Sewage/Effluent Treatment by Growth of Diatom Algae

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February 21, 2008

Abstract

A new process to treat sewage/effluents, by using Nualgi, a patented product that aids the growth of diatom algae in the waste water is described. The growing diatom algae absorb nutrients and carbon dioxide from the water and produce oxygen by photosynthesis at micro plant level. The oxygen released during photosynthesis helps aerobic bacteria in breaking down the organics and converting the pollutants to base constituents. The stinking odor of anaerobic system is thus eliminated. The diatoms are eaten by zooplanktons that are in turn consumed by fishes. The ecosystem of the water is maintained as observed by presence of lively and healthy fishes which are fit for human consumption. Thus all the polluted lakes and rivers can be restored to their original glory using NUALGI.

Introduction

Bacteria digestion of organics is the known method to reduce BOD, COD, TSS, TDS etc in Sewage / Effluent waters. Anaerobic and Aerobic types of bacteria are generally found in nature to do this job. Anaerobic bacteria proliferate in untreated sewage / effluent giving rise to H₂S gas that produces the obnoxious smell. Aerobic bacteria require plenty of dissolved oxygen to do the organic digestion.

Objective

Polluted water bodies constitute a serious health hazard and lead to bad living conditions for both men and animals. It is desirable to clean up the rivers, lakes, oceans and all bodies of water from water borne organic wastes generated from pollutants and sewage. It is also desirable to convert the waste into wealth and produce fishes thereby increasing the per capita availability of protein in the
population at large. The objective of the present work is to study the effectiveness of Nualgi in cleaning up polluted waters.

**Current practices**

Untreated sewage and effluents are let off into the nearest water bodies where anaerobic bacteria slowly consume the organics and produce H$_2$S that gives rise to bad smell. Further the waters become infested with water weeds and plants like hyacinth. These then become the breeding place of mosquitoes and disease producing organisms. World over the acceptable technology for treatment of Sewage / effluent is by the use of activated sludge process having aerators and allied equipments. This process is slow, involves capital equipment and has a high running cost. There are capacity restrictions and problems of the biological activated sludge collapsing due to process variations and imbalances. So far there has been no alternative.

**Problems of current practices**

To treat sewage, investments in capital equipments have to be made and amounts are to be spent for their maintenance. The population pressure and the generation of sewage are dispersed over a wide geographical area making it difficult to build plants all over the place. The costs are enormous and it is difficult to make the population pay for the upkeep. Hence people live with the problems of bad smell and contaminated river bodies and expect nature to solve their problems. Every year the monsoon floods the land and the untreated wastes are washed down to the sea where the problems are shifted to a new environment but not solved. The dissolved oxygen levels in the sea are decreasing and the dinoflagellates that cause the red tides are proliferating leading to growth of jelly fish rather than finfish. The production of neuro toxins by algal blooms is well documented.

In rivers / streams / lakes where sewage is dumped untreated the proliferation of green and blue green algae is seen. The water will be dark green or blackish in color. The usual bad smell of H$_2$S is present. These algae have cellulose cell walls and hence cannot support downstream food chain for the fishes. Sometimes the blue green algae (cyanobacteria) release neuro toxins that create problems for cattle and drinking water supplies. The algae periodically dies off causing algal crash, and in the process it removes dissolved oxygen from the water causing mass fish kill.
Solutions proposed

In water, growing algae has the capacity to consume nutrients and absorb carbon dioxide and release oxygen by photosynthesis. Among several species of algae, diatoms as a species are responsible for more than 50% of the world’s food produced in the oceans.

We have developed and patented a product called 'NUALGI' that can grow diatoms in any water be it seawater, high saline water, fresh water, polluted water, sewage water etc. The growth of diatoms is very fast starting within 5 minutes and continues till the nutrient lasts. The growing diatoms absorb CO$_2$ and release O$_2$ at the micro plant level. The O$_2$ helps aerobic bacteria breakdown organics into its constituents thus cleaning up the water. The suspended solids break down into nutrients, gases and sludge. The nutrients are further absorbed by the diatoms to grow.

The diatom algae produce food by photosynthesis and are soon consumed by zooplankton. The zooplankton becomes food for fishes and the waters are cleaned. If there are no fish the zooplankton become part of the sludge and become excellent manure for plants. There is no bad smell both in the water and in the sludge. The dissolved oxygen content of the treated water improves considerably. Every kilogram of Nualgi is expected to generate in excess of 100 kg of oxygen by photosynthesis depending on the species of diatoms growing.

Note on the technology of Nualgi

NUALGI is primarily a plant growth nutrient. If plants have to grow on land they pick up the required nutrients from the soil. In water, the nutrients are not soluble and hence they precipitate out. Even on adding the soluble inorganic nutrients or chelated nutrients, they will react with each other and will precipitate out in the oxidizing medium of water. In NUALGI all the nutrients required for the growth of the plant are specially made to be chemically and biologically stable in water medium and their particle size is in the nano range. This enables the microscopically small diatoms to absorb the nutrient from the water medium and grow fast. The technology is complex but the finished product is simple to use. All the trace nutrients required by the aerobic bacteria for breaking down the organics are also provided by NUALGI and extra nutrients are not necessary.

