

Sewage Treatment

Through the Application of EM
(Active Sludge Method)

EM Brief

EM stands for "Effective Microorganisms" and was coined by professor Teruo Higa of the College of Agriculture, University of the Ryukyus in Okinawa, Japan and who developed EM. EM consists of a wide variety of effective, beneficial and non-pathogenic microorganisms produced through a natural process and not chemically synthesized or genetically engineered. It comes in a liquid form. EM has a broad application. EM has no adverse effects on and is beneficial to plants, animals, and humans. Very simply put, EM lives off our waste while we live off "their waste". Their waste simply translates to a healthy environment for us in which EM becomes inactivated, therefore, a mutual existence can be had. EM only creates the condition for best results, that is, the users should nurture the condition and provide the resources for EM to perform optimally. Microorganisms exist naturally throughout the environment from rock crevices to our internal organs. In our present day environment, putrefactive microorganisms, those types responsible for the rotting of organic matter to maladies in organisms, dominate much of the sphere of the microorganisms. EM has the potential, given the conditions, to suppress the putrefactive microorganisms and dominate this sphere and create a re-animated surroundings, that is, organics are transformed through the process of fermentation as opposed to putrefaction, and living organisms, as well as, inorganic materials are enabled with the means to impede deterioration. Deterioration is here meant the activity of active oxygen or free-radicals through which organisms degenerate and inorganic materials corrode, as in iron rusting. EM can thus, also, be considered as an antioxidant.

Introduction

EM has been used in treating sewage water for more than five years now. Sewage usually goes through some septic tank or through a sewage treatment system of tanks if it does not otherwise go directly into the city's sewer system or into some body of water. The application and treatment here described is mainly for facilities using an active sludge method, that is, where an aeration equipment is used. Also, the method described can be used for sewage treatment in general as in septic tanks common in households and for toilets and drains that may go directly into the public sewer system.

Water is precious; it is crucial for life and for the maintenance of health and environmental hygiene. We use water to irrigate farmland, water our gardens, clean our bodies, clean our streets, keep our cars, homes and place of work clean. Most of the water used ends up in the city or public sewer system which inevitably winds up in our rivers, lakes, and oceans. A shortage of water can cause outbreak of diseases, not to mention, the dehydration in people and loss of crops. Most, if not all, of our water can be recycled. That is, tap or potable water from our reservoirs used for drinking and washing which mostly end up in the septic tanks or some sort of sewage treatment facility can be recycled back into toilets and for general purpose cleaning: washing cars, streets, the home, the

place of work, watering lawns, gardens, and house plants. This not only represents avoidance of "water shortage emergencies", but also a great savings in costs: water bill, water treatment costs, and tax dollars ("water emergency" incurred costs, treatment and handling of polluted waters). EM can greatly help accomplish the above recycling, including, considerable reduction, if not elimination, of foul odor, of sludge, and the cleaning of our rivers, lakes, and oceans. EM prevents corrosion through the suppression of activities of free radicals and therefore prevents the deterioration of the sewer system and tanks. This would translate into long term savings in maintenance cost. As EM pervades throughout the sewer system and into the rivers, lakes, and oceans, EM creates a condition in which plant life can propagate. And such revitalization of plant life along river banks, shorelines, and sea coasts, can prevent their erosion.

The Gushikawa City Library EM Sewage Treatment

In 1991, the Gushikawa City Library in Okinawa, Japan, installed a sewage treatment system in which, through the application of EM, the resulting treated water is recycled back into general purpose use other than drinking. Their system involves a series of tanks through which the sewage is gradually purified into water through the action of EM. The facility also consists of an aeration unit and a filtering system which is not necessary but required by law. The facility also collects rain water which adds to the water being recycled.

