ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875 ResearchBib IF: 8.848 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-4, ISSUE-4

ASSESSMENT OF EFFICIENCY OF ULTRAFILTRATION METHOD IN TREATMENT OF OILY WASTEWATERS

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Abstract: This paper is devoted to the study of ultrafiltration method in the context of oily wastewater treatment. Oily wastewater is a serious environmental problem and requires effective treatment methods to prevent pollution of water resources. The ultrafiltration method is a promising approach to remove micro- and macromolecular contaminants, including petroleum products, from wastewater. This article discusses the principles of ultrafiltration, the main components of the system and the process of oily wastewater treatment. In addition, the advantages and limitations of the ultrafiltration method are discussed, as well as the prospects for its use in industry and research. Based on the results obtained, this paper contributes to the field of wastewater treatment and suggests new ways to improve the efficiency and environmental sustainability of the ultrafiltration process.

Keywords: ultrafiltration, oily wastewater, water treatment, environmental pollution, water resources, environmental sustainability.

ОЦЕНКА ЭФФЕКТИВНОСТИ МЕТОДА УЛЬТРАФИЛЬТРАЦИИ ПРИ ОЧИСТКЕ НЕФТЯНЫХ СТОЧНЫХ ВОД

Аннотация: Данная статья посвящена исследованию метода ультрафильтрации в контексте очистки нефтесодержащих сточных вод. Нефтесодержащие сточные воды представляют собой серьезную экологическую проблему и требуют эффективных методов очистки для предотвращения загрязнения водных ресурсов. Метод ультрафильтрации является перспективным подходом для удаления микро- и макромолекулярных примесей, в том числе нефтепродуктов, из сточных вод. В данной статье рассматриваются принципы ультрафильтрации, основные компоненты системы и процесс очистки нефтесодержащих сточных вод. Кроме того, обсуждаются преимущества и ограничения метода ультрафильтрации, а также перспективы его использования в промышленности и научных исследованиях. На основании полученных результатов данная статья вносит вклад в область очистки сточных вод и предлагает новые способы повышения эффективности и экологической устойчивости процесса ультрафильтрации.

Ключевые слова: ультрафильтрация, нефтесодержащие сточные воды, водоочистка, загрязнение окружающей среды, водные ресурсы, экологическая устойчивость.

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Most of the pollutants that enter the atmosphere or lithosphere from natural water bodies are natural accumulator. The reason for this phenomenon is the global water cycle, the ability to dissolve various gases and mineral substances. And it is also important that any body of water is a pit for the discharge of all kinds of solid particles from land. Oil-containing wastewater is a serious problem in terms of environmental pollution and requires effective treatment methods. One such method is ultrafiltration, which is based on the use of membrane separation to purify petroleum products from wastewater. Determining the effectiveness of the ultrafiltration method in the treatment of oily wastewater is an important aspect of the study because it allows us to evaluate the results and efficiency of this method. The effectiveness of the ultrafiltration method is measured by the degree of purification of petroleum products from the wastewater. This is done by analyzing the concentration of petroleum products before and after the ultrafiltration process. High efficiency of the method means a significant reduction in the petroleum product content of the treated water. One of the important aspects of determining the efficiency is analyzing the quality of the treated water. The treated water must comply with the norms and standards of environmental safety, not contain hazardous substances for the environment and be suitable for reuse.

Figure 1. Ultrafiltration process for oily wastewater treatment

Evaluating the performance of an ultrafiltration method also involves analyzing the pore size of the membrane used and its ability to remove macromolecular contaminants and colloidal particles. The smaller the pore size, the more efficient the filtration and removal of contaminants. The efficiency of the ultrafiltration method also depends on the degree of filtration and the backwashing efficiency of the membrane. Regular maintenance and optimization of the filtration and washing processes help to maintain the high efficiency of the method. To better determine the efficiency of the ultrafiltration method, it is necessary to compare it with other methods of oily wastewater treatment. This identifies the advantages and disadvantages of each method and determines how effective the ultrafiltration method is compared to alternative methods. Pressure plays an important role in the ultrafiltration process. The optimum pressure should be sufficient to overcome the resistance of the membrane, but should not be too high to avoid membrane damage. Experimenting with different pressure values and measuring the cleaning efficiency will help to

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determine the optimum value. The flow of wastewater also affects the ultrafiltration process. High flow can lead to turbulence and reduce removal efficiency, while low flow can lead to membrane fouling. It is necessary to determine the optimum flux at which the best cleaning efficiency is achieved. The concentration of petroleum products in the wastewater is also important when optimizing the ultrafiltration process. High concentrations can lead to membrane fouling and reduced performance.

