**INNOVATIVE METHODS FOR SOLVING ENVIRONMENTAL PROBLEMS**

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Nowadays, the entire world is looking for safe and effective solutions of environmental problems that we are facing in the era of large-scale manufacturing. Contaminated waste water from plants and factories falls into ponds, rivers and seas. People bathe in contaminated waters and then suffer from serious diseases. Household and industrial waste is poorly utilized, often just stored, thereby causing damage to the soil and water and emitting harmful gases into the atmosphere, which again influences people's health.

Ecology plays­ an important part in our lives and it is our duty to improve the environment.

There is a large range of tools to solve environmental problems. Recently, EM technology (Effective Microorganisms) became widespread in Japan and in more than 120 countries around the world, including Russia.

EM Technology is the safest and the most efficient technology in the world; it is able to solve the majority of environmental problems, including purification of soil, water, and wastewater, waste dumps containing hazardous constituents, contaminants and gases. The essence of EM Technology is that EM helps to activate other microbes.

Applications of EM-technology are conducted in many countries and in different ecological fields.

**Purification of water**

EM can decompose organic matters. In the body of water, EM can decompose sludge at the riverbed or bottom of the sea by using EM liquid solution and EM-mud balls.

Polluted water characteristics usually are: high BOD & COD, low DO, low Biodiversity.

How EM clean water: we use activated EM1 & EM mud balls - EM ferments sludge. EM break down the sludge and create nutrition from it, and then other microbes use the nutrition and break down the sludge again. EM helps other microbes to get activated.

With increase in nutrition, phytoplankton amount increases and so does oxygen. Other microbes, which are using oxygen, promote decomposed organic matters. The amount of Zooplankton and small creatures increases gradually.

Finally sludge starts to decrease and ecosystem gradually begins recovery. Dissolved oxygen increases and BOD & COD decreases. Water quality improvements, as well as positive changes in Fish & clam can be observed. This is the mechanism of how EM clean the water.

 Now I will show you the example of cleaning water. This is Nihonbashi river near Tokyo Bay in Japan.

Many volunteers have been applying EM for over 10 years and the surrounding river and Tokyo Bay started to clear up. The smell of river became odorless and biodiversity returned.

 The total use of activated EM1 & EM mud balls was 3886t & 356,000 EM mud balls within 10 years.

Fish and shrimp can be observed now. A great number of mullet species returned. Due to increase of fish amounts, a great number of birds returned too. Biodiversity is recovering gradually.

For the first time over 50 years, the beach was opened, as *E. coli* level reduced and the Tokyo Government allowed people to swim.

In other Bay, which is Mikawa bay in Japan, many EM volunteers use a lot of EM; small dolphins, fire flies, and fishes, which only can live in clean water, came back.

Moreover, EM is used by UNICEF. In UGANDA more than 15,000 people are living from Congo river. EM was applied into the sewage & waste water treatment in elementary school to suppress foul odor.

You can see on their web site how UNICEF uses EM.

**Circulating water supply**

With the help of EM-technology it is possible to conduct water recycling. The EM effects in wastewater treatment are: reduced bad smell, BOD (biological oxygen demand), and sludge surplus.

This is the flow of waste treatment system in Gushimaka library; it is a typical activated sludge treatment system in Japan. EM is just applied to the first tank from the toilet in the library and just about 10L of EM1 is used. Recycled water is collected in recycle tank and used for many things in the library.

The economic benefit is expressed in the reduction of the cost of water and electricity supply. Aeration time is 2.5h/day. Usually the aeration is 24 hours, yet the needs of electricity are 10 times lower as EM are anaerobic microbes; therefore, there is no need in 24-hour aeration. BOD of inflow was 200 mg/l and 1-5 mg/l in outflow. Water is odorless after processing and can be used for watering plants, flashing toilets, and cleaning carpets, however, that still exempts drinking. Technically, the water is suitable for drinking, however, in accordance with Japanese legislation recycled water it is NOT allowed for drinking.

**Processing of solid waste dumps**

Around the world EM-technology is most widely used at solid waste dumps.

In Cairo, Egypt, thousand tons of garbage are yearly brought to the dump; unpleasant smell spread around the area. The Ministry of Environment of Cairo began treatments with EM. Smell disappeared and garbage turned into organic fertilizer.

In Cajica City, Colombia, at each household kitchen waste was treated by EM and turned into compost. 55,000 people live in Cajica City; students learned how to make EM bokashi and students taught their community how to make EM compost at their houses. (page 29­30).

**EM processing of soils to neutralize or remove petroleum products**

Large-scale studies of soil under contaminated oil were conducted in Okinawa within a few years. The main purpose was to clean soil of oil products. Results of EM liquid solution treatment are as follows: After 3 months, oil content was sufficiently reduced. Bad odor was gone and benzene was not detected. (page 31­32).

**Disaster management**

EM is used when disaster happens. This is the example of floods in Malaysia in 2007. These floods occurred due to the typhoon; this typhoon also hit Singapore and Indonesia and caused floods. When floods happened, infectious outbreaks skyrocketed, yet EM cleaned polluted areas and waters; bathing city streets and application of soil treatment promoted its recovery after floods. In cooperation with Johor Government EM was sprayed to improve the hygienic environment at the time.

These are the floods in Thailand in 2011. There were high possibilities of infectious outbreaks since waste dumps were flooded. At the time, military and volunteers sprayed EM and EM mud balls for sanitary control. Even the Prime Minister threw EM mud ball to popularize use of EM by general public.

This is the earthquake in Haichi in 2010. Many people died due to the earthquake and outbreaks of infections began. Members of NGO sprayed activated EM1 for sanitary control.

This is the picture of earthquake at Fukushima in Japan in 2011. Many fishes are dead around the coastline so odor was a problem. One of our partners in that area provided EM to suppress bad odor. Many volunteers supray EM at school grounds for sanitary control.

Our partner in Russia JSC "Primorsky EM Center" allocated as humanitarian aid large amounts of EM liquid solution for elimination of consequences of floods in the Amur Region in 2013 and in the Primorsky Territory in 2016.

Today Vladivostok is seen as a city of tourist attraction, eastern outpost of Russia. Vladivostok is now interesting for investors and tourists, and it is important to assure that environmental problems are solved effectively solved. Thus, we (EMRO) are willing to share our results of studies of safe and effective methods for solving environmental problems, which are used worldwide.

EMRO is now conducting additional studies on solution of environmental problems. Large-scale studies regarding the use of EM to solve environmental problems are conducted now in Indonesia, Malaysia and other countries.

Our company would like to contribute to solving such problems in Russia too. We would like to propose to the future international forum "Nature without Borders" to hold an exhibition of innovative safe methods, tools and technologies for solving environmental problems in addition to reports and presentations. As for our part, we are ready to take an active part in the exhibition and share our experience with its visitors.