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Study the Effect of Addition Silver Nanoparticle on Structure and Morphological Properties for PVDF Hollow Fiber

Abstract- *In this research was the study of the impact of silver nanoparticles solution on the structure and properties of the morphological membrane fibrous hollow PVDF through a dip PVDF Hollow fiber membrane in silver nanoparticle solution preparation via using laser ablation method. The characteristics of membrane and silver Nano particle solution and was examined using X-ray diffraction (XRD)and Scanning Electron Microscopy (SEM) also using laser particle size analyzer for Silver nanoparticles (AgNPs) to measurement particle size to AgNPs.*

Keywords-*.PVDF Hollow fiber; Membrane; Silver nanoparticle*.

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1. Introduction

In years the chemical engineering process have increased interests of scientific community in membrane has been tried out as a method for polymer [1]. It has been grown rapidly in the last decade because of their reliability, ease of operation, and compact design [2].

Membrane has been greatly utilized at fields as biotechnology, biomedicine, and in curing of industrial, drinking water wastewater treatment [3, 4], and it have the production of high quality water without chemicals or utilities, and small footprint [5]. However, polyvinylidene fluoride (PVDF) hollow fiber film technology have received large interesting predominant ultrafiltration (UF) film substance because it was excellent mechanical and physicochemical characteristics, like rise mechanistic force, thermal stabilization, anti-ultraviolet radiation, sleek surface, low albuminoidal adsorption [6-9]. Generally, to improve the film separation execution and chemical stability, mechanical and thermal resistance employ inorganic nanoparticles such as, AgNPs where incorporation of the basic properties AgNPs and polyvinylidene fluoride (PVDF) had high ability to forming. Therefore, organic-inorganic composite membranes have attracted ever more attentions [10,11]. Silver ions employed in many application such as medical ,biological and industrial where filters water and air witness large important improvement silver ions used as anti-bactericidal therefore it was coating with filters water to removed bacteria and much pathogen and other contaminations [12]. Nanoparticle of silver (Ag) has a great importance in separation process since it provides a valuable opportunities for different science fields for example photonics, catalysts, sensing and purification units. Many authors used silver nanoparticle to coating the membranes filtration and filters in air and water purification, water treatment [13-15].

Currently there are several methods to prepare silver nanoparticles, a physical and chemical method, such as chemical reduction in aqueous solutions, laser ablation, electrochemical reduction, template method, ultrasonic-assisted reduction, photocatalytic reduction, biochemical reduction and microwave-assisted synthesis [16].

The aim of this research improve the efficiency of the PVDF hollow fiber membrane flow through soaking in silver nanoparticle solution prepared by laser ablation.

2. Experimental Work

I. Materials

Polyvinylidene fluoride hollow fiber Membrane (PVDF, FR 904) supplied from Shanghai 3F New Material Co., Ltd. China, has pore size 0.01 µm, outer diameter (1.2 mm), inter diameter (0.8 mm), maximum temperature 40℃ and tranmembrane pressure 300KPa, pH range 1-10, flow rate 0.2-.75 (m^3/m^2.day).And prepared Ag NP had been mean diameter particle size(22.2 nm), by laser ablation method a silver metal as target in demonized water, using Nd:YAGlaser operating at the second

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harmonic laser (532 nm) wavelengths, with frequency 6 Hz), with laser flounce was about (0.3 J/cm^2)laser shots of 100 pulses.

II. Procedure

Polyvinylidene fluoride (PVDF) Hollow fiber membrane was soaked in silver nanoparticle collides by ultrasonic device for one day at a temperature of 45℃. This leadto the saturation coverage, then left at room temperature for drying and was air-dried.

