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भारत सरकार
आवासन और शहरी कार्य मंत्रालय
निर्माण भवन
GOVERNMENT OF INDIA
MINISTRY OF HOUSING AND URBAN AFFAIRS
NIRMAN BHAWAN
नई दिल्ली-110011, तारीख 20
New Delhi-110011, dated the 20

D.O. No. Z.16025/3/2016-CPHEEO
Dated 25.01.2021

Dear Sir/Madam,

As you are aware, due to rapid urbanization, the problems associated with sanitation has increased manifold. The existing sewage treatment capacity in the country is about 40% and the rest of the sewage is being discharged with partial/no treatment. Similarly, the existing treatment capacity of municipal solid waste is about 68%. The Ministry of Housing & Urban Affairs is committed to help States/UTs and cities/towns across India to make sustained progress in management of waste and wastewater. As a part of its efforts, Ministry has published Manuals on Sewerage and Sewage Treatment Systems, Part A: Engineering, Part B: Operation & maintenance and Part C: Management in 2013 and the Municipal Solid Waste Management (Part A, Part B and Part C) in 2016 to guide the States/UTs & ULBs with various treatment technologies and best practices.

2. With the passage of time, the technologies and innovations in the sanitation sector have grown up. In continuation to this, Ministry has received few latest technologies in the waste and wastewater treatment from Government and Private Organisation sand the same have been reviewed by CPHEEO/Expert Committee, constituted by the Ministry. This will help ULBs to improve their sanitation status and adhere to standards notified by State Pollution Control Board/Pollution Control Committee and Central Pollution Control Board.

3. The detailed guidelines/description of the following technologies are enclosed herewith

I. Jalopchar: An Eco-Friendly Wastewater Treatment Technology developed by Indian Council of Agriculture Research (ICAR), New Delhi.
II. Ghoga Drain Pilot Project designed and implemented by Irrigation & Flood Control Department, Govt. of NCT of Delhi.
III. (iii) Waste Water & Sludge Treatment and Biomethanation by Department of Atomic Energy.
IV. Bioremediation Mediated Insert Solid Removal (ISR) modular wastewater Treatment Plant developed by M/s. Telemachus High Tech Private Limited.

....contd.

4. These technologies are cost effective and can be implemented in a decentralised manner and some of which may be suitable for implementation in major drains. The States and ULBs are advised to set up these plants at a small scale in few cities/towns and assess the performance and scale up after assessing the efficacy of these technologies. The selection of these technologies may be made on competitive tendering keeping in view the techno-economic analysis, actual ground condition, capital cost, availability of land, O&M cost, climatic condition, quantity and characteristics of sewage/municipal solid waste generated or treated.

5. I, therefore, request you to take advantage of these low cost, low energy and eco-friendly municipal solid waste & sewage treatment technologies and improve the sanitation services in the States/UTs/cities.

With warm Regards.

Yours sincerely,

(**Dr. M. Dhinadhayalan**)

Encl : As above

To

(i) Principal Secretary/ Secretary, In-charge of UD/PHED/Water Supply and Sanitation Departments-All States/UTs.

Copy to:

I. Addl. Secretary (D, UT & SBM), MoHUA for kind information to AS (D,UT& SBM).
II. Joint Secretary (AMRUT), MoHUA for kind information to JS(AMRUT).
III. Dr. Ravinder Kaur, Principal Scientist, Water Technology Center (WTC), former Project Director, WTC & Officiating Director Indian Agricultural Research Institute, New Delhi.
IV. Mr. Nikhil Kumar, IAS, Secretary, Irrigation & Flood Control Department, Govt of NCT of Delhi.
V. Director, Waste Water & Sludge Treatment, Department of Atomic Energy
VI. MR. Rajesh R. Pandey, CEO, M/s Telemachus High Tech Private Limited, Lucknow.

