



DOI NUMBER: 10.5958/2278-4853.2019.00142.3

A REVIEW ON: EFFECTIVE MICROORGANISMS AND IT APPLICATIONS

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ABSTRACT

*The Effective microorganisms is a commercial bio fertilizer that contains a mixture of co-existing beneficial microorganisms collected from natural environment. Effective microorganisms were developed at the University of the Ryukyus, Japan, in early 1980 by Dr. Teruo Higa. Approximately 80 different microorganisms are capable to positively influencing decomposition organic substance such that is revert in to a life promoting process. EM is a fermented mixed culture of naturally occurring species of co-existing microorganisms in acidic medium (pH below 3.5). Among the main microorganisms in EM culture are the species of photosynthesis bacteria (*Rhodospseudomonas pastrics*, and *Rhodobacter sphaerodes*), *Lactobacilli* (*L. plantarum*, *L. casei*, and *Streptococcus lactis*), yeast (*Saccharomyces spp*) and actinomycetes (*Streptomyses sp*). EM technology has not only helped agricultural but it also assisted in the field of live stock, the environment, construction, industry and health. EM X Gold drink a potent health drink formed from the effective microorganisms. The drink can help strength of immune system, Reduce risk infection, improve body is acid, alkaline balance, increase decontamination.*

KEYWORDS: *Effective Microorganisms, Biofertilizer, Agriculture.*

INTRODUCTION

EFFECTIVE MICROORGANISMS:

Effective microorganisms (EM) are various blends of common predominantly anaerobic microorganisms in a carbohydrate –rich liquid carrier substrate (molasses nutrient solution). The Effective Microorganisms is a common biofertilizer that contains a mixture of co-existing beneficial microorganism collect from natural environment. Effective Microorganism was

developed by the University of the Ryukyus, Japan, in the early 1980 by pro. **Dr. Teruo Higa**. Approximately 80 different microorganisms is capable to positively influencing decomposing organic substance such that is reverts in to a “Life is promoting” process.

Effective Microorganisms are mixed cultures of beneficial naturally occurring organisms that can be applied as inoculants to increase diversity of soil ecosystem. Effective Microorganisms strands for (EM). Effective Microorganisms comes in liquid form and consist of naturally occurring beneficial microorganisms. The microbes in EM are non-harmful, non-pathogenic, non genetically engineered or modified (non GMO) are not chemically synthesized. EM is combined culture of aerobic microorganisms (requiring oxygen to survive) and anaerobic (requires non oxygen survive) that to exist together to the mutual advantage of both (symbiosis).

EM is fermented mixed culture of naturally occurring species of co-existing microorganisms in acidic medium (pH below 3.5). Among the main microorganisms in EM culture are the species of photosynthesis bacteria (*Rhodospseudomonas pastrics*, and *Rhodobacter sphaeroides*), Lactobacilli (*L. plantarum*, *L. casei*, and *Streptococcus lactis*), yeast (*Saccharomyces spp*) and actinomycetes (*Streptomyces spp*). Microorganism in EM improve crop health and yield by increasing photosynthesis, producing bioactive substrate such as hormones and enzymes ,accelerating decomposition of organic materials and controlling soil borne disease [1-2].

The basic groups of microorganisms in EM are Lactic acid bacteria, Yeast, Actinomycetes, and photosynthetic bacteria.

The effective microorganisms secrete beneficial substances such as vitamins, organic acids, chelated minerals, and antioxidants, when in contact with organic matter they change the soil micro flora and fauna so that disease inducing becomes diseases suppressing soil.

EM technology has not only helped agricultural but it also has assisted in the field of live stock, the environment, construction, industry and health.

EM X Gold is potent health drink formed from the Effective Microorganisms. The drink can help strength of immune system, reduce risk of infection, reduce allergies, improve body is acid, alkaline balance, increase decontamination in your body. EM X GOLD contains highly bio available EM derived low molecular weight metabolites. These metabolites include trace minerals, and enzymes. Benefits of EM X gold include:

- Faster and more effective decontamination of the organs
- General improvement of the body acid/alkaline balance
- General strengthening of the immune system
- Reduction of the susceptibility of infection
- Reduction of allergies

EM technology has also assisted in supporting oral health.

EM 1 is liquid probiotic supplement that support that healthy digestive, support weight loss, improve absorption of food, controlling yeast infection. Most EM culture contain from three to fifteen different species of lactic acid bacteria. phototropic organisms are microbes that are photosynthetic ,which can use sunlight to produce energy and energy compounds. All EM culture contain at least 2 or 3 species of phototrophic organisms ,usually from the extremely powerful and versatile and near magical purple non-sulfur bacteria (PNSB) are family of phototrophic microbes ,which seem to possess powerful and interesting energy and oxidative

effects .EM has found application in many areas especially agriculture, production of health drink ,waste water treatment ,preparation waste biomass material for bio conversion into fuels such as bio-diesel and other etc.. These effective microorganisms are used to produce fermented extract from unpolished rice, papaya and see weeds. The effective microorganisms fermented extract was claimed to possess has strong anti-oxidation property.

