Synthesis of SiO_2 – PVA – Gelatine Nanocomposite Membrane by Handling of the Gelatine

Jan Ady[1*], Muhammad Abdul Aziz[2], Siti Nur Seha[2]

[1*,2] Department of Physics, Faculty of Science and Technology, Airlangga University, Surabaya – Indonesia

[*]Corresponding e-mail address: jan-a@fst.unair.ac.id

ABSTRACT. Works for synthesithes of the SiO_2 – PVA – Gelatine nanocomposite membrane has been made by freeze thawing methods and had been done by the notation in their compositions. It was found that optimum elongation at break in about 79.03% and 4851.7 g per sample for its swelling ratio of membrane. This results had obtained by sample in which that composed on the 50.0 wt% of PVA and 32.50 wt% of gelatine in were added to 17.50 wt% of SiO_2 powder in their notation. Therefore, this variations could be uses as a membrane and then by the gelatine handling had been effectively to controlled their mechanical characteristics as well as both of the elongation at break and swelling ratio too.

Keywords: nanocomposite, PVA, SiO_2, gelatine, freeze thawing.

1. INTRODUCTIONS

Nanocomposite is a multiphase solid material where one of the phases has one, two, or three dimensions of less than 100 nanometers (nm), or the structures having nano-scale repeated by distances between different phases that make up the material [1-3]. Ceramic matrix composite is a specimen of the nanocomposite based on ceramic, where it was uses and apply to many field of industries, due to it was having the finely properties as well as a coating or membrane like a thin film [4-6]. In this study was works to synthesis a nanocomposite based on ceramic silicate (SiO_2) with a few added of polyvinyl alcohol (PVA) and gelatine handling to exposed the mechanical properties as well as a membrane. By the freeze thawing treatment in their preparations and looking for its microscopic characteristics that proper as a membrane, by uses some equipments such as FTIR for looking the functional groups [7], PSA uses for looking the particle size distributions [8], and by SEM uses for looking the surface morphology of the membranes [9]. Then going up to the macroscopic characteristic through of the mechanical properties by elongation at break, tensile strength, and ratio of swelling of membranes.

2. MATERIALS AND METHODS

The main materials were used in this works from Merck-7735 for silicate or SiO_2 with purity about 99.0 percents. That are two polymers were used as a filler to the matrix, namely are gelatine and polyvinyl alcohol or PVA. Previously, that is nanoparticle of SiO_2 were formed by means of milling with HEM equipment and then added by two filler inside of the sample. Temperature handling at 95^0C throughout mixed by means of stirred up of the material components and then molded by spread out technique. Finally, obtained its sample of the nanocomposite of SiO_2 – gelatine – PVA and by repeatedly ways were conducted to got many samples identical. The characterization of the microscopic had been verified by PSA to particle size distributions exposes, FTIR to the functional group tracing, and SEM to the morphology of the sample. Furthermore, for their macroscopics characterization are viewed by elongation at break, ratio swelling, and tensile strength.

3. RESULTS AND DISCUSSIONS

Nanocomposite of SiO_2 – gelatine – PVA had been made by means of gradually methods as well as in the preparation of sample with handling of the gelatine and by means of freeze thawing methods. Start off were tracking their particle size distribution of SiO_2 nanopartikel by way of PSA equipment and it was shown in the Fig. 1. Its results has been indicated the particles size distribution of SiO_2 dominantly into the nanometer, as in the (A) record file (27.7% at 68.08 nm) and only a few percentages over than 100 nm, as in the (B) record file (7.3% at 5560 nm). In the other words, this is still not optimum results to getting nanoparticle size for SiO_2. Nevertheless, this is quite good results for physically attempt by HEM treatment [10].

