iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** IX **Month of publication:** September 2020

DOI: https://doi.org/10.22214/ijraset.2020.31582

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IX Sep 2020- Available at www.ijraset.com

Design and Fabrication of Water Treatment by using Solar Illumination and TiO_2

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Abstract: ***This paper presents the concept of Water treatment mainly carried out for water wastage and polluted water based industries. Industries are basically meant for the production of useful goods and services to be provided at a low production cost, machinery cost and low inventory cost. Today in this world every task has been made quicker and fast due to technological advancement but this advancement does not think about the environment. We have developed a conceptual model of a model which would be capable of performing the water treatment from the polluted waters in the industries, and it should be economically efficient. In this model, we are actually using TiO_2 and Solar Illumination for the treatment of polluted water. When the water from the industry is passed to the model the water will flow across the TiO_2 membrane. Through TiO_2 reacts with Solar Illumination it produces an UV Radiation. The model facilitate us to get the operation perform by filtering the water and removing the bacterial contents and impurities from the industry polluted water. Objective of this model are conservation of electricity (power supply), reduction in the cost of operation, reduction in pollutants, reduced floor space.***
Keywords: Solar Illumination, TiO_2, UV Radiation, Water Treatment.

I. INTRODUCTION

This concept concerns the design, development and fabrication of the "Water Treatment model by using solar Illumination and TiO_2". The concept of the water treatment model is mainly used for industries. Water demand is a major problem in all of our major cities and the need for water treatment is essential to reduce the wastage of used water. Today in this world, every activity has become faster and faster due to technological progress, but this progress also requires huge investments and expenses. Each industry in this world every task has been made quicker and fast due to technological advancement but this advancement does not think about the environment. In a sector, a considerable part of the investment is made for the installation of machinery. So, in this project a works proposed in which a machine is designed capable of performing operations such as Water treatment, filtering and Purification operations at the same work centers simultaneously, which implies that the Industrial will not have to spend high for the machine.

II. MATERIALS AND METHODS

The concept concerns the design, development and fabrication of the “Water Treatment model by using solar Illumination and TiO_2”. The concept of water treatment model is mainly used for industries. We see that all the industries, which are spending high cost equipments and operation cost for the treatment of water. They are spending a lot of money on man power and equipments for water treatment. By the utilization of this TiO_2 based water treatment model which will use less power as well as less time and labour. This machine provides working at different center so it reduces the time consumption up to an appreciable limit. In an industry a considerable portion of investment is being made for water treatment which is very costly. So, we have proposed a model that can perform operations like water treatment, filtering and purification.

A. 2D Design

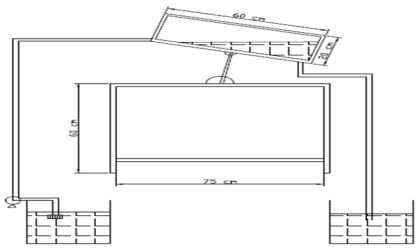


Fig. 1. 2D design

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B. 3D Design

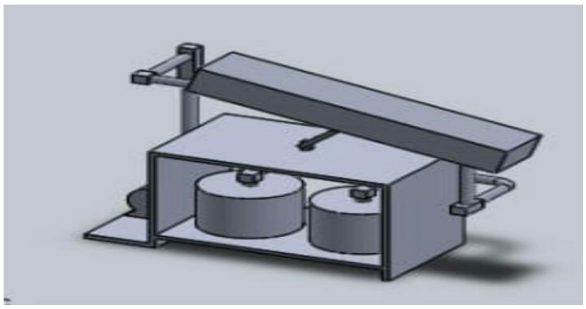


Fig. 2. 3D design

C. Titanium dioxide (TiO_2)

TiO_2 is that the most ordinarily used semiconducting photocatalyst and one among the foremost studied nanoparticles for environmental applications. TiO_2 proved to be more safe and economical to treat organic pollutants at low capital investment. The performance of the metal oxides like titanium oxide (TiO_2), within the conversion of solar power into energy, is decided by its semiconducting properties. The conversion process is closely associated with the light-induced reactivity between the oxide semiconductors and water, which can cause partial water oxidation and consequently water disinfection. The performance are considered by the sunshine absorption, light-induced ionization over the band gap, charge separation, charge transport, charge transfer, and therefore the chemical reactions happening at anodic and cathodic sites. Optimization of those interconnected performance related properties is discussed, alongside the photocatalytic application in water disinfection.

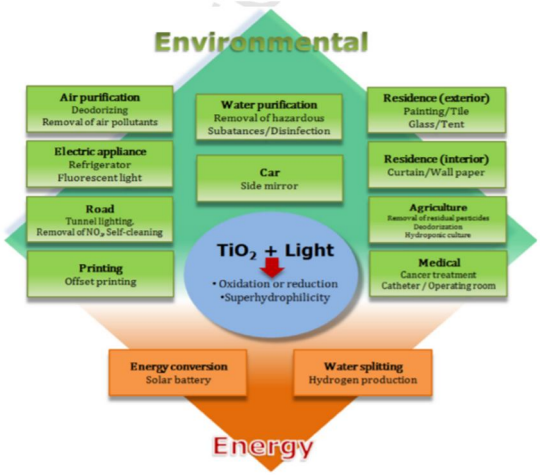


Fig. 3. TiO_2 in Environment

D. Water Treatment

Water treatment is any process that improves the standard of water to form it more acceptable for a selected end-use. The top use of the treated water is also for drinking, industrial water system, irrigation, river flow maintenance, water recreation or many other uses, including being safely returned to the environment. Water treatment removes contaminants and undesirable components from the water and also reduces their concentration in order that the water becomes fit its desired end-use. This treatment is crucial to human health and allows humans to profit from both drinking and irrigation use.