Technologies Developed at Different DAE R&D Institutes for Societal Applications

(AtmaNirbhar Bharat Directive #3 for DAE)

परमाणु ऊर्जा का सामर्थ्य

आत्मनिर्भर भारत

Bioremediation Mediated ISR modular Sewage Treatment Plant
M/s.Telemachus High Tech Private Limited

1.0 Introduction

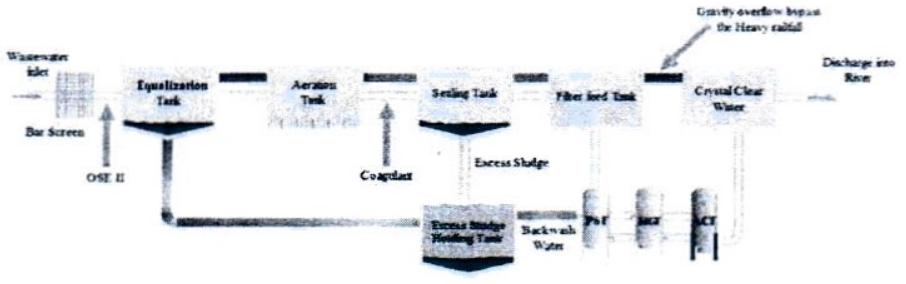
It is estimated that by 2027, India will most likely overtake China to become the most populous country in the world with 1.47 billion people. India is facing immense challenges arising from rapid population growth and intense urbanization, where about 45% of the population now live in towns and cities.During the last few decades, the number of countries experiencing water scarcity has increased.Owing to the huge discharge of municipal wastewater and urban drainage into river basins, the effect is more pronounced in the water quality in these areas.This in turn affects the aquatic lives and agriculture, and hence the humans who reside in these areas. The challenge for any country is to undertake sustainable development without causing damage to the natural environment, e.g. Avoiding crucial issues leading to the rapid deterioration and degradation of the water quality in the water supply intake points. Further, cost-effective methods are more convenient for developing countries to protect their natural resources.

1.1 Proposed Technology

M/s.Telemachus Pvt Ltd provides Bioremediation mediated ISR modular sewage wastewater treatment plant. It is claimed to be suitable for densely populated areas to handle high volume of wastewater.

2.1 Description

The proposed ISR (Inert Solids Removal) STP is designed to function on "Bioremediation" followed by a 3-stage operation say, primary, secondary and tertiary treatment. The term, Bioremediation refers to biological processes for treating wastewater. Here a particular type of enzymes (OSE II) is obtained from effective microorganisms (EM) for the efficient degradation of organic and inorganic material into CO_2 and H_2O. Telemachus introduces OSE IIin equalization tank in order to increase the surface area of the substratum thereby facilitate the biochemical reaction for the reduction of BOD and COD in the treated wastewater according to NGT norms.



2.1.1 Primary Treatment

Wastewater from open drain Nalla contains large solids and grit that can interfere with treatment processes or cause undue mechanical wear and increased maintenance on sewage treatment equipment. To minimize potential problems, these materials require separate handling.

2.1.2 Secondary Treatment

Bioremediation Treatment: After the bar screen, the wastewater will be pumped in equalization tank. It will equalize the flow & organic load. Oil Spill Eater II (OSE II) is dosed here at the inlet of the Feed Pump with transfer's water further in a controlled manner. It is advised to provide a gravity bypass line for heavy rainfall conditions. When combined with fresh or salt water and oxygen, OSE IIwill cause organic substances to rapidly decompose, eventually biodegrading them to carbon dioxide and water.OSE II bio-remediate organic based compounds which are a major source of contamination in Drains on account of discharge of untreated sewage, hydro-carbon variations including crude oil and some of the most hazardous materials. OSE II is claimed to be capable of bio remediating industrial outputs, viz. greases, engine oils, dry cleaning fluids; pesticides, viz. DDT, Melathion and organic pesticides; and other compounds viz. Tertiary Butyl Ether, Benzene, Toulene, Zylene, Phenol and its compounds etc.The wastewater in drains flows over a long distance with low dissolved oxygen and can become anoxic. To mitigate this, the process is further enhanced by holding the wastewater in an additional chamber having compressors and air diffusers at the bottom for Aeration, as oxygen further enhances the bioremediation process.

2.1.3 Inert Solids Removal (ISR)

The wastewater & degraded material will be transferred into settling chamber under gravity. Here the heavier suspended biomass will settle down at the hopper bottom of the chamber as semi solid bio- sludge in given retention time. To enhance phase separation especially of colloidal inert matter, small concentration of flocculant is used. Excess biomass in the presence of OSEII will further decompose. While OSE II will keep working on any residual Biological Sludge and further treat the same, the Settled Solids in the system also contain Sand, Silt and other Inorganic Inert Material. As these Inert Materials settle at the both, over time excess sludge from the bottom may need to be extracted.The excess Sludge is periodically pumped into an Inert Solid handling Stage along with Backwash water. This comprises of inert sludge handling stages like Sludge Beds or Filter Press which will separate the tiny fraction of Inert Solids from water. The water is fed back to the beginning of the process, whereas the Solid Sludge Cakes can be used as soil additive or suitably disposed.

