FORM 2

THE PATENTS ACT 1970

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THE PATENT RULES 2003

COMPLETE SPECIFICATION

(SEE SECTIONS 10 & RULE 13)

1. TITLE OF THE INVENTION

Micro Algae-Based Sewage Treatment Plant

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2. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner in which it is to be performed

Title: Micro Algae-Based Sewage Treatment Plant

Abstract:-

The present invention provides a microalgae (spirulina)-based sewage treatment plant that offers a sustainable and cost-effective solution for wastewater treatment. The closed photobioreactor and IoT platform used in the process provide a tertiary biotreatment coupled with the production of valuable biomass that can be used for various applications, including biofuel production. The microalgae culture removes inorganic nitrogen, phosphorus, heavy metals, and toxic organic compounds from the sewage water, making it a safe and eco-friendly process. The treated water can be used for secondary purposes such as irrigation, cleaning, or toilet flushing, contributing to water conservation. The microalgae-based sewage treatment plant is scalable and can treat wastewater volumes ranging from 250 days to 50 ML/day. The present invention provides a significant contribution to the field of sewage water treatment and it can be used in agriculture or secondary utilization in domestic areas and it can revolutionize the industry by providing a sustainable and low-cost solution.

Descriptions:

Introduction

The world is facing a serious problem with regard to the treatment of wastewater. Traditional methods of wastewater treatment have not been efficient in completely removing harmful pollutants from water. These pollutants include nutrients, heavy metals, and organic compounds, which have the potential to cause environmental damage. A new technology that has emerged as a promising solution for wastewater treatment is algae-based sewage treatment plants. Algae offer tertiary biotreatment coupled with the production of valuable biomass, which can be used for several purposes.

This report presents an innovative system for the treatment of wastewater using microalgae. The system is capable of treating 250 L/day to 50 ML/day of sewage water, making it suitable for both centralized and decentralized wastewater treatment. The process is eco-friendly and chemical-free, as it utilizes a micro plant to treat the sewage water. The micro plant is cultivated in a closed photobioreactor, which utilizes LED light for photosynthesis. The treated water can be used for secondary purposes, such as domestic use, and the biomass generated from the photobioreactor can be processed further and has numerous applications.

Background

Wastewater is a major source of pollution in the world, and traditional methods of treatment have not been efficient in completely removing harmful pollutants from water. The pollutants found in wastewater include nutrients, heavy metals, and organic compounds. These pollutants have the potential to cause environmental damage if not

removed efficiently. Therefore, there is a need for an innovative and efficient technology for the treatment of wastewater.

Algae-based sewage treatment plants are a promising technology for wastewater treatment. Algae have the ability to use inorganic nitrogen and phosphorus for their growth, making them suitable for the removal of nutrients from wastewater. Algae also have the capacity to remove heavy metals, as well as some toxic organic compounds, making them an attractive solution for the treatment of wastewater.

The technology for algae-based sewage treatment plants involves the cultivation of microalgae in a closed photobioreactor. The photobioreactor utilizes LED light for photosynthesis, enabling the plant to run throughout the day. The treated water can be used for secondary purposes, such as domestic use, and the biomass generated from the photobioreactor can be processed further for numerous applications.

System Design

The algae-based sewage treatment plant is designed to treat 250 L/day to 50 ML/day of sewage water. The system can be used for both centralized and decentralized wastewater treatment, making it suitable for a variety of applications. The system is eco-friendly and chemical-free, as it utilizes a micro plant to treat the sewage water.

The micro plant is cultivated in a closed photobioreactor, which utilizes LED lights for photosynthesis. The photobioreactor is made of durable materials that can withstand harsh environmental conditions. The system is completely monitored and controlled using an IoT platform. The platform contains microcontrollers and sensors, such as CO2, Dissolved Oxygen (DO), Total Dissolved Solids (TDS), Electrical Conductivity (EC), and more. These sensors help in monitoring and controlling the growth of microalgae, ensuring efficient treatment of wastewater.

The biomass generated from the photobioreactor has numerous applications. It can be processed further to produce biofuels, animal feed, fertilizer, and more. Biomass can also be used in the pharmaceutical industry, as it contains valuable compounds that have therapeutic properties.

Operation

The algae-based sewage treatment plant operates as follows. The sewage water is first screened to remove large solid particles. The screened water is then pumped into the closed photobioreactor, where microalgae are cultivated using LED lights for photosynthesis. The microalgae use inorganic nitrogen and phosphorus for their growth, making them suitable for the removal of nutrients from wastewater.

The treated water is then collected in a tank and can be used for secondary purposes, such as domestic use. The biomass generated from the photobioreactor can be processed further

for numerous applications. The biomass can be harvested using a simple filtration process and can be further processed using techniques such as drying, pressing, and centrifugation.