E. Water Treatment Methods

Our modern lifestyle provides us the posh of using various products to form our lives easier and straightforward, but it comes at a price. A common by product of our current lifestyle includes wastewater, which may either be within the sort of water running down the shower or runoff from wet roads. This wastewater is not used for humans to consume or also for using it for some other purposes. By the following water treatment methods, the wastewater is made usable by employing the wastewater treatment technologies that filter and treat the wastewater by removing contaminants like sewage and chemicals. Four common ways to treat wastewater include,

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1) Physical water treatment,
2) Biological water treatment,
3) Chemical treatment, and
4) Sludge treatment.

F. Working

We had developed a water treatment model which works by the chemical treatment method. This model is made of steel frame and transparent glasses to flow the water. The transparent glass is filled with TiO_2 for treating the impure wastewater. When the water is passed between the transparent glasses the water flows through the filled TiO_2 in the glass and simultaneously the water also gets reacts with the sunlight. The glass consists of TiO_2, Carbon balls and a sponge filter for the treatment and the purification process of the impure water. The water is passed to the glass by using a motor from the waste water storage tank. After the reaction with the sunlight and the TiO_2 catalyst in the glass the treated water gets cleared mostly from the impurities and the chemical substances in it. The physical waste contaminants, colour and odour from the water is also gets treated by this model.



Fig. 4. Model layout

III. RESULTS AND DISCUSSION

The most commonly using tests for checking the quality of water is by using the

A. pH

A relative measure of alkalinity/acidity. This test uses liquid reagent and a colour comparator. Chemically, pH indicates the number of Hydrogen ions. At a pH value of 7.0, water contains an equal number of Hydrogen ions (H+) and Hydroxyl ions (OH-). If there are more Hydrogen ions than hydroxyl ions, the substance is acidic and has a pH level lower than 7.0 if there are more hydroxyl ions, the substance is alkaline and it has a pH value higher than 7.0.

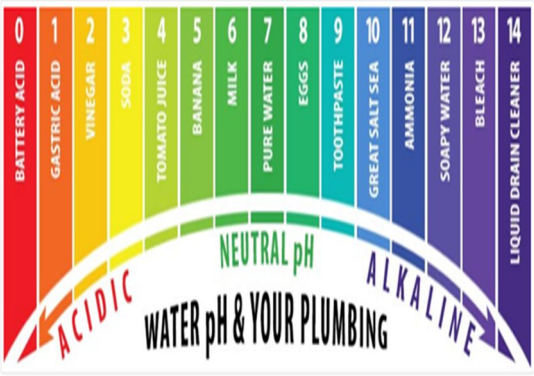


Fig. 5. pH Value

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B. Total Dissolvd Solids (TDS)

A measure of dissolved solids in water sample. The test uses a digital meter that measures "micromhos", a measure of electrical conductivity. When measuring TDS, the meter reading must be multiplied by 0.5, which is a standard conversion factor. When measuring the salinity of sea water, brackish water or other waters, the sample must first diluted with demineralized water; then the meter reading is multiplied by the level of dilution and the standard conversion factor. From the TDS meter the value of the measured water will be acquired by PPM.



Fig. 6. TDS Meter

C. Result

By using the above mentioned test methods to identify the quality of water, we had selected different types of water and the test results are listed as follows,

Table 1: Result of Water Treatment

Type of Water	PPM Before Treatment	PPM After Treatment
Ordinary Water	664	427
RO Water	110	104
Waste Water	1167	862
Dyeing Water	1788	1545

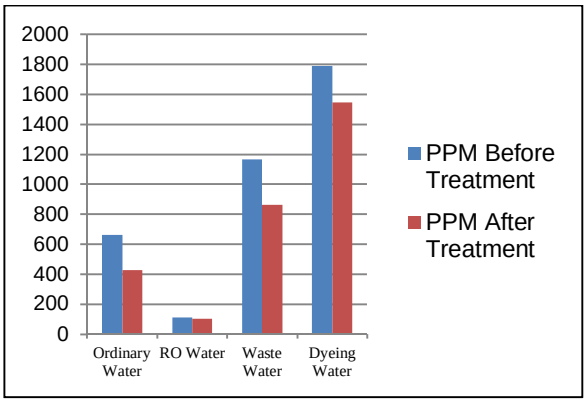


Fig. 7. Result Graph

From the test results for the different types of water tested and we had observed that there is a change in value of the water after the treatment. This states that this water treatment model can have the ability to treat different kinds of industrial water and also by this we can reduce the pollution of water.

