Project Title: Development of technical knowledge for making filters and nanostructured membranes based on carbon nanotubes

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Project Financial Code:	123042	***Project Quality Code:***	PNTPN23-3
Type of Project/Program:	Outsourcing	***Assistant:***	

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Keywords:

Nanostructured Membrane - Carbon Nanotube - Filter - Wastewater Treatment Plant - Porous Membrane - Membrane Processes

Project Necessity:

In recent years, due to population growth and development of urbanization, industry and agriculture, per capita water consumption and consequently the production of industrial effluents has increased significantly. For this reason, the use of treated wastewater as a sustainable water source has received more and more attention and special attention has been paid to creating modern and inexpensive technologies for water treatment and industrial wastewater. The use of treated wastewater in agriculture and industry has several benefits such as providing a cheap and permanent water source, reducing treatment costs, releasing part of good quality water resources for other uses and reducing the environmental effects of wastewater disposal to water resources. To follow. In our country, power plant effluents constitute a significant volume of industrial effluents that contain organic and pathogenic pollutants that are generated from repair effluents, toilets and restaurants and cause pollution. Environment and physico-chemical and thermal changes in the receiving waters. This type of wastewater is considered as a high-salt wastewater that increases solids in the receiving water, algae growth, corrosion of the receiving water, creating toxic gases such as mercaptan, etc. and producing an unpleasant odor in the environment. In recent years, along with the reduction of water resources used by power plants and high water consumption in thermal power plants, the creation of high volumes of wastewater has become an environmental problem. These effluents are not reusable due to their harmful ions such as sodium ions and hard ions, heavy metals, high charge, odor, turbidity, color, and high electrical conductivity. Applying appropriate separation methods to reduce the mentioned pollutants treated these effluents.

Project Goals:

In recent years, membrane filtration processes have been proposed as an efficient method for the treatment of various effluents, especially industrial effluents. The most important advantages of membrane filtration processes are: Reduced energy consumption due to no phase change ⁾ Small volume and no need for much space ⁾ High separation efficiency compared to other methods, especially for dilute solutions Low need for additives and solvents ⁾ Variety of shape and size of membrane modules for different applications ⁾ Ease of setting up a semi-industrial system after performing preliminary tests and building a small-scale guide unit ⁾ Environmentally friendly On the other hand, the use of new technologies, especially nanotechnology in order to reduce the effects of environmental pollution, is considered as one of the management strategies.

Abstract:

The present project aims to fabricate nanostructured membranes based on carbon nanotubes for wastewater treatment. Carbon nanotubes are among the best options for making membranes due to their excellent physicochemical properties such as high surface area, high permeability, good mechanical and thermal stability, good flexibility, good resistance to chemicals and capillary properties. They are nanostructured. Carbon nanotubes can be uniformly aligned to form nano-pore membranes. Due to their smaller size, water molecules easily pass through the pores of the resulting nanostructured membranes, while most contaminants, especially organic and inorganic micropollutants, are selectively removed. Another important advantage of carbon nanotube membranes is that they have high strength similar to ceramic membranes and high flexibility similar to polymer membranes. Carbon nanotubes also have antibacterial properties. According to the issues raised, the most important goals of the present project can be stated as follows: Fabrication of nanometer porosity membranes using carbon nanotubes: Following the initial meeting and considering the economic issues, it was decided that the membranes of the present project are made of polymer and be modified with carbon nanotubes. Therefore, the first chapter of the report (the present report) has been compiled focusing on the types of polymer membranes and their manufacturing methods. Identifying the structural properties of fabricated membranes: The structural properties of fabricated membranes will be investigated using structural analysis analyzes such as SEM, AFM, XRD, FT-IR, EDX, contact angle, porosity, zeta potential, etc. The filtration performance of these membranes will be evaluated using membrane filtration devices available in the laboratory and performing various tests such as purification of pure water, filtration of protein solution to study clogging, excretion of polyvalent and monovalent salts. Investigation of the performance of the membrane made in the treatment plant effluent treatment: Following the initial meeting, considering the extent of various plant effluents, it was decided to focus the present project on the treatment of saline effluents.

Steps and Methodologies:

Many chemical engineering operations deal with the problem of concentration changes in solutions and mixtures, which are not necessarily caused by chemical reactions. The importance of mass transfer-based separation processes is clear to all chemical engineers, and it is rare to find a chemical process that does not require the initial purification of raw materials or the final separation of products from process by-products. Most of the costs of a process are often spent on dependent separations. The costs associated with these separations will be directly related to the ratio of the final concentration to the initial concentration of the separated material. Also, in recent decades, there has been an increasing need to use these processes to

control pollution and protect the environment, and this control, especially in the chemical industry itself, which is a major source of environmental pollution, is becoming more serious. ¬girê. Many separation processes are based on the direct contact of two insoluble phases with each other. Except for a small number, in this case a balance between different components is used. In other words, the distribution of different components of a mixture is different in two phases. In mass transfer operations, neither of the two equilibrium phases will contain a single component. Also, when two phases come in contact with each other, they do not reach equilibrium immediately and the system slows down due to penetration over time. The manufacturers approach equilibrium from one phase to another, so the separation will never be complete. Of course, more complete separation (rather than 100%) can be achieved by repeating the operation. The main areas of separation in industry are the separation of raw materials and products, and since climate is the most used in industry and on the other hand, climate pollution causes many problems in terms of environment, so in addition On the product and food, the climate must also be purified and the impurities in them must be reduced.

Main Results (technical outputs, patents, papers, books, reports, etc.):

Nanostructured membranes based on carbon nanotubes, report