EM technology is the use of a liquid culture of Effective Microorganisms. EM technology was introduced in to Aurovilles farms in October 1999. It was first used in agricultural through spraying, and then with EM compost and Bokashi. Later EM5 and fermented were used for the pest management. Auroville international township (longitude 79 54, latitude 12 north) is located in viluppuram district of Tamil Nadu on Coromandel Coast of southern India.

Maple Organization Technology (India) Ltd. Maple EM products offered by as are widely used in many ETP, hotel ,food processing industries, Hospital and municipal corporations.

Copenhagen demarks –lake had clarity of 8 cm from surface and after treated with EM went to one meter.

North Korea EM fertilizer increased corn production two time and **9-10** kilo gram cabbage heads were unheard of before EM.

NATURAL PREPARATION OF EFFECTIVE MICROORGANISMS [3]

papaya (1kg), pumpkin (1kg),as the equal volume .The ingredients process in to chopped and mixing well and this content mixed with cane molasses (1/2kg), egg(1), banana(2) , grapes (½ kg), neem powder (1/20 kg) and jaggery (100g).

5 Liters of distilled water mixed well and tightly sealed. Then ingredients are mixed well in twice a day rotating the container. The process is continuing for 45 days. After 45 days the white layer was formed on the surface. The fermented EM solutions were collected by filtration and transfer to sterile bottle.

SUGGESTED DOSAGE

Take one teaspoon (5ml) in the morning and one teaspoon in the evening on an empty stomach.

To increases effect, mix in hot liquids such as hot tea or coffee.

STORAGE OF EM

Store in the coolest environment available (preferably about 50 degrees), in a closed container away from light. Of the three elements that awaken the dormant microbes, light is the most influential, then heat, then air.

To avoid contamination, do not use the cap as a serving spoon.

Consume within one month after opening.

Product is sterilized and does not contain any live microorganisms.

MODE OF ACTION OF EFFECTIVE MICROORGANISMS

Effective microorganisms live symbiotically with each other. Most, however, struggle with other colonies; and mark clearly defined territories with special biochemical secretion .EM with in same colony usually specializes in particular function .To protect against pathogens, EM produce a number of natural antibiotics XE antibiotics designed to reduce the population of competitors.

At the same time, some of their antibiotic secretion and body's immune system by stimulating T-cell XE (T- cell) and B cell XE (B- cell) activity.

EM release antibiotic secretion called bacteriocins that selectively reduce the growth of other pathogens, including yeast and pathobiotics. EM can also quickly harmful bacteria or fungal over growth and work directly to eradicate time. EM produces chemical substances that destroy invading pathogenic microorganisms. EM also produced acetic acid, formic acid, lipopoly saccharide XE (lipopolysaccharide), peptidoglycans XE (peptidoglycans), and super antigen [4].

BENEFICIAL ROLE OF EFFECTIVE MICROORGANISMS

Agricultural uses

- One claim made by its producers is that EM is very useful in farming because it can increase the yield and quality of crops when used as a supplement [5].
- A study by [6] put this claim to the test by adding EM to a mixture of compost, and measuring wheat grain yield and the growth of nematodes, which are important soil organisms involved in nutrient recycling and decomposition.
- Results showed that the number of nematodes, as well as crop biomass and yield were much greater in soil treated with EM compost than in soils treated with nitrogen-phosphorus (NP) fertilizers or traditional composts alone.
- Another study by [7] attempted to further examine EM composts and their quality compared to traditional compost and found that EM composts had a higher concentration of nitrogen, potassium, calcium and iron.
- Such minerals are used (in trace amount in the case of iron) for the growth and metabolism of the plant [8-9-10].

Environmental uses

- As EM composts give rise to better soil quality and crop yield, it is already clear that they can benefit the environment by acting as alternatives to inorganic fertilizers. However, other environmental uses of EM have not yielded positive results.
- A study by [11] tested the ability of EM in cleaning septic tanks and concluded that it is not effective in removing any significant amount of suspended materials from it. EM has also shown to be ineffective in treating cyanobacteria blooms in water, despite claims that the potentially useful bacteria in it would replace harmful bacteria [12].
- More recent studies are attempting to assess the effectiveness of EM in treating heavy metal pollution in water, which can be toxic to the surrounding ecosystems, yet the findings are not promising.
- [13] compared the abilities of alginate -immobilized EM and normal EM and found that while the former can be useful in removing heavy metals, the effects were largely because of the alginate gel itself, and not the EM.
- To date, attempts at finding effective environmental uses for EM have been largely unsuccessful; however, as evident from its use as a good alternative to other fertilizers in farming practices, EM can have great environmental effects and further research is required to assess its true potential.
- EM used as a spray to wash down the facilities acts as a disinfectant of the buildings.