The IoT platform plays a crucial role in the operation of the algae-based sewage treatment plant. The platform contains microcontrollers and sensors that help in monitoring and controlling the growth of microalgae. The sensors measure parameters such as CO2, DO, TDS, EC, and more, which help in optimizing the growth conditions for microalgae. The platform also helps in the automation of the system, reducing the need for human intervention.

Advantages

The algae-based sewage treatment plant has several advantages over traditional methods of wastewater treatment. Some of the advantages include:

1. Eco-friendly and chemical-free: The system utilizes a micro plant to treat the sewage water, making it eco-friendly and chemical-free.
2. Efficient removal of pollutants: The system efficiently removes pollutants such as nutrients, heavy metals, and organic compounds from wastewater.
3. Valuable biomass: The biomass generated from the photobioreactor has numerous applications, making it a valuable by product of the wastewater treatment process.
4. Low-cost: The cost of maintaining microalgae growth in wastewater is lower than that of conventional wastewater treatments.
5. Decentralized treatment: The system can be used for both centralized and decentralized wastewater treatment, making it suitable for a variety of applications.

Applications

The algae-based sewage treatment plant has several applications in various industries. Some of the applications include:

1. Municipal wastewater treatment: The system can be used for the treatment of municipal wastewater, making it suitable for use in cities and towns.
2. Industrial wastewater treatment: The system can be used for the treatment of industrial wastewater, making it suitable for use in various industries such as food and beverage, pharmaceutical, and more.
3. Agricultural wastewater treatment: The system can be used for the treatment of agricultural wastewater, making it suitable for use in farms and agricultural settings.
4. Aquaculture: The biomass generated from the photobioreactor can be used as a source of feed for fish and other aquatic animals.

Conclusion

In conclusion, the algae-based sewage treatment plant is a promising technology for the treatment of wastewater. The system efficiently removes pollutants such as nutrients, heavy metals, and organic compounds from wastewater, making it suitable for use in various industries. The system is eco-friendly and chemical-free, and the biomass generated from the photobioreactor has numerous applications, making it a valuable by product of the wastewater treatment process. The IoT platform plays a crucial role in the operation of the system, ensuring efficient treatment of wastewater.

The algae-based sewage treatment plant has the potential to revolutionize the way we treat wastewater. With the increasing demand for sustainable and low-cost solutions, the algae-based sewage treatment plant offers an elegant solution that not only provides tertiary bio-treatment but also produces potentially valuable biomass.

The system can be easily scaled up or down to meet the demands of different applications. The capacity of the system can be increased from 250 LD to 50 MLD or even more, depending on the requirements. This scalability makes the system suitable for a variety of applications, from small-scale domestic wastewater treatment to large-scale municipal or industrial wastewater treatment.

The biomass generated from the photobioreactor has numerous applications. The biomass can be used as a source of feed for fish and other aquatic animals, as well as for the production of biofuels, bioplastics, and other valuable products. The biomass can also be used as a fertilizer, as it is rich in nutrients such as nitrogen, phosphorus, and potassium.

The system is also easy to maintain, with low operating costs. The cost of maintaining microalgae growth in wastewater is lower than that of conventional wastewater treatments. The system requires minimal human intervention, as the IoT platform helps in the automation of the system.

The algae-based sewage treatment plant has the potential to contribute to the achievement of several United Nations Sustainable Development Goals (SDGs). The system can help in the preservation of the environment by reducing the pollution of water bodies, which is in line with SDG 6 - Clean Water and Sanitation. The system can also contribute to the reduction of greenhouse gas emissions by producing biofuels and bioplastics, which is in line with SDG 13 - Climate Action.

In conclusion, the algae-based sewage treatment plant is a promising technology that offers an elegant solution for wastewater treatment. The system efficiently removes pollutants from wastewater, produces valuable biomass, and is eco-friendly and chemical-free. The scalability, low operating costs, and numerous applications of the system make it suitable for a variety of applications, from small-scale domestic wastewater treatment to large-scale municipal or industrial wastewater treatment. The system has the potential to contribute to the achievement of several United Nations Sustainable Development Goals and can play a crucial role in the achievement of a sustainable future.

Claims:

