mode of Action in Reducing Sludge and Sediment

The characteristics and degradation of sludge and sediment vary depending on the system and type of organic waste. Bio Solutions microbial systems contain a range of microorganisms that not only degrade several types of substrates, but also have a range of environmental conditions to facilitate activity. The system provides tolerance to varying conditions of pH, temperature, and oxygen levels. So whether the solids are sediment in the bottom of a grease trap (mostly starch and protein from food) or wastewater sludge (mostly undigested organic matter and proteins), Bio Solutions microbial systems will be able to target the contaminant.

Under Anaerobic Conditions

Large organic molecules → smaller organic molecules → H₂O, CO₂, NH₃, etc.

Under Aerobic Conditions

Protein (polypeptides) → peptides (chains of amino acids) → amino acids → carbon, hydrogen, etc.

5. Mode of Action in Reducing Hydrogen Sulphide

Hydrogen sulfide gas is produced in excess where there are high concentrations of organic waste and sulphates in sewage. The organic waste contributes to a low oxygen condition (anaerobic), which Bio Solutions systems can help control. Under anaerobic conditions, sulphur reducing bacterial (SRB) convert sulphates into sulfides, including H₂S.

Organic Matter + Low D.O. + SO₄ (sulphates) → HS + H₂S + H₂O

a. Bio-Solutions microbial systems help reduce the organic waste accumulating in sewer systems and help control more stable pH and D.O. (dissolved oxygen).

b. Bio-Solutions provides systems specifically targeted for reducing H₂S by focusing more control on environmental conditions such as pH and D.O.

c. Microorganisms introduced by Bio-Solutions systems will help complete and replace SRB.