Medicinal uses

- While the majority research is focused on the agricultural and environmental uses of EM, there has also been some research on its possible medicinal uses. EM-X1, a version of EM suited for human consumption, has shown to be effective in treating in vitro human cancer cell types such as KG1a Acute myelogenous leukemia (AML) and Hep3B Hapatocellular carcinoma (HCC) by causing apoptosis in the affected cells [14].
- Another way in which EM can have anti-proliferation effects on cancer cells is by reducing the number of vascular endothelial growth factor (VEGF) invitro conditions, and it may also act against angiogenesis, a process that is required for tumour growth [15].
- EM-X1, as shown by [16] can also be used as a treatment for neuro degeneration because it is able to hinder oxidative stress processes.
- Another medicinal use of EM is in treating asthma by reducing the number of type 2 helper T cells (TH2), so that less immunoglobulin E (Ig E) is produced, resulting in a decrease in the airway hyper responsiveness seen in asthmatics [17].
- A number of medicinal uses for EM have been verified; however, more research is required until is ready for practical uses.

ODOR MANAGEMENT IN LIVESTOCK INDUSTRIES [18]

During the mid -1980, livestock and producers in Japan began to test EM for odor control and waste management. This research continuous to the present and has found EM to be effective as probiotic waste treatment and biological control agent.

There are four different ways in EM inoculants can be introduced in to the production system in odour to achieve a deodorizing effect.

1. as a probiotic additive to drinking water.
2. As a probiotic feed additive.
3. As additive to sanitation spray water for washing the facility.
4. As a treatment added to the waste handling process.

EM helps balance the micro flora within animal's digestive tract. EM increases the coefficient of nitrogen utilized by the bird. The lactic acid bacteria EM produce lactic acids that kill pathogenic microorganisms.

NATURE OF EM FOR DISEASE PREVENTION

Health improvement using EM is related to its use as an additive to drinking water and feed. The gastro intestinal tract of birds may house several pathogenic microorganisms [19]. The consumption by the animals is expected to result in health improvements apparently because of competition with pathogenic micro flora in digestive tract. Greater bursa and thymus index in commercial broiler chicken supplemented with EM through drinking water and feed [20].

ADVANTAGE OF EM

- It suppresses flies and mosquitoes.
- It has increased yield and growth development in agricultural field.

-
- EM composts had a high concentration of nitrogen, potassium, calcium and iron.
 - EM in treating heavy metal pollution.
 - EM is used for the medicinal purpose such as human cancer cell.
 - EM is not toxic or pathogenic and is safe for human animal and the environment.
 - The microbes in EM non harmful, non pathogenic and non GMO.
 - EM contributes positively for human health, natural and cost effective revitalisation of drinking water.
 - Inhibit the growth of harmful bacteria that carry diseases in the soil.
 - Control the degree of soil moisturization and nutrient absorption.
 - Product easily available.
 - EM in treating waste water treatment.
 - EM use in livestock and poultry.
 - EM helps the micro flora with in animal's digestive tract.
 - Faster composting and more complete composting.
 - Compost with a higher growth index.
 - Bioremediation of the sludge during the process.
 - Improvement in the quality of water and leach ate coming from the process.

DISADVANTAGE OF EM

- Other environmental uses of EM have not yielded in positive result.
- Environmental uses for EM has been largely unsuccessful.
- Don't use EM straight on your houseplants.
- Don't consume large quantities of EM without buildings up slowly that goes for animals as well as people.

ANTMICROBIAL ACTIVITY OF EM [21]

BACTERIA

Lactic acid bacteria: It suppresses harmful microorganisms and increases rapid decomposition of organic matter. In addition of they can suppress the reproduction of *Fusarium*, a harmful fungus. Lactic acid bacteria have the ability to suppress *Fusarium* propagation which is a harmful microorganisms that causes diseases problem in continuous cropping. These bacteria are differentiated by their powerful sterilizing properties.

Photosynthetic bacteria: these bacteria play role in the activity of EM. They synthesis useful substances from down the organic substances quickly.

YEAST

Yeast synthesis antimicrobial substances for plant growth from amino acid and sugars secreted by photosynthetic bacteria, organic matter and plant roots.

ACTINOMYCETES

The structure of which is intermediate to that bacteria and fungi, produces antimicrobial substances from amino acid secreted by photosynthetic bacteria and organic matter.

The antimicrobial substances suppress harmful fungi and bacteria. Actinomycetes can exist with photosynthetic bacteria. Thus both species enhance of the soil environment, by increasing the antimicrobial activity of the soil.

FERMENTING FUNGI

Aspergillus and *penicillium* decompose organic matter rapidly to produce alcohol, esters and antimicrobial substances. They suppress odors and prevent infestation of harmful insect and maggots.

CONCLUSION

Use of Effective Microorganisms (EM) to achieve a more sustainable agriculture showed that these microorganisms act in a holistic manner, changing the soil's chemical and physical properties, and mainly the aggregation of particles that cause rapid drying of the soil surface layer. This, in turn, probably increases the activity of competitive saprophytic microorganisms which are better adapted to the drier superficial soil layer, despite wide variation in the soil water content.

Principles, application and validity of effective microorganisms (EM) as a sustainable component of organic farming systems reviewed given the global consumer shift to organic produce. This resulted from scientific evidence that justifies it: naturalness, safety and wholesomeness; ecological sustainability, profitability, longer shelf life in storage, higher food value in terms of nutrient, stability of soil fertility, improved maturity period, continuity of yield.

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