© 2018 IJSRST | Volume 4 | Issue 2 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Filtration Textile Material For Waste Water Treatment Methods

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ABSTRACT

Adsorption has been proved to be an excellent way to treat industrial waste effluents, offering significant advantages like the low-cost, availability, profitability, ease of operation and efficiency. Biosorption of heavy metals from aqueous solutions is a relatively new process that has proven very promising in the removal of contaminants from aqueous effluents. Biosorption is becoming a potential alternative to the existing technologies for the removal and/or recovery of toxic metals from wastewater. The major advantages of biosorption technology are its effectiveness in reducing the concentration of heavy metal ions to very low levels and the use of inexpensive biosorbent materials. Metal adsorption and biosorption onto agricultural wastes is a rather complex process affected by several factors. Mechanisms involved in the biosorption process include chemisorption, complexation, adsorption–complexation on surface and pores, ion exchange, microprecipitation, heavy metal hydroxide condensation onto the biosurface, and surface adsorptionThis paper presents a comprehensive evaluation of the current status of dynamic membrane (DM) technology as an alternative to membrane bioreactor (MBR) systems. DM filtration makes use of a physical barrier (e.g. cloth or mesh) on which a cake layer is formed. It is already used in traditional filtration systems, but applications in biological wastewater treatment are still at its infancy. Dynamic filtration of sludge has lower risk of fouling and requires less energy and lower capital costs compared to MBR. A review of the state-of-art in both DM materials and configurations is presented. Factors affecting DM performance are discussed in order to determine the optimum and critical approaches for membrane operation. Future perspectives to enhance the applicability and functionality of the technology regarding the treatment and membrane performance are presented.

Keywords : Dynamic Membrane, Membrane Bioreactor, Biosorption, SFDM, UMFI, LPM, MF/UF,TFF

I. INTRODUCTION

Filtration is a mechanical or physical operation, which is used for the separation of solids from fluids (liquids or gases) by interposing a medium through which only the fluid can pass. Over size solids in the fluid are retained, but the separation is not complete; solids will be contaminated with some fluid and filtrate will contain fine particles (depending on the pore size and filter thickness). Filtration is used to separate particles and fluid in a suspension, where the fluid can be a liquid, a gas or a supercritical fluid. Depending on the application, either one or both of the components may be isolated. The process is Picking out, Decanting, Evaporation, Dissolution and Filtration.

1.1 OBJECTIVES:

- Water is recycled by this treatment coming from textile and chemical industries.

- Waste water gets treated with the help of charcoal and gem crystals.
- It removes the biodegradable organic matter and residual suspended solids.
- It undergoes physical, chemical and biological treatments.

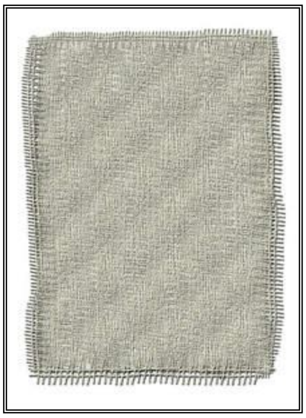


Fig 1: Filtration material by using gem crystals.

1.2 Principles of Filtration

The filtration of the textile materials are of five divisions,

- Interception
- Inertial Disposition
- Random Diffusion
- Electrostatic Disposition
- Gravitational Forces
- Dust Collection Principles

Membranes have been used as solid–liquid separation devices in biological treatment (aerobic and anaerobic) and physical applications for many years. There has been a growing interest in combining membranes with biological wastewater treatment in so called membrane bioreactors (MBRs), giving striking advantages such as improved effluent quality and low system footprint (Judd, 2006). The major constraints of MBR processes are related to membrane costs, energy demand, fouling control, and low flux. Dynamic membrane (DM) technology may be a promising approach to resolve problems encountered in MBR processes (Fan and Huang, 2002; Wu et al., 2005; Ye et al., 2006). A DM, which is also called secondary membrane, is formed on an underlying support material, e.g. a membrane, mesh, or a filter cloth, when the filtered solution contains suspended solid particles such as microbial cells and flocs. Organics and colloidal particles which normally result in fouling of the membrane will be entrapped in the biomass filtration layer, preventing fouling of the support material (Kiso et al., 2005; Jeison and van Lier, 2007a,b). An illustration adapted from Lee et al. (2001) is given in Fig. 1 to demonstrate the dynamic cake layer formation.

