BIOAUGMENTATION .....A Revolution in Wastewater Treatment of Unitech Water Technologies Pvt.Ltd.

(By Indranil Bhattacharya)

The practice of utilizing specific micro organisms to carry out chemical transformations has been applied in brewing, pharmaceutical and dairy industries. Microorganisms are critical components in the treatment of municipal and industrial wastewater.

In the treatment of wastewater microorganisms (mainly bacteria) use the soluble organic matter in the waste stream as a food source. The bacteria consume the organic compounds and convert them into carbon dioxide, water and energy to produce new cells. Ultimately the soluble pollutants are converted into soluble biomass, which can be removed mechanically from the waste stream and sent to disposal.

Wastewater treatment plants come in many types and configurations, but this discussion will concentrate on aerobic treatment for industrial systems. Two of the most common general categories of aerobic waste treatment systems found in industrial plants are the ones through aerated lagoon system and the facultative pond system. In aerobic treatment systems, aerobic bacterial utilizes oxygen in the digression of the organic compounds. For the system to function, numerous parameters must be controlled. Among these parameters, dissolved oxygen levels, pH and nutrient levels (nitrogen and phosphorus) are the most critical. Classical control strategies have focused on monitoring and controlling the system parameters with little actual attention to the micro organisms themselves.

The microorganisms constitute the 'workforce' of a wastage treatment system. In a dynamic state of flux different microbes are dying while others grow and become more dominant. Under adverse conditions such as toxic shock, certain bacterial populations may be reduced or eliminated, causing poor effluent quality. Examples of toxic shock would be black liquor spills in paper mills or a process upset in a chemical plant sending high levels of tarpons to the wastewater plant. Historically, under such conditions, waste treatment plants have been slow to recover. National Pollution Discharge Elimination System (NPDES) permits often have been violated or the manufacturing process stopped to avoid the legal repercussions NPDES permit violations.

The biological additives industry was started in the early 1960s to address the problems of slow biomass recovery and to supplement lost bacterial populations. The application of this technology is termed bioaugmentation. Frequently, the terms bio-redemption and bioaugmentation are used interchangeably. Bioremediation will be defined here as the use of selected microorganisms to accomplish a biological cleanup of a specified contaminated area, such as soil or water, bioaugmentation will be defined as the application of selected microorganisms to enhance the microbial populations of an operating waste treatment facility to improve water quality or lower operating costs. In other words, Bioremediation deals with a finite project or area, while bioaugmentation involves working to improve a continuous process. Bioaugmentation has been practices since the 1960s. Because of frequent misapplication of additives or poor documentation

of results, the technology has been regarded as less than specific. The approach assumes that the indigenous population, via routes such as windblown solids, rain water and the plant influent stream always will contain the best suited organisms. In reality, even though the natural population may develop into an acceptable one, there may be performance limitations that only can be overcome through the introduction of superior strains of microorganisms. In the aeration basin of a typical industrial water treatment plant, one would expect to find numerous species or strains of bacteria. This bacterial diversity as it is called is necessary because some types of bacterial degrade different compounds most efficiently.

These bacteria generally are well-suited to handle the contaminants in the waste influent and will become acclimated, over time to provide the desired results, assuming a steady state of operation is approximated. Unfortunately, few industrial waste treatment plants ever achieve steady state. The influent characteristics may change drastically from week to week, or even day to day. The variations may be due to production schedules of batch processes, chemical spills in the production plan, or incapable plant equipment. Many treatment plant biological populations never attain optimum numbers or diversity of species. Without bioaugmentation the indigenous population should consist of numerous types of organisms. Some of these organisms are more efficient and effective than others at degrading the various organic compounds and producing a settleable biomass into Population A (desired indigenous organisms), Population B (other indigenous organisms), and population (selected bioaugmentation organisms). The goal of the bioaugmentation programme is to enhance the growth of Population B, establish the selected organisms of Population C, and minimize Population A. The net result is to improve both the quality and quantity of the bacterial population.

There is a question of why bioaugmentation products must be fed continuously after the initial dosing of the products. Due to system upset and influent composition changes, a minimum dosage is required to maintain the desired population diversity.