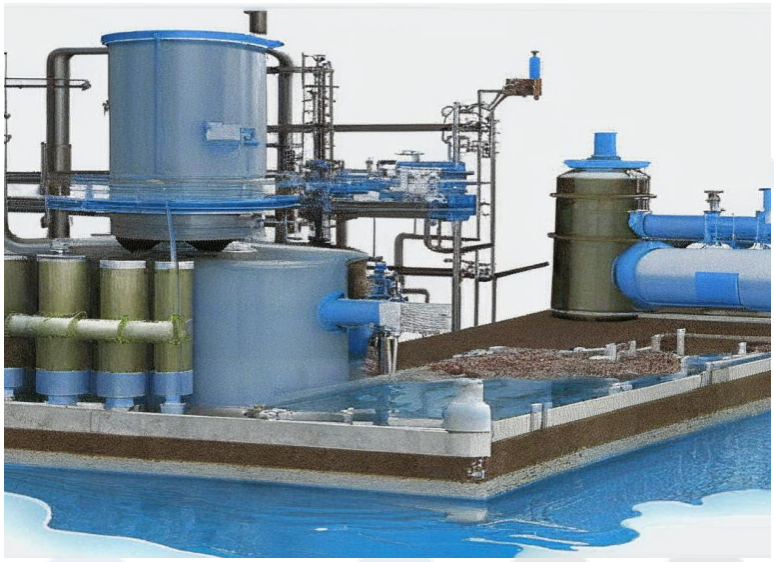

Figure 2. Physico-chemical treatment of oily waste water

Optimization of ultrafiltration process parameters and conditions plays a key role in achieving high efficiency of oily wastewater treatment. Investigation and optimization of these parameters will enable the development of more efficient and sustainable ultrafiltration systems that can effectively treat oily wastewater, reduce environmental impact and ensure sustainable use of water resources. Collection of oily wastewater samples is an important procedure for analyzing and assessing the quality of water resources. This process is critical for assessing pollution and determining whether the wastewater meets regulatory requirements. Gravity sample collection: based on the use of gravity flow of wastewater to collect samples. Samples are collected using tanks or containers placed under pipes or orifices from which wastewater flows. Gravity sample collection is widely used in industry and can be a convenient way to collect representative samples. A sampler is a specialized device that allows wastewater samples to be collected at specified locations and depths. It is usually a cylindrical tube with a mechanism to capture the sample inside. The sampler is used to accurately collect samples at specific points in the wastewater system. Automatic collection devices are used to continuously monitor and collect samples over a period of time. They are usually connected to the wastewater system and collect samples at predetermined intervals. Automatic sample collection provides long time series of data for more complete analyses. Wastewater characterization is important for understanding and effectively treating oily wastes. One of the main characteristics of oily wastewaters is their chemical composition. They may contain a variety of hydrocarbons including volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), phenols, benzene, toluene, xylene and other harmful substances. The concentrations of these substances can vary widely depending on the source of the wastewater and the processes with which they are associated.

The physical characteristics of oily wastewater are also important to its treatment. These include viscosity, density, temperature, pH, and solids. High viscosity of oily wastewater can make

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it difficult to transport and treat. Density and temperature can influence the physical properties of the wastewater and the choice of treatment methods. pH may indicate the presence of acidic or alkaline compounds that may require special treatment. The presence of solids such as sand or clay may require pretreatment to clean up these contaminants. Another important characteristic of oily wastewater is its toxicity and environmental impact. Some components of oil and petroleum products can be toxic and cause serious adverse effects on aquatic ecosystems. Therefore, it is necessary to assess the toxicity of wastewater and take measures to reduce or completely eliminate them. Understanding the characteristics of oily wastewater is the basis for developing effective methods and technologies for its treatment. Different methods such as physico-chemical treatment, biological treatment, filtration and membrane technology can be applied depending on the characteristics of the wastewater and its treatment requirements. The characterisation of oily wastewater plays an important role in determining the best treatment methods and ensuring the safe and effective treatment of such wastes. The selection of the right ultrafiltration membrane depends on several factors including fluid type, particle composition, required degree of purification and process performance.

The study found that the selection of an optimal ultrafiltration membrane plays an important role in achieving high purification efficiency. The membrane parameters such as pore size, hydrophilicity and strength should be carefully selected based on the characteristics of the oily wastewater and the required purification level. Optimisation of ultrafiltration process parameters and conditions is also important to maximise efficiency. Factors such as flow rate, pressure, solution concentration and pH value must be optimised to meet the specific requirements of the system under investigation. Studies have shown that non-stationary conditions such as changes in temperature and solar radiation intensity can affect the efficiency of the ultrafiltration process. Therefore, it is necessary to consider these factors when designing optimal conditions for a specific application. Improving energy efficiency and reducing costs are also important aspects of ultrafiltration method research. The development of new materials and technologies such as modified membranes and integration with other purification processes can significantly improve the efficiency and sustainability of the process. Overall, the study of the ultrafiltration method for the treatment of oily wastewater confirms its potential in solving the problem of water pollution. However, for its successful implementation, further research, process optimisation and development of innovative solutions are needed to ensure the environmental sustainability and economic viability of this method.

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