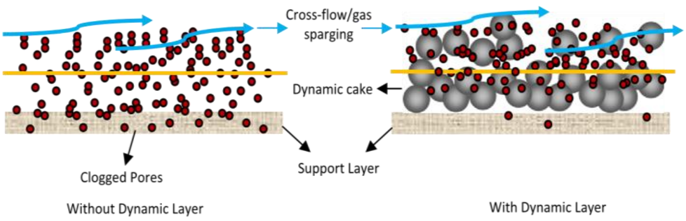
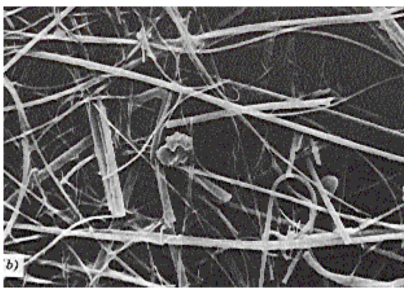


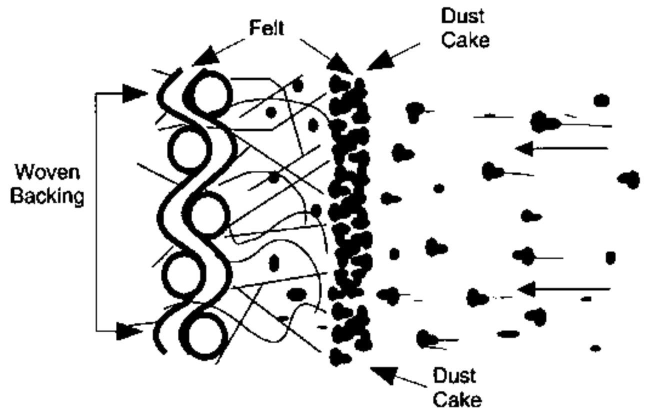
Fig:- 2. Demonstration of the dynamic cake layer.

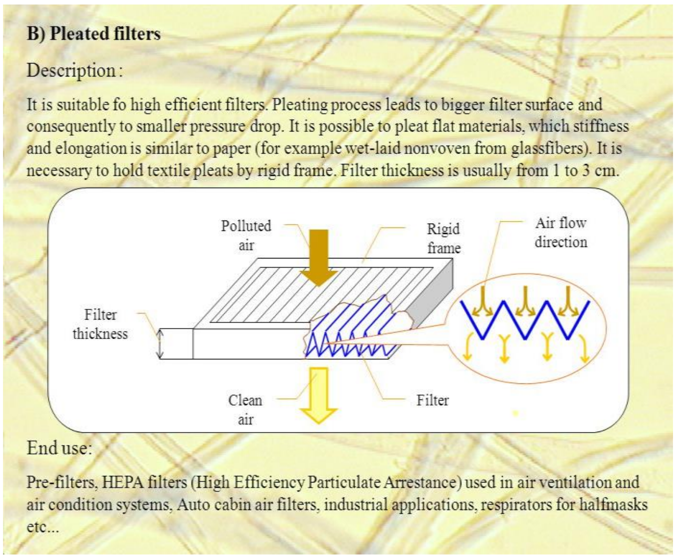
1.3 Filtration Textiles:

Dynamic layer forming materials

DMs can be mainly classified into two groups, i.e. self-forming and pre-coated. SFDM is generated by the substances present in the filtered liquor, such as suspended solids (SS) in wastewaters, whereas pre-coated DMs, also denominated formed-in-place (FIP) membranes, are produced by passing a solution of one or more specific colloidal components over the surface of a porous material (Al-Malack and Anderson, 1996; Ye et al., 2006). The main disadvantage of this approach over SFDM is the requirement of an external material. The pre-coated DMs can also be subdivided into two groups, namely single additive and composite (bi-layer) membranes.