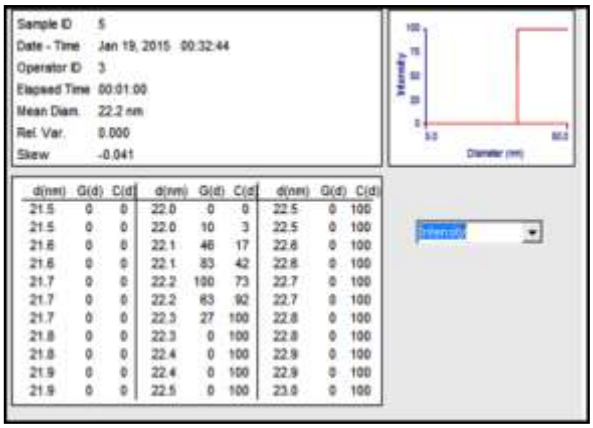
III. Characterization of PVDF Hollow Fiber Membrane and Silver nanoparticles (AgNPs)

Characterized of the topographic surface and structure properties of PVDF hollow fiber membrane and silver nanoparticles (AgNPs)were examined by using: Scanning Electron Microscopy (Vega T scan)and X-ray diffraction (XRD)from (Shimadzo)also using particle size analyzer (NanoBrook 90Plus Particle Size Analyzer) for Silver nanoparticles (AgNPs)to measurement particle size**.**

3- Result and Discussion

Particle size analysis (PSA) afford a thought of the changes in size and size distribution and stabilized Ag of the particle prepared and Figure 1(a) shows the intensity size distribution of Ag collide dispersed in water with the mean medium was 22.2nm with very good homogeneity in size distributions for Ag nano particles [17]

Figure 2 the results of XRD explain that not found any impurity in diffraction peaks in the pattern and Ag nanopartical have high quality from crystalline and the results of XRD appear clear and sharp peak with dominant peaks on 2θ =34.7993°,2θ =38.145°, 2θ =43.974°, 2θ=46.9861° , 2θ=54.58 , 2θ=57.7861 and 2θ=64uniform to the (111) ,(200),(220) (311),(020),(331), and (220) peaks respectively [18]. Ag nanopartical with polcrystalline structure was established by (JCPDS card No. 04-0783). (3) SEM PVDF hollow fiber before and after soaking in silver nanoparticle colloid where surface morphology for these results from SEM analysis as shown in Figure (3a,b) PVDF Hollow fiber have size of surface pore , fixed surface region and porosities are clear that the hollow fibers generally had smaller surface pore sizes in both cross section inner and outer layer .The cross section of SEM after soaking in silver nanoparticle colloid was shown in Figure (3c,d) was observed that silver nanoparticle colloid spread on nearly outer and near inner layer PVDF hollow fiber with uniformity distribution and homogeneity. The X-ray diffraction spectrumlated to such a trade PVDF membrane after soaking in silver nanoparticle colloid, display main diffraction peaks at 2θ = 20.1°, 17.09°, and 14.27°, which is in perfect compact with the special peaks of PVDF crystals notify and appear diffraction peaks located at 36.2°and 42.8° (2θ) are spotted in those related to the X-ray diffraction spectrum of Ag nanoparticle



indicating that the structured Ag formed in PVDF is composed of Ag crystallites.

Figure 1: Particles Size and their distribution for prepared Ag nano using the software of (PSA)