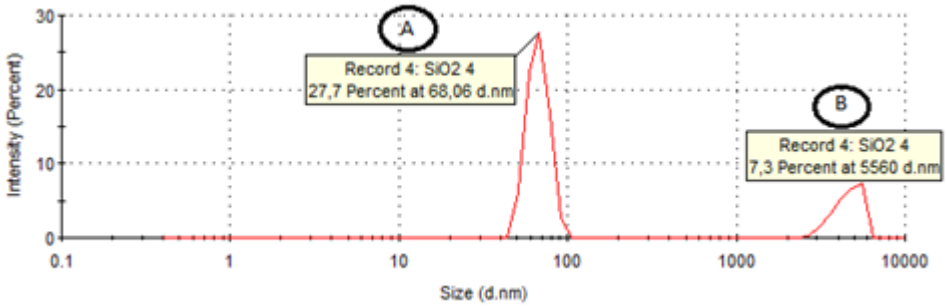

Fig. 1. Particle size distributions of SiO_2 were conducted by milling treatment

Table 1. was shown all the particle size distributions of SiO_2 when it was attemp by HEM treatment. By the file record (A) its results has been appropriated to inside nanometers unit and while it (B) is over than (A).

Table 1. Particle size distribution of SiO_2

Sample	Record peak	Particle size distributios (nm)	Intensity (%)

SiO_2	(A)	50.75	6.3
		58.77	22.3
		68.06*)	27.7
		78.82	16.8
		91.28	2.7
	(B)	2669	0.3
		3091	1.5
		3580	3.3
		4145	5.2
		5560	7.3

***) is a optimum value of particle size of SiO_2**

Functional group of each nanoparticle element of SiO_2 – PVA – gelatine were formed by both of gelatine handling and freeze thawing treatments. The bonding group of O – H indicated to hidroxyl formed and C – H bonding to PVA effects with specific wave number in the range 344.79 cm^{-1} – 3423.65 cm^{-1}.

Table 2. Functional group of sample

Functional groups	Wave number standart (cm^{-1})	Wave number of sample of gelatine content (cm^{-1})			
		10.0 wt%	17.5 wt%	25.5 wt%	32.5 wt%
O – H	3570 – 3200	3446,79	3433,29	3441,01	3423,65
C – H	2990 – 2700	2926,1	2939,52	2939,52	2941,44
C = O	1640 – 1580	1629,85	1631,78	1635,64	1631,78
Si – O – Si	1100 - 1000	1097,50	1097,50	1089,78	1093,64

Bonding group of C = O indicated to gelatine effects with specific wave number in the range 1635.64 cm^{-1} – 1629.85 cm^{-1} [11]. Finally, Bonding group of Si – O – Si indicated to silicate nanoparticle were formed by cross linked effects [12-13]. The details data of functional groups of this sample were listed in the Table 2. and shown in the Figure 2.

