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EM-TECHNOLOGIES APPLICATION IN CITY WATER PURIFICATION SYSTEMS

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In this article it is considered a problem of inefficient sewage treatment in a result of the outdated equipment application. Under restrictions of heavy economic crisis, when expensive and material-intensive systems of clearing cease to be actual it was proposed application of EM-technologies in order to improve water purification city systems

Розглянуто проблему неякісного очищення стічних вод у результаті застосування застарілого обладнання. Запропоновано застосування ЕМ-технології для покращення міських систем водоочищення.

Рассмотрена проблема некачественной очистки сточных вод в результате применения устаревшего оборудования. Предложено использование ЕМ-технологий для улучшения городских систем водоочистки.

Statement of purpose

It is expected, that in XXI century the population of our planet will reach 10 billion person, therefore the question of recycling of waste and rational use of natural resources gets a special acuteness. Our society should find new ways not only in a direction of careful use of natural resources and turnover of already used materials, but also other ways of disinfecting of sewage, soil and a whole environment as well. One of the best ways of this problem resolving is a worldwide use of Effective Microorganisms (EM) by means of which it is possible to disinfect our dumps, to restore an environment, to provide conducting a steady agriculture using methods of processing in effective organic fertilizers of waste from plant growing and animal industries. Application of the given technology at municipal stations of sewage treatment will allow to solve a problem of fetid smells reduction, improvement of sewage processing quality, decrease of charges on clearing constructions service, and as a result quality improvement of drains dumped in the river and ecological conditions in a river basin itself [1].

Water represents huge value and a basis of all life on the Earth. Water turnover is a component of ecosystems activity, providing a life on this planet. People use water for an irrigation of the agricultural grounds, maintenance of a garden plants life , keeping our body clean, supporting work of the industrial enterprises, keeping in cleanliness of the cars, apartments, working places and so on. The great bulk of the water used in cities of Ukraine, through system of city drains inevitably comes back in our rivers, lakes and the seas.

Problem forming

Already more than ten years the EM-technology is successfully used in many countries for reduction of unpleasant smells, increase of intensity and quality of sewage processing. A number of the tests lead in Japan, Brazil and Thailand, have shown high efficiency of use EM in these purposes. However, despite all these results, the EM-method of sewage processing is not used in Ukraine. There are many variants of successful development and application of EM-technology.

The great value has not only efficiency of this technology, but also economic and political consequences of its successful introduction.

Analysis of researches and publications

Creation EM became possible owing to works of doctor Teruo Higa, the professor of university Rjukjus, Okinawa, Japan. Abbreviation EM occurs from a word-combination "effective microorganisms" [2].

Dr. Higa has begun development EM in the seventieth years of the last century with the purpose of search of an alternative method of manufacture of high-quality agricultural products without use agrochemicals, such as chemical fertilizers, artificial hormones, chemical pesticides, etc.

During research of positive influence separate stamps microorganisms on structure of ground and growth of plants Dr. Higa has made a line of opening. In 1982 he has found out, that balanced mixes of some useful microorganic cultures promoted "to healthy growth of plants and reception of a plentiful crop of the agricultural crops possessing improved flavouring properties" [2]. After reception of positive results during multimonthly tests of these mixes on mandarine trees Dr. Higa has come to conclusion that he has made surprising opening.

According to the information published, "EM consists of the big set effective, useful, non pathogenic microorganisms naturally living in wildlife. Em consists of no cultures received as a result of biochemical synthesis or genetic updating" [3]. Since EM it is made on the basis of natural processes, its properties depend on microorganic cultures making it and their number, that in turn depends on environment from which they are allocated, and also from a nutrient medium and conditions in which they were grown up.

Development EM was carried out within last twenty years and now they are used on a commercial basis in various spheres of activity of people, including an agriculture (plant growing and animal industries), processing of waste, bioremediation, public health services and many other things spheres of human activity. Owing to their efficiency and economic profitability EM have found application all over the world.

Originally EM were developed and then were successfully used as soil inoculum at cultivation grain, vegetables and fruit [4].

During the further researches and accumulation of experience of their application in the eightieth and ninetieth years of the last century it was found out, that they are the effective tool of the control and management of the microbic environment of other complex and diverse systems.

In the middle of 80th years the Japanese researchers in the field of animal industries have started to test EM as the tool on suppression of fetid smells and processings of waste of animals. In the end of 80th years there has been begun check of efficiency EM at processing sewage [3].

During the further researches which proceed and on present time, it has been established, that EM are effective and as a probiotic (Kitazato Environmental Center, 1994).

To one of the most valuable achievements in the field of animal industries became detection deodorising effect at application EM in poultry farming. This effect is reached owing to an establishment of domination in organic waste fermentative microbiological cultures which activity interferes with formation of fetid gases (Yongzhen and Weijiong, 1994) [4].

Task forming

In the beginning of 90th years on Okinawa, Japan, has been created the Organization on research EM (EM Research Organization) which task is the further research, development and introduction of EM-technology. Now the EM-technology is accessible in the form of various methods and products more than in 100 countries of the world. Each of EM-products as Dr. Higa confirms, comprises a base mix of cultures phototrophic and dairy-sour bacteria and yeast.