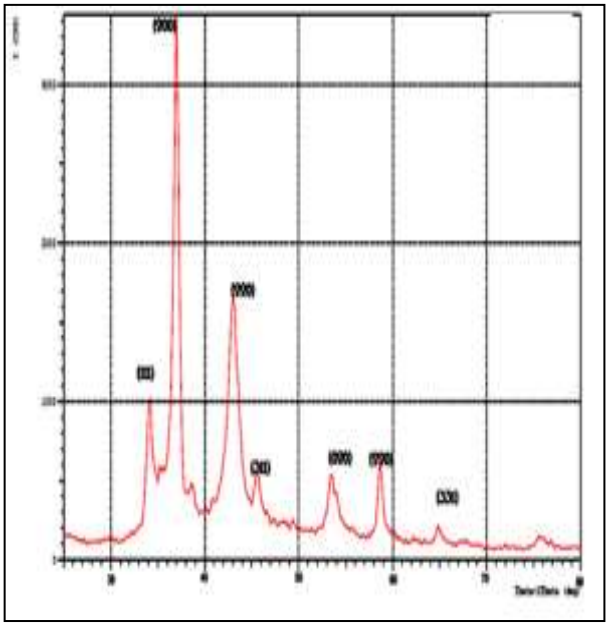


Figure 2: XRD spectrum of Ag nano particles

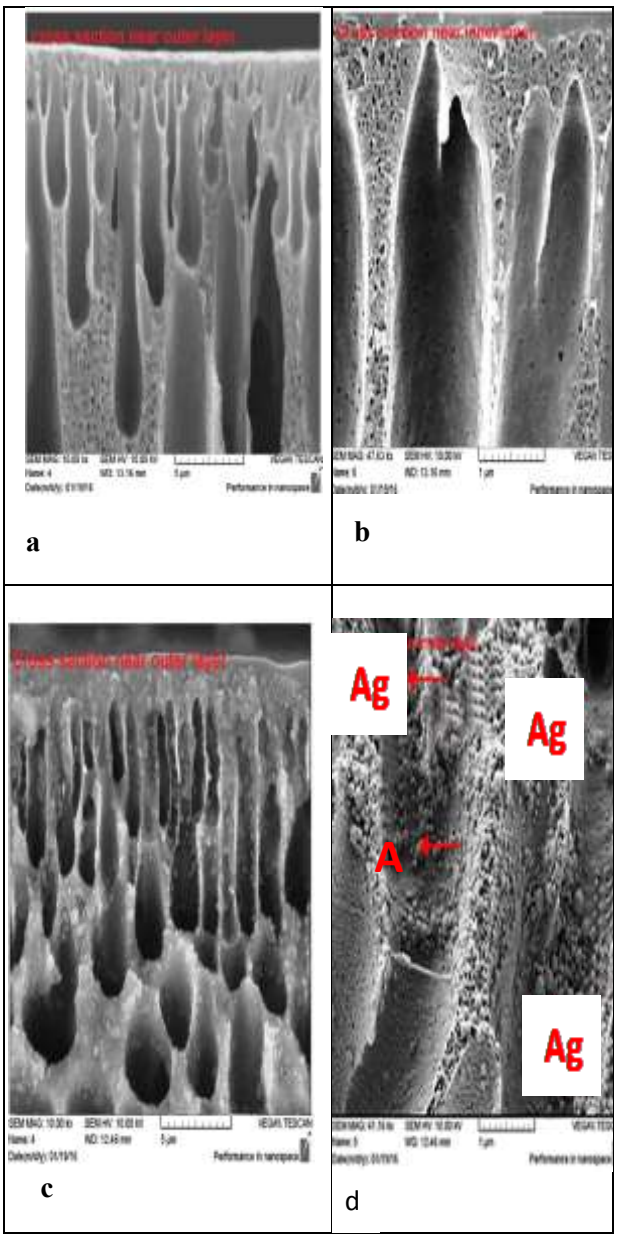


Figure3: SEM imageat different magnification 5 µm and 1 µm (a ,b) beforesoaking and(c,d)after soaking in silver nanoparticle colloid at magnification 5 µm and 1 µm

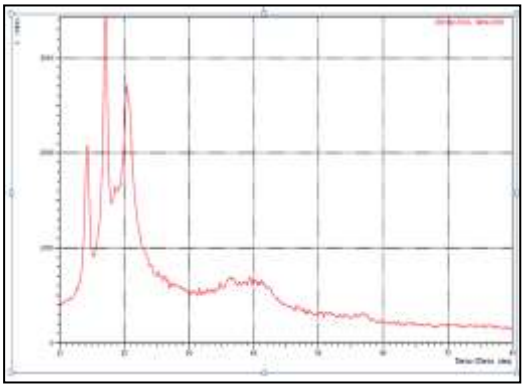


Figure 4 XRD PVDF membrane after socking in Ag nanoparticle collide

4-Conclusion

Ag nanopartical prepared by laser ablation with the mean medium was 22.2nm with very good homogeneity in size distributions. SEM image show PVDF membrane before and after socking in Ag nanopartical with good adhesion on PVDF membrane and the result of X-ray diffraction spectrum of Ag nanopartical indicating that the structured Ag formed in PVDF is composed of Ag crystallites.

5- Acknowledgment

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References

[1] G. Raja, "Enhancement of membrane permeability by gas-sparging in submerged hollow fiber ultrafiltration of macromolecular solutions: Role of module design," Journal of Membrane Science, Vol. 274, PP.73–82, 2006.

[2] R. Isabel, "Addition of a Magnetite Layer onto a Polysulfide Water Treatment Membrane to Enhance Virus Removal," Thesis submitted in partial fulfillment of the requirements for the degree. 2011.

