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# Effective composite membranes of cellulose acetate for removal of benzophenone-3

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ABSTRACT

In thiswork,Cellulose acetate/Zinc oxide-Zeolite composite membranes were successfully synthesized via a simple DIPS method for the removal of benzophenone- 3 from water.The influence of the different concentrations of cellulose acetate and Zeolites-Zinc Oxide Nano composite particles were prepared and inserted in the membrane matrix. The resulting membrane was characterized by ATR-IR, XRD, SEM, ICP-OES and AFM analysis. The water uptake study was also carried out to know hydrophobicity of the membrane. The membrane performances were significantly improved after the addition of ZnO-Zeolite in the Cellulose acetate solution in ascending order.The concentration of Zeolite ZnO enhances the hydrophilicity of the membranes. The membrane showed 98% rejection of benzophenone-3 in neutral pH. However rejection and permeate flux increases with the concentration of Zeolite ZnO. The effect of applied pressure and feed concentration was studied and discussed with scientific reasons.

## 1. Introduction

In the fast growing population, diminishing water resources and climate changes are extending the duration of droughts and floods by making drinking water a contentious resource in many parts of the world. Over the past decade, the presence of pharmaceuticals, personal care products (PPCPs) and endocrine disrupting compounds (EDCs) in water source are inevitably a growing global concern due to their noticeable effects on aquatic life (notable skewing of sex ratios) and their unknown effects on humans [1]. These contaminants invade surface waters primarily via wastewater effluents and could also be the result of agricultural activities. In this regard, an exceptional and efficient water purification technology is considered as an urgent need to address the problems related to benzophenone-3 such as water shortages, health, energy and climate change.

Benzophenone-3 (Bp-3) is well known sunscreen agent and its metabolite 2,4-dihydroxybenzophenone have been detected in human urine. It directly enters in to the gastrointestinal tract. Benzophenone-3 has complex receptor interactions in vitro and are estrogenic in fish. Hence, removal of BP-3 is a major issue and it is very serious threat for aquatic ecosystem. Usually for removal of EC's, photocatalytic degradation is feasible process but, BP-3 lacks functional groups that difficult to degrade in the environmental water. There are very well known treatments for benzophenone-3removal, i.e. biological treatment systems (activated sludge and biological trickling filter) [2], physicochemical treatment like coagulation, flocculation and lime softening [3]. Membrane processes like microfiltration (MF), ultrafiltration (UF), Nano filtration (NF) and reverse osmosis (RO) are considered as promising alternatives in removing the huge amounts of organic micro-pollutants [4]. NF and RO are proven to be very effective filtration technologies in withdrawing micro pollutants [5,6].

The preparation of a soft membrane with an excellent selective properties and molecular sieving properties is very desirable from both practical and fundamental stand points. One of the common methods is to combine a crystalline such as; porous solid metal oxide with a flexible cheap and abundant organic matrix; cellulose acetate. There are several reports found on metal oxides induced membranes for water purification. $TiO_2$ [7], ZnO [8], $Al_2O_3$ [9], Zeolite [10], Graphene oxide [11], and carbon nano tubes [12] are showed impact in membrane separation. Among these metal oxides, Zeolite has unique property which is very obliging to the membrane separation. Zeolites are crystalline micro porous and tetrahedral units of aluminosilicates. These are made up of silicon-oxygen and aluminum-oxygen bonded tetrahedron units, which are negatively charged hydrophilic pillers. Overall, around 46 natural and 150 synthetic zeolite minerals are known in the literature. Among all these Zeolite X showed better properties for membrane

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