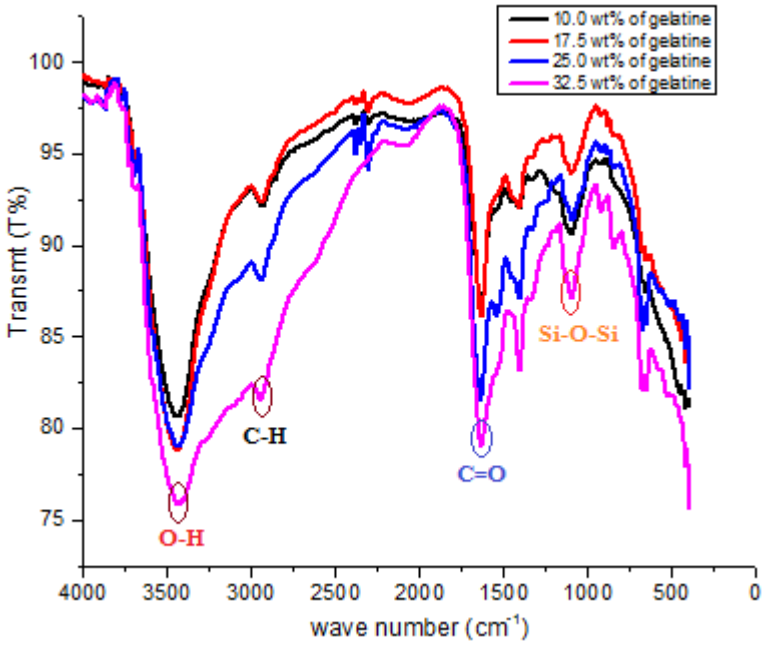

Fig. 2. Functional groups of each sample and by gelatine handling

The surface morphology of all samples under the gelatine handling had been obtained and then it was shown in the Figure 3. Surface roughness for whole samples in Figure 3a. (10.0 wt% of gelatine), 3b. (17.5 wt% of gelatine), 3c. (25.0 wt% of gelatine), and 3d. (32.5 wt% of gelatine) still are seemed. However its shown their roughness tend to decreases with increases of gelatine into the sample. In the other words, that effects of gelatine tend to leverage of the surface morphology of nanocomposite SiO_2 – PVA – gelatine.

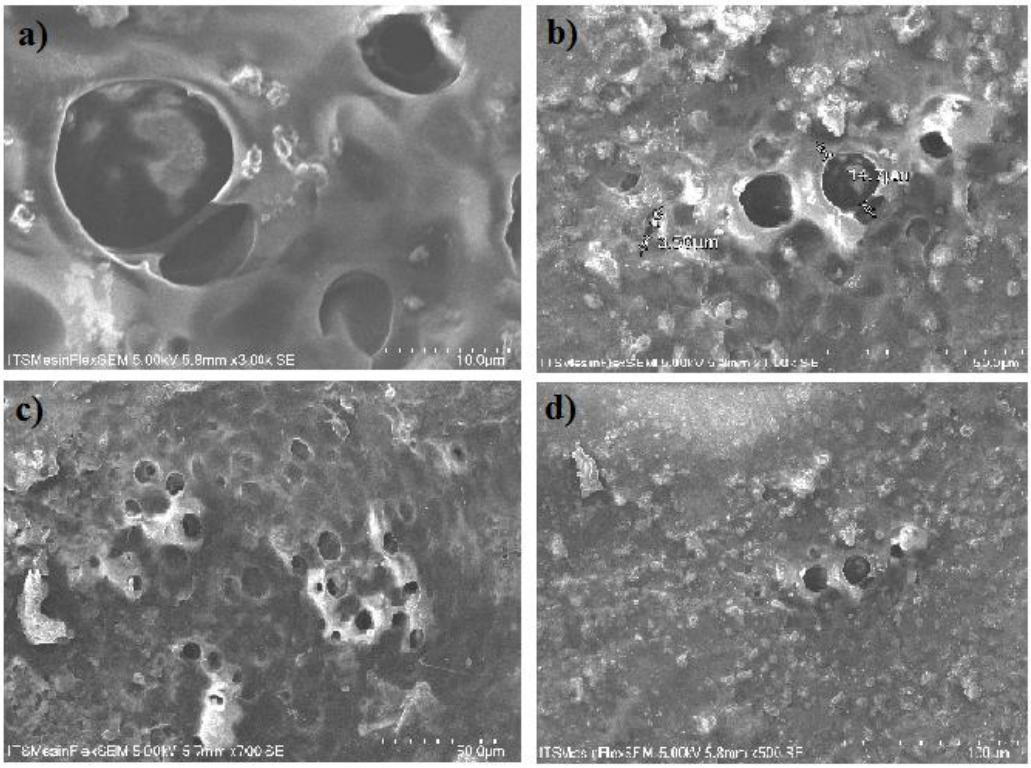

Figure 3. SEM of the all sample a). 10.0 wt% of gelatine, b). 17.5 wt% of gelatine, c). 25.0 wt% of gelatine, d). 32.5 wt% of gelatine

The macroscopic characteristics of nanocomposite SiO_2 – PVA – gelatine have been traced by mechanical properties verified, involve their elongation at break, tensile strength and swelling test. In the Figure 4a). Elongation at break of all samples were detected and tends to decreases with was increasingly of the gelatine contents. Reversely, its tensile strength of all samples tends to increases with was increasingling the gelatine, as well as shown in the Figure 4b).