Proper monitoring of the system using statistical process control, combined with microbiological analysis techniques will provide the information that the bioaugmentation consultant needs to maintain the desired population. By using microscopic analysis and advanced plating techniques, the consultant can correlate bacterial population characteristics with plant performance for a particular waste treatment system. Because every system is unique, the optimum population will vary from plant to plant.

THE PRODUCT: Typical bioaugmentation products consist of several strains of microorganisms usually bacteria or fungi. The organisms are isolated from nature and are not genetically altered in any way. They are selected on the basis of accelerated reproduction rates and their ability to perform specific functions such as good floc forming capabilities to enhance settling or the ability to degrade specific compounds. The products are sold in a variety of forms with dried organisms on bran carrier and liquid products being the most common MICROBIAL ACCELERATOR is a Bio-Tech Revolution and Live Bacterial Digestant. It is a liquid solution which is being used almost the world over for solving wastewater and soil pollution problems which has caught the attention of environmentalists and public authorities to save this planet.

The organisms of Microbial Accelerator are non-toxic and non-pathogenic. It is safe and purely natural product, harmless to human animal, plant aquatic and marine life. Microbial Accelerator bacteria will be perfectly compatible with the indigenous populations and work synergistically with the bacteria and enhance their capabilities by creating a competitive environment.

It solves problem of overloading in industrial and municipal waste water lines, stabilizes complex processes in ETPs and STPs and optimizes efficiency in special reactors with or without activated sludge. It is also usable in fermenting and anoxidial process.

It works aerobically or anaerobically with or without light, works in a wide range of temperature and pH value tolerance. It has purely natural and ready to use product and no special storage is required. It may be stored at room temperature. Direct sunlight should be avoided.

Dosage selection for a particular application is based on a combination of laboratory treatability studies and field experiences in similar applications. Microbial Accelerator is a special mixture of dormant bacteria, made from a formulation of many naturally occurring strains of bacterial that are found on our planet and are adapted to specific stress situations and is designed for a broad spectrum of applications in Industrial, Agricultural, Consumer fields wastewater treatment. When introduced into a polluted area, the bacteria will immediately receive and being feeding and reproducing while attacking the material in the water that causes the pollution. Markets served by MICROBIAL ACCELERATOR.

Food Processing Industries, Fruit and Pulp Processors, Beverages and Bottling Plants, Milk, Dairy and Cheese Processing plants Ice-cream plants, Pharmaceutical Industries, Meat Processing Industries, Paper and Pulp Mills, Sugar Industries, Distilleries, Wine & Alcohol producing units, Solvent Extraction plants, Paints & Resin Industries, Town & Municipalities, Sewage Treatment Plants (STPs), Lagoons, Lakes & Ponds, City Drains, Zoo, Textile units (using Organic Dyes), Military Bases, Refineries, Petrochemical Industries, Hotels & Resorts, Golf Clubs (for their ponds), Fish Farming and Aquaculture units and any industry that produces organic wastewater/effluent.

MORE THAN JUST A PRODUCTS: Successful bioaugmentation requires total system management. If the microbiological population can be viewed as a workforce, then the consultant or system manager is responsible for keeping the workforce productive.

The system manager must provide an acceptable work environment by controlling the key factors such as pH, temperature and oxygen levels. He must compensate them with nutrients to ensure good growth and a healthy population. He has to know when to lay off workers through wasting to keep the population young and vital. Finally, the successful system manager knows when to hire new workers to provide skills not found in his workforce. Bioaugmentation is the mechanism to provide these skilled workers. A critical part of the success of a bioaugmentation programme is proper application. Because every system is unique, it is essential that products are properly applied. Bioaugmentation programs should be implemented with the help of surveying the total system, assessing the best solution to the impact of the program. Simply dumping a

product into the influent is not bioaugmentation. The purpose of bioaugmentation is to facilitate a gradual shift in the microbial population, not to totally replace the existing biomass. The population shift must be accomplished in a planned and controlled manner to maintain the integrity of the microbial ecosystem. Overfeeding these selected microorganisms could result in a no better equipped to handle the influent than the original population.