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IV. CONCLUSION

We see that all the industries, which are spending high cost equipments and operation cost for the treatment of water. They are spending a lot of money on man power and equipments for water treatment. By the utilization of this TiO_2 based water treatment model which will use less power as well as less time and labour. This machine provides working at different center so it reduces the time consumption up to an appreciable limit. In an industry a considerable portion of investment is being made for water treatment which is very costly. So, we have proposed a machine that can perform operations like water treatment, filtering and purification. The following conclusions can also be drawn that,

A. This is useful for all the industries like dying, chemical, food etc.
B. Workers movements can be minimized.
C. Water wastage can be reduced.
D. Power consumption is not required.
E. Floor area required is reduced.
F. Cost of water treatment is also reduced.

V. FUTURE SCOPE

1) The pollution of the water can be controlled.
2) Wastage of water can be reduced.
3) Suitable for industries to treat water with low cost.
4) Renewable energy source is used.
5) Economical and environment friendly.
6) Consumption of floor space and labour is reduced.

A. Acknowledgements
The authors are grateful to the Nandha Engineering College for providing necessary facilities to develop this prototype. The authors are also thankful to the department lab for modeling our prototype.

B. Conflict of Interest
There is no conflict of interest to be described.

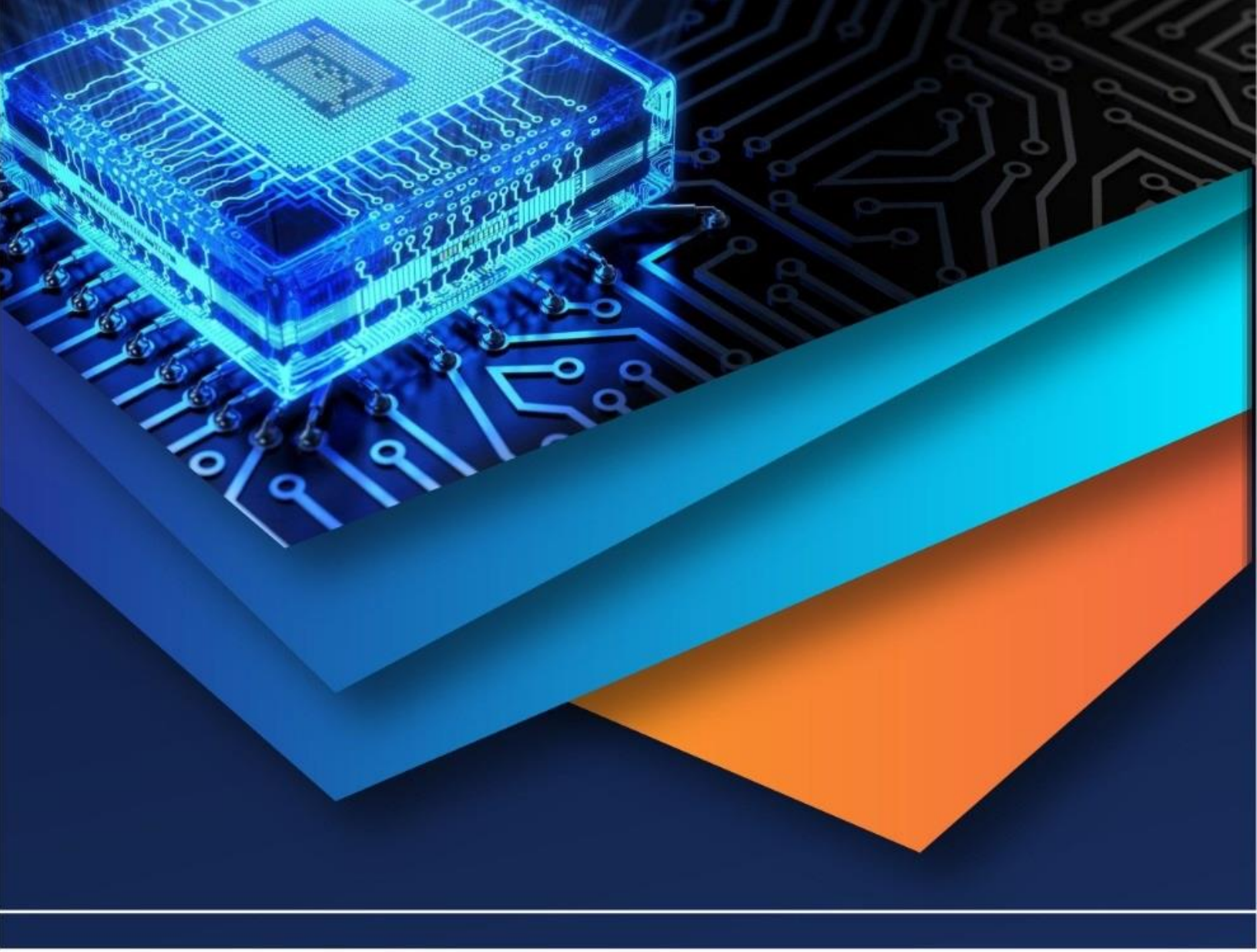
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