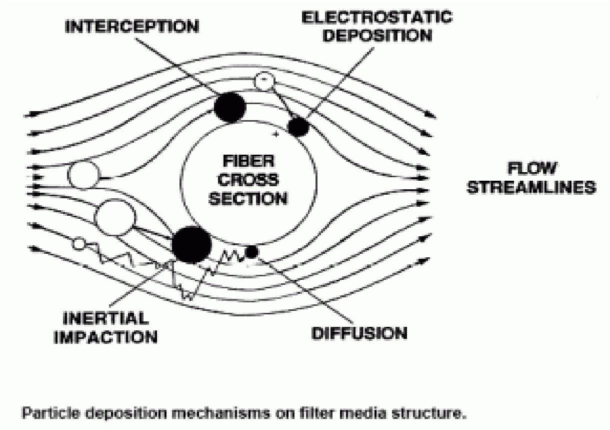
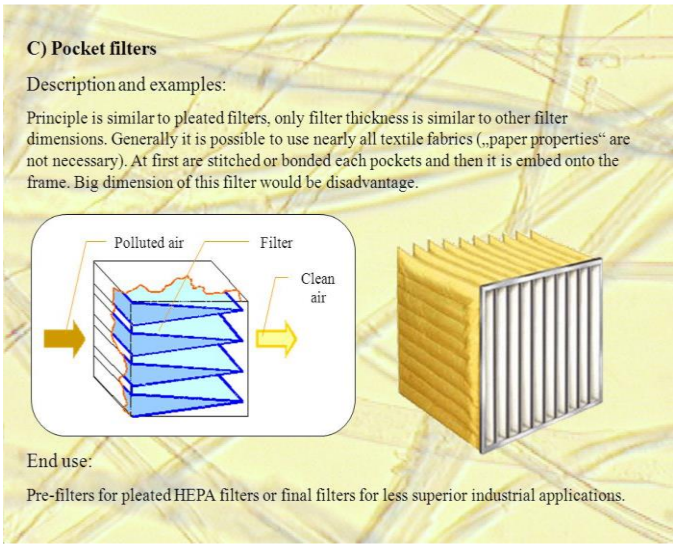


Fig :- 3 - Fibrous filter and Felted filter - A

D – Filtration Fabrics



II. Filtration Process

2.1 Considerations on dye adsorption:

Synthetic dyes are an important class of recalcitrant organic compounds and are often found in the environment as a result of their wide industrial use. These industrial pollutants are common contaminants in wastewater and are difficult to decolorize due to their complex aromatic structure and synthetic origin. They are produced on a large scale. Although the exact number (and also the amount) of the dyes produced in the world is not known, there are estimated to be more than 100,000 commercially available dyes. Many of them are known to be toxic or carcinogenic.

Recently, numerous low-cost adsorbents have been proposed for dye removal. Among them, non-conventional activated carbons from solid wastes, industrial by-products, agricultural solid wastes, clays, zeolites, peat, polysaccharides and fungal or bacterial biomass deserve particular attention as recently summarized in a review by Crini [6]. Each has advantages and drawbacks. However, at the present time, there is no single adsorbent capable of satisfying the above requirements. Thus, there is a need for new systems to be developed. In addition, the adsorption process provides an attractive alternative treatment, especially if the adsorbent is selective and effective for removal of anionic, cationic and non-ionic dyes

2.2 Waste Water Treatment

2.2.1 Filter Backwash Wastewater

Filter backwash wastewater is produced during the filter washing operation. Filters are washed daily, once every two days, or less frequently. There is usually a large volume of wash water with low solids content. The volume of wash water is large because the backwash rate may be 10 to 20 times the filtration rate. For alum coagulation plants, the volume of wash water ranges from 2 to 5% of the water filtered.

The composition of backwash wastewater may be similar to that of coagulant sludge, but with much finer particles. This type of wastewater normally contains hydroxides of aluminum and iron, fine clay particles, added chemicals and reaction products which did not settle in the sedimentation tank, and a small portion of filter media and activated carbon. Since the durations of filter backwash operations and release patterns of solids vary widely, it is necessary to carefully assess the quantity and characteristics of the wastes generated during filter washing operations.

Treatment and disposal of waste from a water treatment plant depend on the types of waste and on local conditions. Treatment methods used for domestic wastewater sludge are most likely applicable to water plant wastes. However, further studies should be conducted to evaluate their feasibility. Generally waste treatment processes for water plants consist of three elements: co-treatment, pre-treatment, and solids dewatering. There are several methods available for each of these elements. Co-Treatment Discharge of water plant wastes to a sewage system, either raw or after concentration, has been a common practice for many facilities. It is probably more cost-effective than using separated systems, especially for communities which own both the water and sewer systems.

