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Project Title: Design and Construction of a Portable Oily Wastewater Treatment Package in pilot Scale Based on Nanotechnology for Using in Power Plants

Department:	Nanotechnology development center	Employer:	Niroy Research Institute
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Project Necessity:


Wastewater generated from different stages of power plants containing suspended solids, oil, toxic pollutants such as heavy metals, hydrazine and specific inorganic pollutants are seriously harmful to natural aquatic environment when released without proper treatment. In the past, the subject of oily wastewater treatment of power plants has received little attention and was not considered as a high priority topic. Due to the limitation of available water resources and the reduction and elimination of these sources over time, finding a solution to recycling of the oily wastewater, is necessary.

Project Goals:

The overall goal of this project was to obtain an inexpensive, rapid and operational oily wastewater treatment system based on nanotechnology for power plants and recycling of water.

Partial objectives:

- Design and fabrication of suitable nono-material's based micro-filters polymeric nanofibrous membranes as well as a chemical pretreatment system for application in power plants wastewater treatment.

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- Design and construction of a pilot plant for power plants wastewater treatment in a continuous process.

Abstract:


In the present work attempts have been made to remove contaminants of power plant oily wastewater in a multistage modular process in a laboratory scale pilot as the first stage. The first and most effective step of the treatment system was a rapid coagulation-flocculation process based upon nanomaterials (Nano-flocculants). TOG/TPH analysis along with turbidity, COD, BOD₅ and TOC measurements showed that in this step more than 99 percent of pollutant especially oil and suspended solids which can cause foul the membrane pores, will remove from the effluent. The results obtained from the last stage of wastewater treatment showed that the amount of oil in the effluent output is less than 1 ppm. And this amount is much less than the allowable standard of effluent discharge.

Based on the obtained results from the laboratory stage, an industrial scale pilot package was designed, constructed and transferred to Yazd power plant for commissioning. Due to corona virus pandemic pilot package was transferred to Tarasht power plant for commissioning test. The package was tested using a synthetic effluent obtained from mixing of used VDL100 compressor oil (2000 operating hours) and solid pollution resulting from soil addition. The results of wastewater analysis before and after treatment showed that the turbidity of the purified water by the package was significantly lower than the sample entering the package, which was confirmed by the turbidimeter and showed 99% efficiency. Analysis of COD, BOD, TOG and TSS showed that in all cases the efficiency of reducing the values was higher than 95% and for TOG was 99.9%.

Steps and Methodologies:

In the present work attempts have been made to remove contaminants of power plant oily wastewater in a multistage modular process. For this purpose, the following phases were considered for achieving the objectives.


1. Laboratory scale phase: a laboratory phase pre-treatment system based on nanomaterials.
2. Design and construction of the package
3. Performing semi-industrial scale using the constructed package

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Laboratory phase performed using a very fast flocculation process based on a new nano-flocculant. In this process all soluble and insoluble oily pollutants of the effluent were removed. Based on the impressive results obtained from wastewater treatment on a laboratory scale pilot scale package with a capacity of 250 liters per hour, a semi-industrial phase was designed. Based on the results obtained from the laboratory phase (as the first phase), a package on a semi-industrial scale with a capacity of 500 liters per hour was designed, built and commissioned and tested at the Tarasht power plant.

Main Results:

- Based on the research project methodology and project work breakdown structure (WBS), project activities were designed in four phases and the results were presented in the form of four technical reports.
- In this research, technical know-how for oily wastewater treatment of power plants on a semi-industrial scale based on nanotechnology was obtained.
- In this research, a portable pilot package of oil wastewater treatment on a semi-industrial scale with a capacity of

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