[3] Q. Ren, A.R. Nasrul, M. Hideto, "Preparation of hydrophilic poly(vinyl butyral)/Pluronic F127 blend hollow fiber membrane via thermally induced phase separation," Separation and Purification Technology, Vol. 61,PP.1–8, 2008.

[4] J.Q. Jian, M.C. Yi, Q.L. Ye, L. Ying, H.O. Maung, L. Hsiaowan, "Hollow fiber ultrafiltration membranes madefrom blends of PAN and PVP," Separation and Purification Technology, Vol. 36,PP.149–155, 2004.

[5] S.S. Madaeni, A.T. Akbarzadeh, "Preparation and Characterization of Microfiltration Membrane Embedded with Silver Nano-Particles," Iran. J. Chem. Chem. Eng., Vol. 29, No. 4, PP. 105-111, 2010.

[6] A. Bottino, G. Capannelli, A. Comite, "Novel Porous Membranes From Chemically Modified Poly (vinylidene fluoride)," Journal of Membrane Science, Vol. 273, PP. 20–24, 2006.

[7] Z. Qinglei, L. Xiaolong and Z. Lihua, "Preparation of Polyvinylidene Fluoride (PVDF) Hollow Fiber Hemodialysis Membranes," Membranes, Vol. 4, P.P.81-95, 2014.

[8] F. Enrica, C.J. Johannes, C. Alessandra, C. Efrem, D. Enrico, "Effect of Additives in the Casting Solution on the Formation of PVDF Membranes," Desalination, Vol. 192, PP.190–197, 2006.

[9] Q.F. Alsalhy, H.A. Salih, S. Silvia, Z. Mumtaz, D. Enrico, F. Alberto, "Poly(ether sulfone) (PES) Hollow-Fiber Membranes Prepared from Various Spinning Parameters," Desalination, Vol. 345, P.P. 21–35 , 2014.

[10] F.H. Ling, L.X. Zhen, Y.Y. Li, M.W. Yong, and C. Yue, "Performance of PVDF/Multi-nanoparticles Composite Hollow Fibre Ultrafiltration Membranes,"

Iranian Polymer Journal, Vol. 19, No.7, PP. 553-565,
[11]A. Sheneva, "Synthesis of Silver Nanoparticales by Chemical Reaction method and their Antifungal Activity," Int. Res. J. arm., Vol.4, No. 10, PP. 111-113, 2013.
[12] J. Prashant, T. Pradeep, "Potential of Silver Nanoparticle-Coated Polyurethane Foam as an Antibacterial Water Filter," Biotechnology and Bioengineering, Vol. 90, No. 1, PP.59, 2005.
[13] R.G. Hamid, "Nano-silver Colloidal Solution Formation by a Simple and Green method," Oriental journal of chemistry, Vol. 30, No. 3, PP. 1417-1419, 2014.
[14] C.C, Mercedes, R. Gustavo, W. Marcus, H. Dominic, C.V. Elza S. Ralph B.R. Verónica, "Plasma Deposition of Silver Nanoparticles on Ultrafiltration Membranes: Antibacterial and Anti-biofouling Properties," Chemical Engineering Research and Design, Vol. 94, PP.524-537, 2015.
[15] Wenning, F. Lajun, F. Hui, K. Zhenzhen, G. Meijuan, "UltrafineSilver(II) Oxide Particles Decorated Porous Ceramic Composites for Water Treatment," Chemical Engineering Journal, Vol. 175, PP.592-599, 2011 .
[16] T. Tsuji, K. Iryo, N. Watanabe, M. Tsuji,"Preparation of Silver Nanoparticles by Laser Ablation in Solution: Influence of Laser Wavelength on Particle Size," App. Surf. Sci., Vol. 202, P.P. 80-85, 2002.
[17] S.S. Shaker, "Production of Silver Nanowires from Silver Nanoparticles by Thermal Treatment," Eng. & Tech. Journal, Vol.34, No.2, 2016.
2010.
[18] Abdul R. K. and Dayah N. Raouf, "Preparation of Silver Nanoparticles by Pulsed Laser Ablation in Liquid Medium," Eng. & Tech. Journal, Vol.29, No.15, 2011.

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