III. Methodology

Membrane filtration is considered an important technology that can contribute to the sustainability of water supplies. However, its continued development necessitates the establishment of proper techniques for the assessment of membrane fouling. Unified Membrane Fouling Index (UMFI) was developed in this study in order to quantify and assess the fouling of low-pressure membranes (LPM) observed at various scales of water treatment. The foundation of UMFI is a revised Hermia model applied to both constant pressure and constant flux filtration. The adoption of UMFI makes it possible to simplify and standardize the bench-scale testing of membrane fouling potential by directly using the commercial LPM of interest. This approach can overcome a major challenge to fouling assessment, i.e., the membrane-specificity of fouling potential, which has not been wholly addressed by existing fouling indices. The fundamentals of UMFI are presented in this paper, together with the methodology for bench-scale testing. The application of UMFI to the assessment of the fouling of a LPM by natural surface water is also discussed. Good agreement between bench-scale UMFI and pilot-scale UMFI was found, suggesting the validity of this new scientific concept for environmental applications. Unified membrane fouling index is established theoretically and applied to the assessment of short- and long-term performance of commercial MF/UF membranes in water treatment.

Ultra filtration and micro porous membranes are used in pressure-driven filtration processes. Practitioners in the field of separation processes by membranes easily differentiate between microporous and ultrafiltration membranes and generally distinguish between them based on their application and aspects of their structure. Microporous and ultrafiltration membranes are made, sold and used as separate and distinct products. Despite some overlap in nomenclature, they are separate entities, and treated as such in the commercial world.

Ultra filtration membranes are primarily used to concentrate or dia filter soluble macromolecules such as proteins, DNA, starches and natural or synthetic polymers. In the majority of uses, ultrafiltration is accomplished in the tangential flow filtration (TFF) mode, where the feed liquid is passed across the membrane surface and those molecules smaller than the pore size of the membrane pass through (filtrate) and the rest (retentate) remains on the first side of the membrane. As fluid also passes through there is a need to recycle or add to the retentate flow in order to maintain an efficient TFF operation. One advantage of using a TFF approach is that as the fluid constantly sweeps across the face of the membrane it tends to reduce fouling and polarization of the solutes at and near the membrane surface leading to longer life of the membrane.

Microporous membranes are primarily used to remove particles, such as solids, bacteria, and gels, from a liquid or gas stream in dead-end filtration mode. Dead-end filtration refers to filtration where the entire fluid stream being filtered goes through the filter with no recycle or retentate flow. Whatever material doesn't pass through the filter is left on its upper surface.

Ultrafiltration membranes are generally skinned asymmetric membranes, made for the most part on a support which remains a permanent part of the membrane structure. The support can be a non-woven or woven fabric, or a preformed membrane.

Micro porous membranes are produced in supported or unsupported form. Usually, the support has the membrane or a portion of the membrane formed in the support, rather than on the support, as in ultra filtration membranes. The early cellulosic, nylon and polyvinylidene fluoride microporous membranes were symmetric and for the most part, unskinned. Presently, some asymmetric microporous membranes are produced, and some of these are skinned.

While it would seem that the two types of membrane could be differentiated by pore size, this is not the case, as will be discussed below. The reasons for this are that they are used in different applications, requiring different characterization methods. None of the methods usually used give an absolute pore size measure, and different methods cannot be directly compared. Micro porous membranes were commercially developed from the work of Zsigmondy by Sartorius Werke (Germany) in 1929. These were what are now call “air cast” membranes made by evaporating a thin layer of a polymer solution in a humid atmosphere. These membranes were and still are symmetric and generally unskinned. Since they were used to remove or hold bacteria, they were rated by the bacteria size that would be retained. This method resulted in pore size ratings in microns.

A common method used to rate microporous membranes is the bubble point test. In this method, the microporous membrane is placed in a holder and saturated with a test liquid. Gas pressure is applied to one side of the membrane and the pressure is increased at a fixed rate. The appearance of the first stream of bubbles from the downstream side is a measure of the largest pore.

IV. Results and Discussion

Effective treatment of various kinds of industrial wastewaters is of growing interest worldwide. Conventional biological treatment of industrial wastewater encountered difficulties due to the characteristics of industrial wastewaters that include high organic strength or extreme physicochemical nature, and the presence of toxic or inhibitory pollutants. MBR technology appears to be a prospective one for industrial wastewater treatments and for system closure. The research and commercial applications of the MBR technology for industrial wastewater treatments are rapidly advanced around the world. The application areas cover a wide range of industrial wastewaters, which include food processing, pulp and paper, textile, tannery, landfill leachate, pharmaceutical, oily and petrochemical, and other types of industrial wastewaters.