2.1.4 Tertiary Treatment

Clear effluent from top of the clarifier tank is fed into the Filtration System. After treatment, the treated water will be given filtration treatment to remove small inert suspended solids that still exist in the system. The advanced tertiary treatment

consists of three phases which are carried out in a Pressurized Vessel with the help of pumping. The filtration phase in which particulate matters are removed and accomplished by passing the waste water to the filter through a filter bed composed of granular materials. Within the granular medium filter bed, the removal of suspended solids has accomplished by a complex process involving one or more removal mechanism such as interception, impaction, sedimentation, flocculation and adsorption.The end of filter runs (filtration phase) is reached when the suspended solids in the treated water start to increase beyond an acceptable level or within a limiting head loss occurs across the filter bed. Once either of this condition is reached the filter must be cleaned (backwashed) to remove the material (suspended solids) that has accumulated within through the granular filter bed. Usually this is done by reversing the flow within through the filters. The sufficient flow of washed water is applied until the granular filtering media is fluidized (expanded). The material that has accumulated with a bed is then washed away.

Multigrade filters is a type of physical filtration process where a contaminated fluid is passed through a special pore-sized membrane to remove residual organic matters from process wastewater. It is commonly used in conjunction with the previous separation processes to provide a product stream which is free of undesired contaminants. Approved quantities disinfectant like Sodium Hypochlorite may optionally added and the water reused for Irrigation or Horticulture or released into River Streams as deemed fit.

The pressurized adsorption phase is a final polishing step in the removal of all inorganic matter with the help of Activated Carbon.Activated Carbon is a form of carbon processed to have small, low- volume pores that increase the surface area available for adsorption or chemical reactions. Each particle, or granule, of carbon provides a large surface area, or pore structure, allowing contaminants the maximum possible exposure to the active sites within the filter media. Activated carbon works via a process called adsorption, whereby pollutant molecules in the fluid to be treated are trapped inside the pore structure of the carbon substrate.This is also required for removal of colour&odour along with other contaminants from the treated water.

3.0 CAPEX, OPEX &Space Requirement for 1 MLD Plant

The implementation Details for setting up Bioremediation mediated ISR modular Sewage Treatment plants to treat wastewater up to a level of BOD less than 10 - 20 mg/L are as follows:

- Modular Size – 1 MLD
- CAPEX of Plant – Rs. 1.35 Cr. + GST (tentative)
- Ideal Location – Various open drains & Buildings (Underground)
- Installation period – 3 – 4 weeks
- Treatment – Bioremediation at three stage operations namely, Primary, Secondary and Tertiary.
- Space Requirement – 100 – 250 sqm adjacent to drains and buildings.

➢ Power Consumption – ~ 500 kWh/day

The cost per MLD reduces for larger capacities, in case of a 2.5 MLD Module, the CAPEX of Plant is Rs. 2.5 Cr. + GST (i.e. Rs. 1 Cr. Per MLD) (Tentative)

Dosage quantity & O&M Calculation Chart

Details regarding usage of Bioremediation agent (OSEII) dosage and calculation of Maintenance Charges (24x7 Operation)

OSE II Dosage quantity and cost calculation (Dosage (24x7) quantity for treating 1 MLD (1 million litres of water)

= 6-8 Litres

(depending on inlet BOD ranging between 100 –300 BOD)

Cost of One (1) litre OSE II is = INR 1200/ litre

Cost of 6 litres (based on 100 BOD) OSE II Dosage for treatment of 1 million litre of waste water per day is : = INR 7200 according to present BOD

Cost of OSE II Dosage for 30 days:

= 10,00,000 x 30

= 3,00,00,000 Litres wastewater

= INR 7200 x 30 = INR 2,16,000

Cost of OSE II Dosage for 365 days

= 10,00,000 x 365

= 36,50,00,000 Litres of wastewater

= INR 7200 x 365 = INR 26,28,000/-

Hence, cost of OSE II dosage per litre

= INR 26,28, 000 / 365 * 1000000

= INR 0.72 Paise / per Litre (approx.)

