Opinion
Volume 12:07, 2022

Journal of Textile Science & Engineering

ISSN: 2165-8064 Open Access

Utilization of Recycled Cotton Fabric as an Ultrafiltration Membrane

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Introduction

There are a number of reasons for the textile market's on-going and steady expansion. The population itself is expanding, which is the primary cause. The shorter fashion cycle is another reason. The materials are additionally becoming less expensive than before contrasted with the other shopper merchandise. In less than two decades, clothing purchases in the EU-28 have increased by 40%, according to. Even though clothing consumption is lower in Finland than in other European nations, the number of owned goods has doubled since the 1990s.The challenges associated with dealing with environmental, energy, and resource-related issues arise alongside the textile industry's expansion. Currently, synthetic fibers, primarily made from petrochemicals and resulting in significant emissions of carbon dioxide dominate the textile market (63 percent). The next most common crop is cotton, whose production is linked to toxic pollution and depletion of water resources as a result of extensive pesticide use. Estimates indicate that global consumption of cellulosic fibers will reach 5.4 kg per capita by 2030, whereas cotton's predicted availability will only be 3.1 kg per capita. The textile industry is known to be energy-, water-, and chemical-intensive. In 2017, the Ellen MacArthur Foundation published a report on the textile industry's global impact. The textile industry is expected to continue expanding, necessitating quick and effective recycling as one of the most important steps toward sustainable development. Currently, 95% of the post-consumer textile that is wasted is either disposed of in a landfill or burned, causing additional environmental issues. Due to its properties, cotton textile is the most likely material for efficient recycling because it consists solely of cellulose, which can be utilized in a variety of ways, from reinforced composites to completely different products. The majority of the recycled part is going through down-cycling procedures, which results in a product of lower quality and limits its further use. Up cycling is the process of recycling discarded cotton into a variety of value-added products with adjustable features and the potential for sustainable utilization due to the attractive properties of cellulose.

Description

The production of cellulose membranes, which can be done once the right solvent medium is found, is one of the possible options that hasn't been researched yet. Nowadays, there is a lot of talk about how cellulose dissolves in IL- cosolvent systems and ionic liquids (IL). Utilizing 1-ethyl-3-methylimidazole acetate a low-corrosive and toxic IL, in conjunction with dimethylsulfoxide (DMSO) results in a system that is middle-viscous and inexpensive for the preparation of membrane casting solutions. Due to cellulose's hydrophobicity, biocompatibility, and relatively high stability, resulted membranes can be useful in a variety of applications. The hydrophobicity of the cellulose membrane makes it possible to use it for things like treating different water streams in the pulp and paper industry and bio refinery streams. A review of the literature revealed that there is only one study that has been done so far that reports how to make membranes from textile waste. Blended nano filtration membranes were made with wool-derived IL-extracted keratin in that research. However, to the best of our knowledge, no papers appear to have reported a membrane preparation using cotton textiles directly. As a result, the goal of this study was to see if cotton textile waste could be used to make a filtration membrane [1-5].

Conclusion

The method developed and presented in our previous study was used to prepare the flat sheet membranes using the wet phase inversion method from 100% cotton bed linen dissolved in a mixture of DMSO. By measuring the retention and permeability of polyethylene glycols (PEGs) in water, the usability of the produced membranes was evaluated. The fabricated membranes' chemical structure, hydrophobicity, zeta potential, and membrane porosity were also examined. By stirring cotton textile shreds overnight at constant heating in an oil bath at 70°C, homogeneous solutions of cellulose were prepared in DMSO at concentrations of 2, 5, 6, and 7 weight percent. Because of disintegration, outwardly straightforward homogeneous. The prepared solutions were applied to the carrier material that had been placed on a glass plate at room temperature by spreading an appropriate amount with an Automatic Film Applicator L (BYK-Gardner USA) and a casting knife at a speed of 50 mm/s (with a casting thickness of 150 or 300 m). Casting solution concentration and casting thickness varied, resulting in eight distinct membrane types. Summarizes the variations in casting parameters and provides codes for the produced membrane types for future convenience.

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Date of submission: 02 July, 2022, Manuscript No jtese-22-81710; **Editor assigned:** 04 July, 2022, PreQC No. P-81710; **Reviewed:** 09 July, 2022, QC No. Q-81710; **Revised:** 14 July 2022, Manuscript No. R-81710; **Published:** 19 July, 2022, DOI: 10.37421/2165-8064.2022.12.495

How to cite this article: Atalay, Tuncay. “Utilization of Recycled Cotton Fabric as an Ultrafiltration Membrane.” J Textile Sci Eng 12 (2022): 495.