Fundamental aspects studied in academic research predominantly involve issues related to membrane fouling, microbial characterization, and optimizing operational performance.

MBR systems still face several research and development challenges when applied to industrial wastewater treatments. Among the challenges and opportunities are the following.

- Membrane fouling and its consequences in terms of plant maintenance and operating costs remain the critical limiting factors affecting the widespread application of MBRs for industrial wastewater treatments. Although intensive efforts have been dedicated to the study on membrane fouling mechanisms and control, most of these efforts have been focused on municipal wastewater treatment. It is necessary to develop more effective and easier methods to control and minimize membrane fouling, especially in large-scale applications for industrial wastewater treatments, considering the unique characteristics of industrial wastewaters.
- Anaerobic treatment would offer additional benefits when treating some industrial streams characterized by their high organic strength. However, a review of literature shows that the research and application efforts regarding An MBR are very limited. Further efforts are needed to explore reliable An MBR systems suitable for industrial wastewater treatments.
- Bioaugmentation offers considerable advantage in dealing with the problems of bacterial acclimatization, toxicity of compounds, and restart of the system. Because industrial wastewaters typically contain toxicants, bioaugmentation of special bacteria responsible for utilizing various toxicants would improve the performance of the whole system. However, the bacteria suitable for bioaugmentation have to meet some criteria. For example, they must be catabolically active to degrade specific compounds, and be competitive, and hence persistent, after being introduced into biotreatment systems. They also should be compatible with indigenous microbial communities so that they will not adversely affect the indigenous microbial communities. Therefore, selection of candidate bacteria for bioaugmentation is a complicate work and costs much. Applications of bioaugmentation in MBR systems have been limited in the field and need further studies.
- Most of the research reported on industrial wastewater treatments with MBRs has been confined to bench experiments. Full-scale studies spanning long-term operations have been limited. Many times, bench testing doesn't accurately predict full-scale results. Attempts should be made to bridge the gap between success at laboratory-scale studies and full-scale applications. • This study highlights the lack of standard configuration and design criteria for MBR systems for industrial wastewater treatments. Therefore, further studies are required to improve the knowledge of the design and management of these systems to

enhance the treatment efficiency and reduce treatment cost.

- There is a short of fundamental information on the operational issues, cost issues, energy issues, and manufacture cost of MBR systems for industrial wastewater treatments. Well-controlled pilot-scale MBR studies are needed to address these issues.
- A comparison between industrial wastewater and municipal wastewater treatments suggests that more attention should be paid on membrane fouling control in industrial wastewater treatments.

V. CONCLUSIONS

This result does, however, come with condition chlorine is a poison which is present in the waste materials. While it may bring the bacteria count in water down, it does not make it safe to drink. There are methods of treating the chlorinated water to make it safe to drink, However In this experiment we noticed some flaws in the system that may have hindered our experiment process of removing the dirt's and dust particles. We originally planned on using iodine as well as chlorine for chemical treatment. Unfortunately most stores no longer carry the iodine solution to clean water. Other than, our experiment ran smoothly. Some possible errors in the data are the variability of temperature of the water, the pH tester was not meant to be used for scientific research, the safety of the water for drinking was not tested for safety reasons. For a future experiment, we could test more samples of water. We could also measure other facets of the purity of the water such as salinity and chlorine content.Through this investigation, our filtration methods proved helpful even though they were done on a small scale. If this method was expanded, it would be able to improve several factors of Garland High School's water, including pH levels, hardness, chlorine levels, and alkalinity levels. The water quality is increased and is therefore safer to drink.

The activated charcoal was the most effective method, and is also capable of removing airborne toxins and gases from water and from the environment. Not only did the activated charcoal help purify the water, but it is also good for the environment overall. Because carbon is a natural resource and is fairly inexpensive, it is the best nature-friendly option for purifying water. In addition to this, it can be activated with boiling water to reduce the carbon emissions formed when activating it to the state in which it is able to purify water.By completing this project, we were made more aware of other water filtration methods, their practicality, and their benefits. Low quality water can lead to health hazards that can be avoided by putting into place these safe, inexpensive, and effective water filtration techniques.

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