At the very beginning, fourteen liters in total of EM was applied to all the toilets in the library with positive results showing within the first month. Thereafter, EM has been applied at a rate of three liters every three months, but only to the first of the sewage tanks in which the toilets and drains flow into. For the first year, the aeration time was three hours total per day working intermittently. Normally, in active sludge methods, the aeration is done twenty-four hours a day. Therefore, at the Gushikawa City Library, the savings in electricity cost is estimated at 500,000 yen (approx. \$5,000). From the second year on, the aeration time was reduced to a total of two hours per day working intermittently throughout each day. The water cost for the first year was 60,000 yen (approx. \$600) while prior to that the cost was about 1,200,000 yen (\$12,000). The cost for EM at the time was 2,300 yen (\$23) per liter. The initial fourteen liters' cost was 32,200 yen (\$322). The annual cost from the second year on has been 27,600 yen (\$276) or 6,900 yen (\$69) per application.

The recycled water is used to flush the toilets, wash the carpets, general purpose cleaning, and for watering the lawn and garden. Since EM is present in the recycled water, the toilets have become easier to clean and the carpets show almost no presence of dark molds as they dry in the often hot and humid Okinawa climate. One water quality standard criteria for discharging waste water is its BOD (Biological Oxygen Demand) which should not be more than 20 parts per million. The BOD of the water tested at the Gushikawa City Library conducted monthly by the government has been measured at less than 3 parts per million. The library's system handles 160 people, 32 cubic meter of sewage per day with a maximum capacity of 6.86 cubic meter of sewage per hour, and receives sewage into the system during the seven hours the library is open each day.

Another savings by the Gushikawa City Library is in sludge removal cost. The sludge accumulation has been small enough that removal has been unnecessary. Sludge is a major form of water

pollution that comes from sewer systems and end up in rivers, lakes, and oceans. Also, some sludge removal companies may dump some of the sludge into some body of water, a pond or lagoon, or they may incinerate the sludge in which case results in air pollution and ash problems. The library's system may, therefore, if applied on a grand scale, eliminate much of the sludge coming from sewer systems.

A long term savings for the library may be maintenance cost and replacement cost of the facility. Metal structures which are visible just above the water line or in water which has become clear within the tank at the end of the sewage treatment system, there is no apparent sign of rusting. Towards the top of the tank where the metal structures are least exposed to the EM treated water, only some rusting is visible. The reason behind this may be that EM has the ability to induce antioxidants and therefore suppress or prevent the actions of active oxygen, also known as free radicals.

One problem of sewage which has been minimized is malodor. This represents a significant solution to neighborhood odor problems and being able to recycle the water.

The Gushikawa City Library has reduced costs creating significant savings. Outside itself, the library has contributed to saving water especially in an area where water shortage emergencies occurs every so often, has greatly reduced foul odor problems for its neighbors - a public relations benefit, is helping the environment from sludge pollution, and maintains a beautiful landscape around the library by watering the plants with the recycled EM treated water. EM was first applied for use in agriculture, therefore, its beneficial effects on plants can also be observed here.

The Savings in Utilizing EM in Treating Sewage

Savings in Water Cost

The Gushikawa City Library has reduced its water cost down to 1/20 through the application of EM.

Savings in Electrical Cost

The Gushikawa City Library has reduced its electric bill down to 1/12 of the cost that would be incurred with a 24-hour aeration time.

Savings in Sludge Removal Cost

The Gushikawa City Library has incurred no sludge removal cost thus far as of 1995 (EM treatment began in 1991).

Savings in Maintenance Cost

EM, as a powerful inducer of antioxidants, may prevent early corrosion of the facility and, therefore, greatly minimize the need for maintenance or parts replacement over a long period.

The Benefits of Utilizing EM in Treating Sewage

Contributes to Saving Water by making Recycling Water possible.

Foul Odor Reduced Significantly

EM prevents putrefactive microorganisms from becoming active in producing gases such as ammonia.

Cleaner and Easier to Clean Toilets

EM in the recycled water helps in reducing molds and mildew buildup and helps any matter buildup remain soft and easily removable.

Cleaner Environment Within and Around the Library

The carpeting, the bathrooms, the sinks, and the landscape which are exposed to EM are kept cleaner from non-beneficial fungal and bacterial growth.

Healthier Plant Life

EM in the recycled water in watering the plants has beneficial effects in the plants growth and development.