More details of NUALGI including VIDEO pictures of pond, zooplankton and fishes are given in our website www.nualgi.com/new

Nualgi can be used in several ways:

1. In ETP / STP plants Nualgi can be added to the source effluent for faster
and efficient processing, removing bad odor, faster reduction of BOD and cleaner treated water and increase in capacity of treatment.

2. For adding to Sewage / effluent to be sent to lagoon / river / lake, where fishes can be grown along with the cleaning up of water. In a few days there will not be any trace of the sewage and water color will be light green / golden brown with very good dissolved oxygen. In this case there is no requirement for a capital investment for ETP plants and all our rivers and lakes can be cleaned of all sewage pollution.

3. For adding to large lakes like Dal lake in Kashmir, for cleaning up polluted Yamuna, Ganga rivers, Cooum in Chennai etc without any capital investment. The dissolved oxygen will increase and the organics will break down and become food for the fishes. The per capita protein availability can

Figure 1: Flowchart for the treatment of Sewage/effluent with Nualgi
be increased in the country along with reduction in pollution of the water bodies.

4. Wild life thrives on nutrition and food availability. Adding Nualgi to lakes increases the fish population especially Tilapia enormously. The availability of fishes brings migrating birds like cranes and pelicans into the vicinity of the lakes helping tourism and satisfying nature enthusiasts. In Bangalore we added to Madivala lake and we had Pelicans flocking to the place last November when the fishes were abundant.

5. Removing and crashing out of Blue green algae from lakes or water bodies having this problem without affecting the fishes or the drinking water quality.

6. For preventing wild growth of water weeds like water hyacinth etc by improving water quality.

7. For growth of phytoplankton in the seas to absorb global carbon dioxide and reduce global warming.

8. Preventing and solving MASS FISH KILL in water bodies due to oxygen depletion.

9. Used in water ponds inside hotels and restaurants and beautiful places to prevent the stale and fungus smell.

10. To prevent formation of red tides in the sea formed due to the proliferation of dinoflagellates that help growth of jelly fish instead of finfish. This situation is caused primarily by the dumping of untreated waste into the sea. The red tides also cause shell fish poisoning.

11. In brewery waste treatment the waters are acidic due to dissolved CO$_2$ generated in the fermentation process. On using Nualgi the dissolved CO$_2$ will be absorbed by the growing diatoms thus reducing the acidity of the water and avoiding the use of caustic soda for neutralization.

12. The Nualgi treated effluent is far superior for agriculture use since it has higher availability of trace micronutrients in a biologically available form suitable for plant growth. We have observed that mosquitoes do not breed in the oxygenated water. However scientific studies have to be conducted and facts established.
Where has it been tried?

1. We are already selling the product for aquaculture in AP, KA, TN, Or and Mh for the development of diatom bloom, growth of zooplankton leading to development of the food chain.

2. We have treated several sewage laden lakes in Bangalore like the Madivala lake, Ulsoor lake, Vengayyana kere, Puttenahalli lake, etc. In a number of cases there was fish kill and we solved the problem. The licensees are growing fish in the lakes.

3. We have done tests in Sewage treatment plants of the BWSSB in Yelahanka, Chennai sewage treatment plant at Nesapakkam, Jindal ayurvedic hospital’s sewage treatment plant Bangalore and stopped the H$_2$S generation in the plant. But we could not get a certificate from them since there was no H$_2$S measuring instrument there at that time.

4. We have tested in M/s. Mysore Breweries Bangalore and got valuable experience and good results.


6. We are selling this product to M/s. Cochin Sea Foods, Palavakkam, Chennai for treatment of the marine food processing waste effluent water.

7. We have treated a pond adjoining a library in SSIT, Tumkur and have solved a major problem of blue green algae and foul smell.

How is it used?

Nualgi has to be taken in 60 mesh net and dissolved in water and added by bucket or mug to the water body. It is recommended that about 1-2 kg of Nualgi is used per 4000 m$^3$ of water (4 million liters). The dissolution can also be made in a Sintex tank and the flow may be adjusted on to the sewage effluent. The efficacy of the product is increased by higher dilution. The test for determining the quantity of Nualgi required depends on the ultimate dissolved oxygen of the treated water. One has to optimize.

The product is commercially available in India and we have done extensive testing in several places and solved the problems successfully. The product is priced at Rs.300/- per kg and packing comes in 1X25 kg cartons.
Conclusion

Application of the patented product NUALGI to polluted water bodies is a fast and economical alternative to the conventional ETP plants in treating sewage and other organic wastes. Benefits include converting the waste into wealth in the form of fishes, restoring the water quality and the environment, and improving the habitat of the birds and animals in the nature.

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