

Integration of green energy in wastewater/water treatment processes : Solar Photocatalysis Prototype

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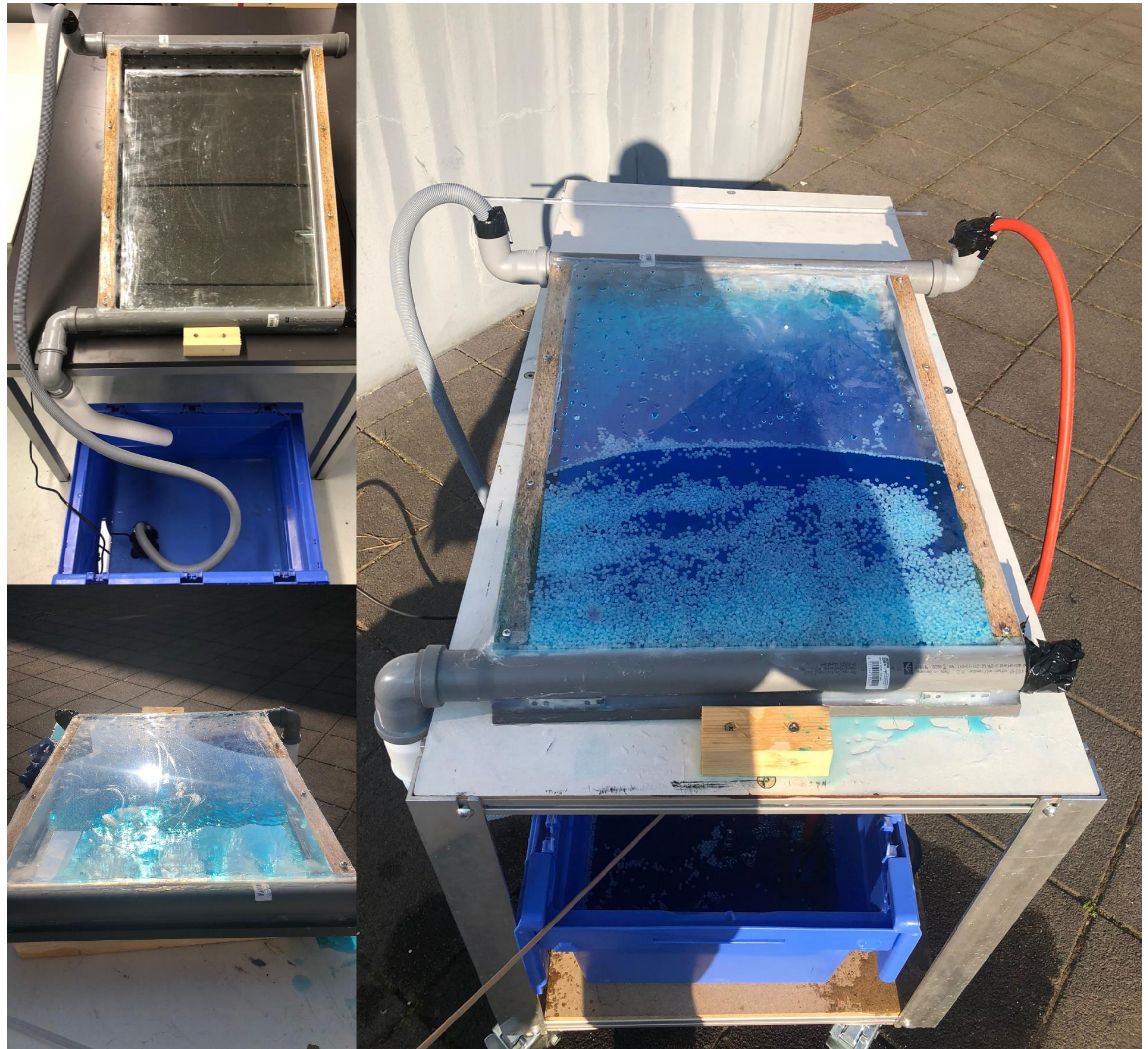
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INTRODUCTION

The elimination of toxic organic compounds from wastewater/water is one of the most important steps of treatment processes, One of the effective technologies that can be used is the Advanced Oxidation Process (AOP), which is a set of chemical treatment procedures designed to remove organic materials in water and wastewater by oxidation through reactions with hydroxyl radicals. In this sense, the integration of renewables can be suggested in order to provide the energy needed for the process and to increase its efficiency. Solar energy is one of the effective option and that by combining it with catalytic oxidation to have a solar photocatalytic treatment process.

PROTOTYPE DESCRIPTION

- The photoreactor where the treatment occurs is a box made of a reflecting mirror as a bottom layer and low iron transparent glass as the top layer, linked by two pipes, an inlet and an outlet one. The dimension of the reactor is 70cmx50cmx5cm.
- Titanium Dioxide TiO_2 is the catalyst used for its affordability and high reactivity in breaking down pollutants under sun illumination, coated to transparent Polyethylene plastic granules. The coating process is a combination of electrostatic and thermal mechanism, the plastic granules were charged by stirring them in a glass box, then mixed with the TiO_2 particles, then heated in an oven at $100^{\circ}C$ for 60 min, finally washed and dried. This process allow TiO_2 particles to adhere to plastic grains and not get washed out during the treatment process.
- Methylene blue mixed with water was used as the wastewater model, the decolorization of the wastewater will be the indicator of the efficiency of the prototype.
- The methylene blue solution is pumped from a container to the reactor via a 400-1000L/h pump, under sun irradiations TiO_2 particles produce high-energy states of electron and hole pairs , capable of initiating chemical reactions producing hydroxide OH^- and other radicals capable of converting organic pollutants into end products such as CO_2 , H_2O and mineral acids (in this specific case reducing the methylene blue to a colorless form), The wastewater kept running in cycle until achieving the highest cleansing rate.



CONCLUSION

Sustainable water supply cannot be achieved without considering the energy required in the treatment processes. Therefore, alternatives need to be found. Solar Photocatalysis come in top of the list for small scale plants, it covers the amount of energy needed especially when combined with solar panels as a source of electricity for the pumps and offers a guaranteed eco-friendly final product. However, making it suitable for a large scale use is still under discovery.



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