General Sewage Treatment

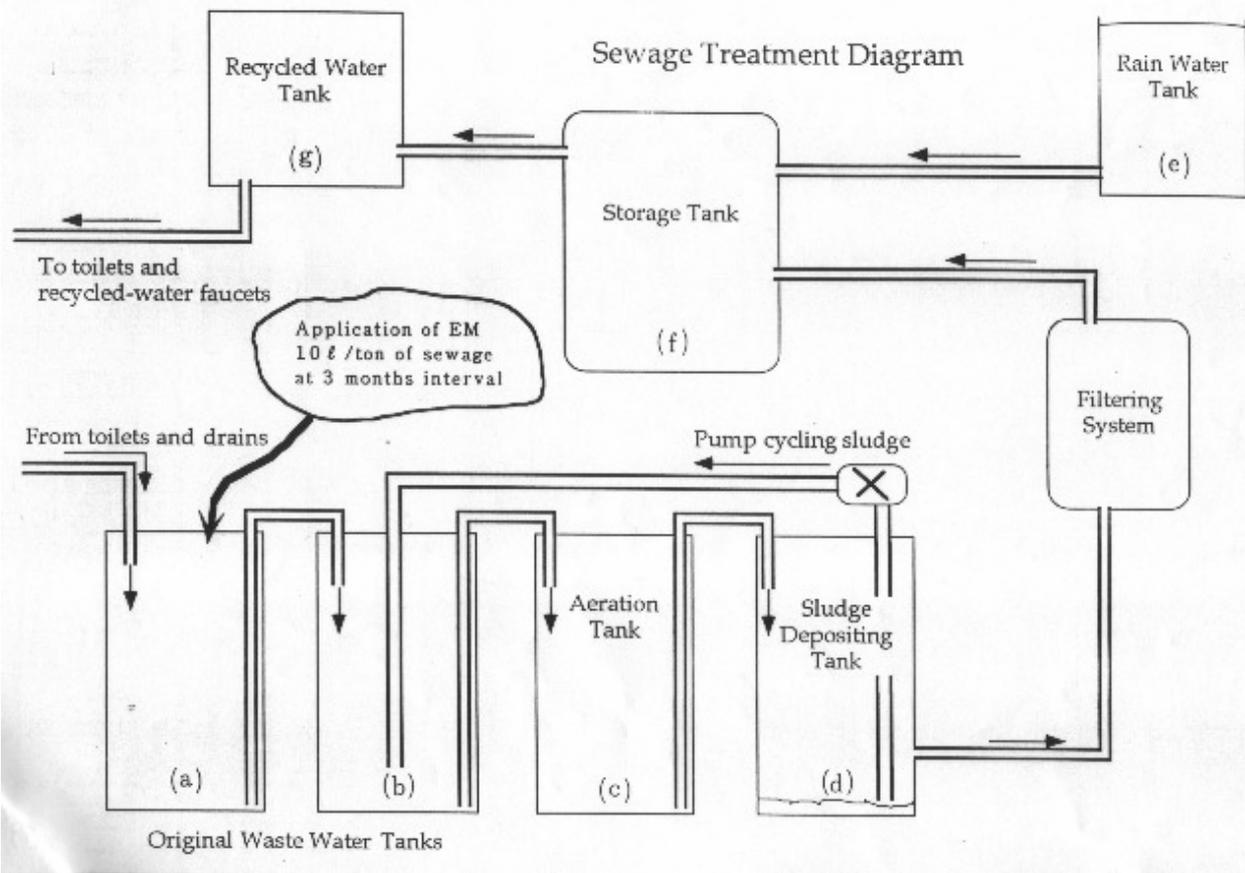
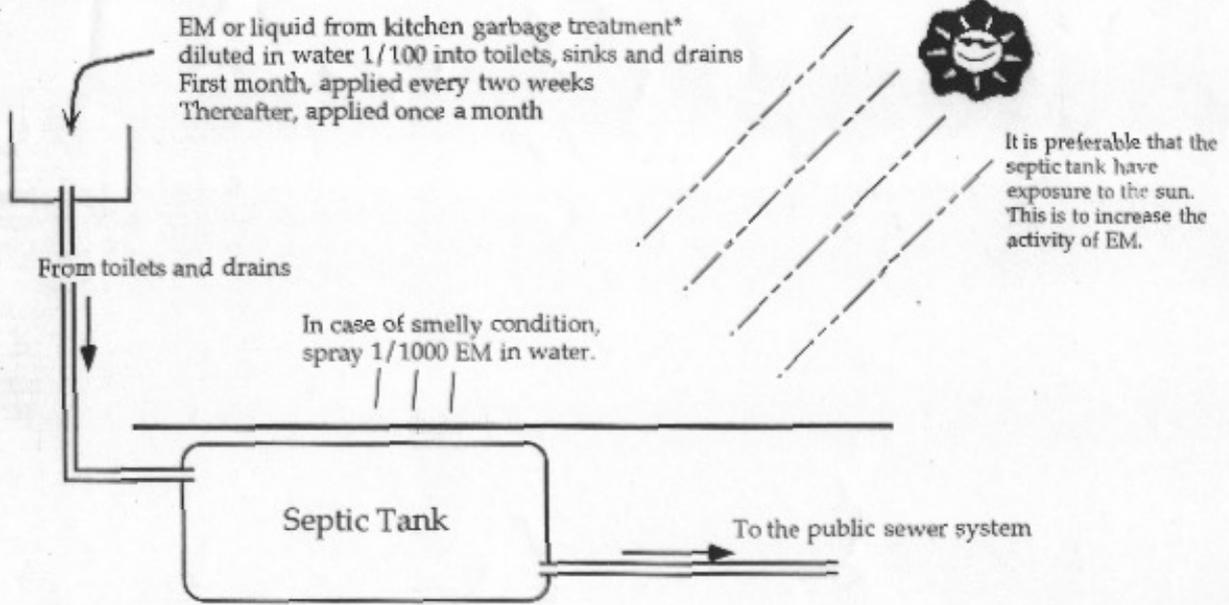
A general and simplified sewage treatment system is shown in the Sewage Treatment Diagram. Any sludge that may have deposited in the Sludge Depositing Tank (d), may be pumped back into tank (b) to reduce it further (the Gushikawa City Library has not needed to do this so far). As mentioned above, the filtering system is not necessary, however, regulations requires that a filtering system be in place.