BENEFITS OF BIOAUGMENTATION: Several areas where bioaugmentation has prevent beneficial are discussed below:

Enhance BOD Removal: Many systems, particularly once through aerated lagoons, are being asked to provide results for the 1990s with technology from the 1960s and 1970s. It would cost millions in capital to upgrade these systems. By increasing the microbiological numbers and diversity via bio-augmentation, the desired results can be achieved. In the pulp and paper industry in the south eastern United States, improvements in BOD levels of 30% tro 50% have been documented.

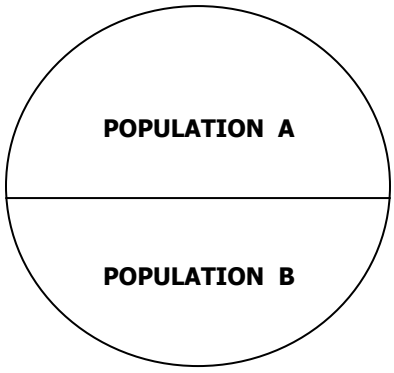
Improved Solids Settling: An important step in biological waste treatment is solids removal, usually through settling in a pond lagoon or clarifier. Bacteria forms a natural bio-polymer that acids in settling. Toxic shocks and system changes can result in a bacterial population with little biopolymer and poor settling characteristics. The traditional approach of adding organic polymer or in coagulants as settling aids can effective but expensive. By inoculating the system with organisms known to be both resistant to the toxicity and excellent flock formers, polymer demand can be reduced greatly or eliminated. Typically the cost of bioaugmentation is significantly less than polymer treatment. In addition, it provides an overall healthier biomass.

Preferential Degradation of Specific Compounds: By addition selected organisms, low levels of particular compounds can be achieved that are not possible with the indigenous population. Compounds such as phenols, chlorinated aromatic hydrocarbons are but after that can be reduced with bioaugmentation.

Improved Nitrification: Many industrial waste plants have difficulties in achieving nitrification or toxic shocks. But regularly adding nitrifying bacteria, the proper population for ammonia removal can be maintained.

Controlling Faecal Coliform Levels: Some Microbial Accelerators can even control the E-Cali level in sewage or effluent without using bleaching powder or chlorine. There are some specific microorganisms which synthesizes the normal strains to harmless strains.

OTHER AREAS: Other areas where bioaugmentation offers benefits include odour reduction, oil and grease removal, rapid system startup and improved tolerance to toxic shocks. Additionally, research continues to explore new application areas for evolving this technology summary. As environmental restrictions tighten, many industrial waste treatment plant operators will be faced with compliance levels that will seriously challenge the capabilities of their existing wastewater treatment plants. In some cases, bioaugmentation will be cost effective, short term, or medium term fix to keep them in compliance unit system changes can be implemented. In other instances, bioaugmentation will be the long term solution because of the lack of capital funds or expenses of the mechanical solutions.



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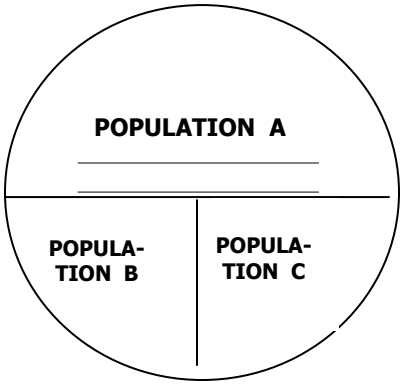

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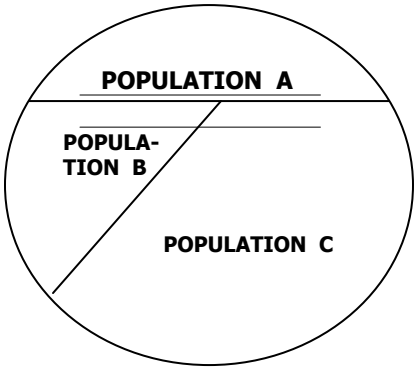

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