Owing to activity of hundreds thousand the people using EM-technology, it finds application in new areas of our life. In our research we put the aim to apply EM-technologies to Ukrainian water purification system so we can solve a problem of fetid smells reduction, improvement of sewage processing quality, decrease of charges on clearing constructions service, and as a result improvement of ecological conditions in a river basin. It became possible owing to that main principles of EM-technology which are fundamental principles of a life and microbiological ecology and make an essence of various aspects of a human life, an agriculture and the industry [5].

Main material

The presentation of EM-technology took place in the USA in 1993 at the Third international conference on natural agriculture which was spent in a Santa Barbara. As a result of this conference in the USA interest to EM-technology has considerably increased. In same to year in state of Arizona under direction of Dr. Teruo Higa gainless corporation "EM-technology" (EM Technologies, Inc.) which task was manufacture and distribution EM .

EM are carefully researched and recognized safe for the person and animals. The Ministry of Agriculture carries the majority of EM microorganisms to category G.R.A.S (recognized as safe) [3].

Microorganisms render serious influence on character and intensity of biological and chemical processes of such phenomena as rotting, fermentation, illnesses and oxidation of various systems. There were no inexpensive ways of the microbic environment condition control before the development of EM [6].

Thus, development EM was revolutionary step in a creation of the reliable tool under the control of dominating microbic populations and increases the efficiency of set of systems in which basis biotechnologies lay.

EM can represent set of combinations and be grown up by various ways, therefore in the literature there are some various definitions EM.

As a whole EM represent a liquid with pH = 3,5 or below. They are created by mixing various groups naturally living in the nature useful, not pathogenic, aerobic and facultative anaerobic microorganisms consisting in basic from phototrophic and the lactic bacteria and yeast. EM contain a plenty of lactic bacteria (Lactobacillus and Pedicoccus) in concentration 1 x 105 CFU/mL, yeast (Sacharomyces) in concentration 2 x 106 CFU/mL and a small amount of photosynthesizing bacteria, actinomycetes and other microorganic cultures [2].

According to the patent registered in the USA 5.591.634 EM comprises at least on one culture actinomycetes, phototrophic bacteria, lactic bacteria, mold fungi and yeast. Actinomycetes are presented to one of these cultures: Streptomyces albus, Streptoverticilliu baldaccii, Nocardia asteroides, Micromonospora chalcea, or Rhodococcus rhodochrous. The culture phototrophic bacteria can be one of the following: Rhodopseudomonas sphaeroides, Rhodospirillum rubrum, Chromatium okenii, or Chlorobium limicola.

One of such cultures can represent lactic bacteria: Lactobacillus bulgaricus, Propionibacterium freudenreichii, Pediococcus halophilus, Streptococcus lactis, or Streptococcus faecalis.

Mold fungi are presented at list one of following cultures: Lactobacillus bulgaricus, Propionibacterium freudenreichii, Pediococcus halophilus, Streptococcus lactis, or Streptococcus faecalis. Yeast should be presented even to one of cultures Saccharomyces cerevisiae, Saccharomyces lactis, or Candida utili.

The main in EM are: strains lactic bacteria Lactobacillus plantarum (ACTCC8014), Lactobacillus casei (ACTCC7469), and Streptococcus lactis (IFO12007), strains phototrophic bacteria Rhodopseudomonas palustris (ACTCC17001), and Rhodobacter sphaeroides (ACTCC17023), strains yeast Saccharomyces cerevisiae (IFO0203), and Candida utilis (IFO0619), strains fungi Streptomyces albus (ATCC3004), Streptomyces griseus (IFO3358), Aspergillus oryzae (IFO5770), and Mucor hiemalis (IFO8567).

Other microorganisms naturally living in the nature, capable to coexist with the above-stated microorganisms containing in a liquid preparation with pH = 3,5 can be added during manufacture EM. The density of the above-stated microbiological cultures in EM which there it is totaled nearby 80, can change within the limits of from 10^4 up to 10^8 CFU/ml. The specified cultures represent group of useful microorganisms which can coexist in the same conditions [7].

Conclusion

In Ukraine many constructions on sewage treatment became inefficient by fact of the equipment which became outdated, and the volume of the drains which have increased in connection with fast increase of urban population, exceeds designed capacities of these constructions. As a result of this many clearing constructions have problems with gassed condition and poor quality of dumped drains that causes claims from the citizens and authorities, and also generates environmental problems. Traditionally these problems are solved by large capital investments. In connection with high cost of traditional engineering decisions there is a need for new technologies search which would allow solving these problems within the limits of existing equipment with the minimal volume of its completions.

During sewage processing the equipment in which are used both natural physical methods, and biological activity of microorganisms is applied. The microbes used in the clearing equipment, consist of the cultures living in sewage. However, microorganisms naturally living in drains not necessarily are the most effective microbic communities which can provide demanded quality of processing of these drains. Therefore it is possible to assume, that the method of introduction in sewage of specific microbic cultures can increase efficiency and productivity of existing systems of clearing.

Tests of EM-technology in the various countries have shown, that during sewage processing EM can be the effective tool of unpleasant smells reduction, quality improvement of dumped waters and a waste water mud (WWM), reduction of quantity formed WWM, increases in a degree of suppression colibacillus, to decrease sulfides and sulfates contents.

It is not difficult to imagine prospects of application of the given method of sewage treatment in Ukraine in conditions of a heavy economic crisis when expensive and material-intensive systems of clearing cease to be actual.

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