1. A sewage treatment system comprising a closed photobioreactor, LED lights for photosynthesis, and an IoT platform for monitoring and control, wherein the system uses microalgae culture to provide tertiary bio-treatment and produce valuable biomass.
2. The sewage treatment system of claim 1 or , wherein the system is scalable and can be used for wastewater treatment ranging from 250 LD to 50 MLD or more.
3. The sewage treatment system of any of claims 1-3, wherein the biomass generated from the photobioreactor has numerous applications, including but not limited to, the production of biofuels, bioplastics, and fertilizer.
4. The sewage treatment system f any of claims 1-4, wherein the system is eco-friendly and chemical-free, and has lower operating costs compared to conventional wastewater treatment systems.
5. The sewage treatment system of any of claims 1-5, wherein the IoT platform includes microcontrollers and sensors, such as CO2, DO, TDS, and EC, for real-time monitoring and control of the system.
6. The sewage treatment system of any of claims 1-6, wherein the system is capable of contributing to the achievement of several United Nations Sustainable Development Goals, including but not limited to, Clean Water and Sanitation (SDG 6) and Climate Action (SDG 13).
7. A method for treating sewage using microalgae culture, comprising the steps of: providing a closed photobioreactor, LED lights for photosynthesis, and an IoT platform for monitoring and control; culturing microalgae in the photobioreactor to provide tertiary bio-treatment of the sewage and produce valuable biomass; and processing the biomass for use as a source of feed, biofuels, bioplastics, or fertilizer.
8. wherein the sewage treatment system is eco-friendly and chemical-free and has lower operating costs compared to conventional wastewater treatment systems.

Drawings:-

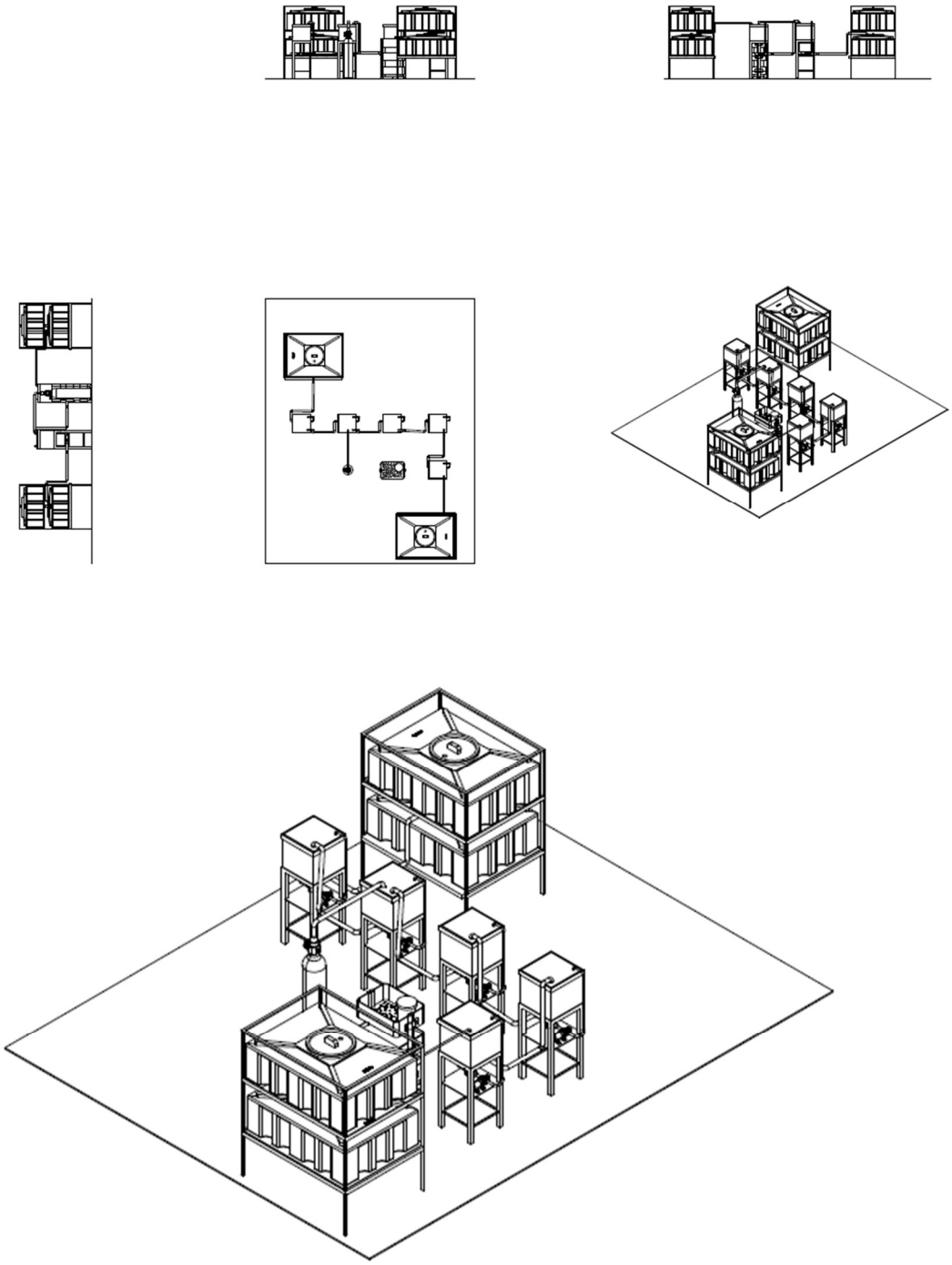

Figure: System line drawing for Spirulina Algae based Sewage Treatment Plant