O&M Calculation (Standard Maintenance (including spares) Cost Formula (Apart from Dosage & other expenses):

= 0.25% of CAPEX

Here approx. CAPEX (For 1 MLD) = INR 1,35,00,000 + GST at actuals

Monthly cost of maintenance = INR 1,35,00,000 x 0.25%

= INR 33,750/-

Yearly cost of maintenance = INR 33,750 x 12

= INR 4,05,000/-

O&M cost per litre = INR 0.11Paise/ Per Litre (approx.)

Cost of Manpower for (24x7) Operations (1 MLD Module):

1 Technician + 3 Shift Operators = INR 80,000 / Per Month

= INR 9,60,000 / Per Year

= INR 0.26 Paise (<1 paise) / Per Litre

Power Consumption = 500 Kwh/hr Per day (~ 50HP Connected Load)

So, here Total O&M Cost (excluding cost of power):

= 0.72 + 0.11 + 0.26 Paise

= 1.09 say = 1.1 Paise

= 1.1Paise / Per Litre (Tentative) + GST at actuals

= **Rs. 11,000 per MLD (Tentative) + GST at actuals**

4.0 Area of Applications

APPLICATION	DESCRIPTIONS
Small isolated clusters (Slum areas)	ISR treatment systems can serve small isolated clusters (slums)
Housing colonies, Apartments, Institutions, Hotels, Restaurants etc.	ISR treatment systems can provide the wastewater treatment for housing colonies and apartment where have space limitations and the treated wastewater can be used as gardening, toilet flushing and fire extinguish etc.
Hospitals	Hospital wastewaters can handle by the ISR treatment system and can use the treated water for toilet flushing and cleaning purposes.
Commercial Buildings such as Malls, Multi-complexes, Natural reserves and Resorts.	Because of regular and numerous visitors, high discharge of wastewater flows into water bodies. ISR treatment system will reduce this potential or ongoing water environment pollution in these areas.
Metropolitan Cities	ISR technology can provide treatment at the point of the source (wastewater generation). Thus, can reduce the transportation of wastewater from one area to the treatment site.
Drains (Ganda Nallah) in Urban Areas, such as Nagar Palika, Townships etc.	In Urban areas, the ISR treatment system can serve communities, public buildings, etc. The ISR treated water can reuse for secondary purposes and groundwater recharging.
Drains (Ganda Nallah) in Rural Level (Nagar Panchayat)	In a rural area, ISR treatment can serve as a small-scale level, and ISR treated water can reuse for toilet flushing and irrigation.
Developing Towns or (Small Towns)	Small towns or developing cities are below the city level and above the village level.

5.0Advantage of the Bioremediation mediated ISR Modular Sewage Treatment Plant:

- Quick installation requiring limited space and can be installed on existing drains at their outlet.
- Can be installed @ per MLD in any residential area / colony / society of 4-5k persons.
- Carries out bioremediation &purification of the Lakes or Rivers downstream after Water Treated is treated and released.
- ISR process removes Solids Waste, Sand and Silt carried by the drains before discharge into water bodies.
- BOD well below 10-20 and COD well below 30 as per NGT norms.
- Low Sludge generation & rapid treatment time.
- Low Power consumption with Easy to Operate and Easy to Maintain.

Advantages of using Bioremediation agent (OSE II), Coagulantand filtration for sewage and effluent mix:

- OSE II can bioremediate industrial outputs, viz. greases, engine oils, dry cleaning fluids; pesticides, DDT, Melathion and organic pesticides; also, Tertiary Butyl Ether, Benzene, Toulene, Zylene, Phenol, chrome etc.
- Natural Coagulants used in the system can effectively precipitate multiple inorganic pollutants.
- Further Multimedia Filtration System can be designed for removal of multiple pollutants like Heavy Metals, such as copper, iron etc., VOCs, Suspended Solids from effluents.

6.0 CPHEEO Note:

The technology should be assessed by the implementing agencies before its implementation & execution on the ground. However, other similar technologies may also be selected for execution &implemented based on the actual ground condition, climatic condition and the kind of waste water to be treated. This above technology by M/s. Telemachus is only for reference purpose. The selection of this technology may be done on competitive tendering with other technologies.