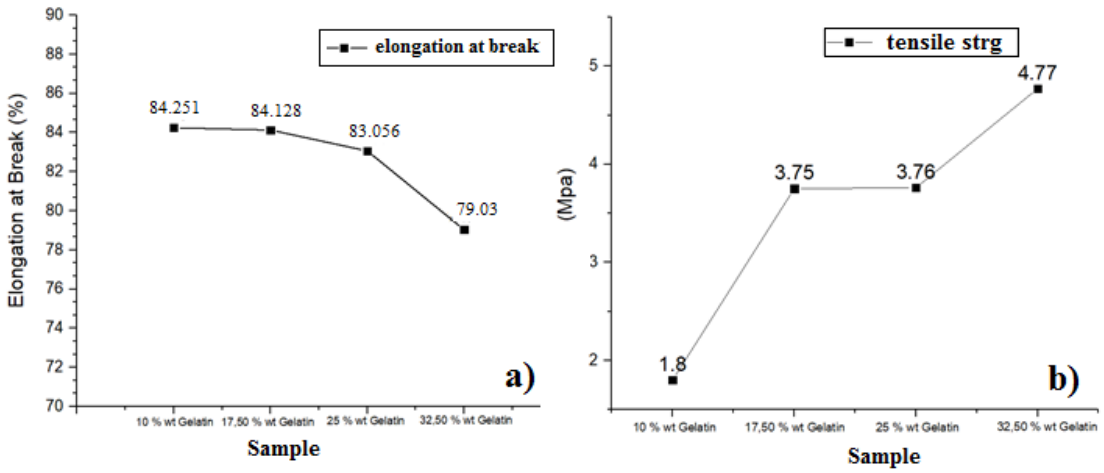

Figure 4. a). Elongation at break and b). Tensile strength of samples

The ratio of swelling of all samples was tracking by absorptions test and it was shown in the Figure 5. It was tends to increses significantly by increses the gelatine and immersion time. This results has been appropriate with elastic properties of samples, where they were indicated to the cross-link occurs at samples inside.

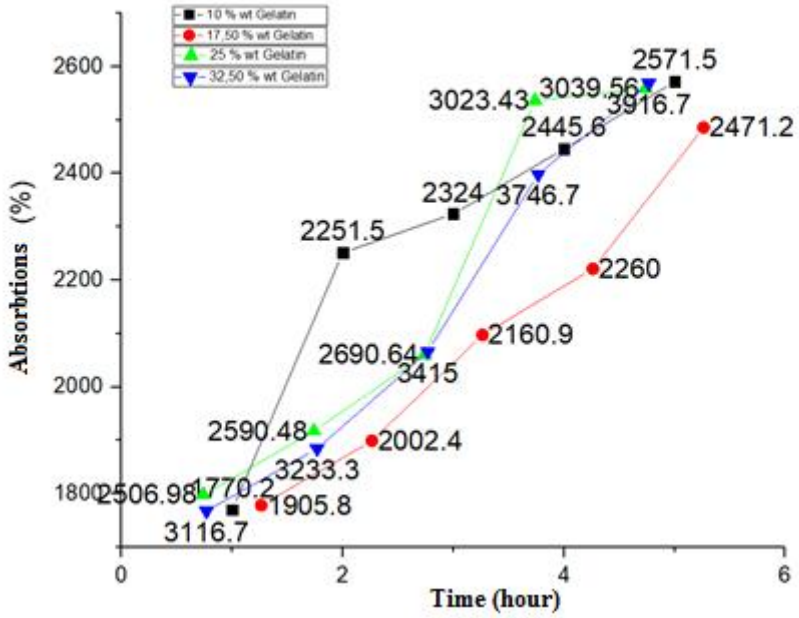

Figure 5. The absorpsion abilities of sample

4. CONCLUSIONS

Overall of this works has successfully made a nanocomposite of SiO_2 – PVA – gelatine with more indicated to gelatine leverage. The freeze thawing technique had been formed and indicated to cross-linked occurs to the sample.

5. REFERENCES

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