Sewage Treatment for Households

The Household Sewage Treatment diagram shows a simple way for households with septic tanks to utilize EM.

This is also a way for places that have their sewage go directly into the public sewer system to utilize EM and reduce foul odor and reduce water related pollutions. Additionally, the widespread utility of EM would clean the environment around bodies of water where the EM treated sewage is released possibly resulting in greater plant life, flourishing of the animals within that region, and prevention of erosion through enriched soil and plant life.

Household Sewage Treatment



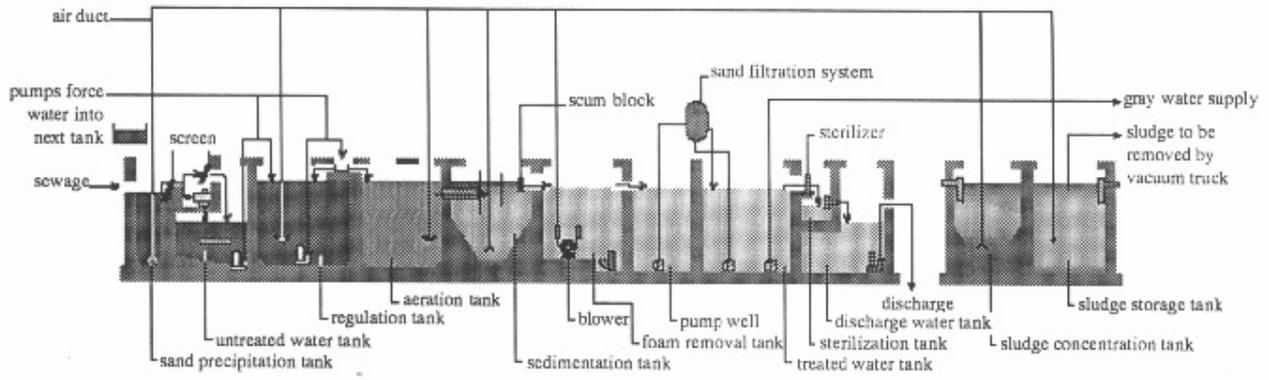


Diagram of Gushikawa City Library's Water Purification System