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HOMO-POLYACRYLONITRILE REMOVAL AFTER CHEMICAL GRAFTING PROCESS: BY TEA BAG EXTRACTION METHOD

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ABSTRACT

In this study, the homopolymer from the grafting solution between two monomers; acrylonitrile and microcrystalline cellulose was purified using tea-bag method technique. Microcrystalline cellulose (MCC) was used as monomer backbone and the acrylonitrile will graft onto its surface. The result of tea-bag method extraction shows that the homopolymer can be isolate from the mixture of the solution. The residue of homopolymer was visualized using scanning electron microscope. The residue was trapped on the tea bag surface. Also, the physical appearance of the polymer before and after grafting also discussed in this study. The tea bag technique can be used as the extraction method in removing homopolymer after grafting polymer process.

Keywords: *Homo-polyacrylonitrile, acrylonitrile, tea bag extraction method, microcrystalline cellulose, amidoxime, grafting*

1.0 Introduction

The preparation and application of grafted polymer as a potential large-scale polymer-based adsorbent to isolate heavy metals in industrial wastewater. 'Grafting' is a process where the monomers are covalently fused onto the polymer chain backbone, the polymerization of a mixture formulae a coating which adheres to the substrate by the physical forces [1] [2]. The grafting process with two monomers will produce the homopolymer. The homopolymer need to be remove from the mixture in order to obtain the purified grafting materials. A lot of homopolymer removal technique need a very high cost and energy process like Soxhlet extraction process. In this study, the cheapest method was introduced which is tea-bag extraction method for the removal of homopolymer.

2.0 Experimental

2.1 Removal of homopolymer using tea bag extraction method

The grafting of acrylonitrile with microcrystalline cellulose using redox polymerization technique with the initiator i.e ceric ammonium nitrate. However, the grafting process does not result in all materials being combine by the process. The residue or homopolymer in the beaker need to be separate. The homopolyacrylontrile was removed from the grafted polymer, by using tea-bag extraction method [3]. The tea bags used in this experiment were purchased at a pharmacy for laboratory use. The process was carried out by soaking grafted polymer in 200 mL of dimethylformamide (DMF) solution [4]. Prior the process, the grafted polymer was filled in the tea bag (Figure 1). Next, 100 mL of DMF and 100 mL distilled water was poured in a 500 mL Winchester bottle. The grafted polymer was soaked (Figure 3.4) in the solution for 4 hours at room temperature and stirred at 100 rpm. Hence, after the soaking process was completed, the tea bag (Figure 2) was dried in a vacuum oven for 24 hours at 60˚C until a constant weight was obtained.

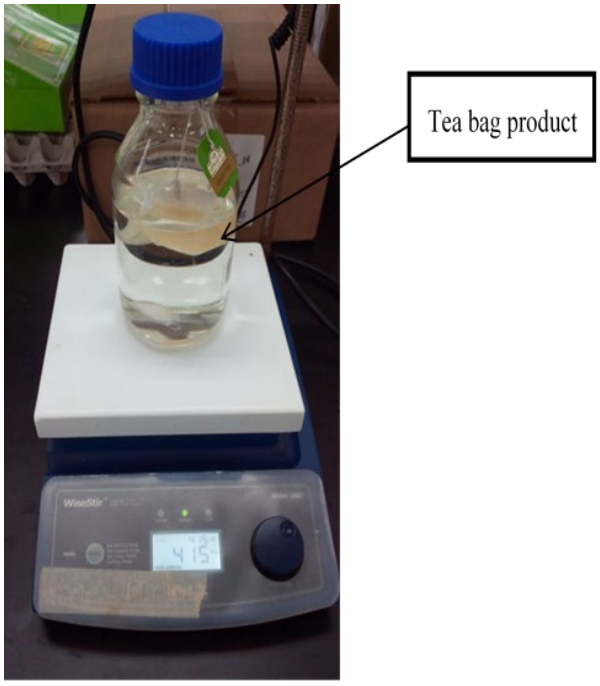


Figure 1: The extraction of homopolyacrylonitrile using tea-bag extraction method (soaking in DMF)

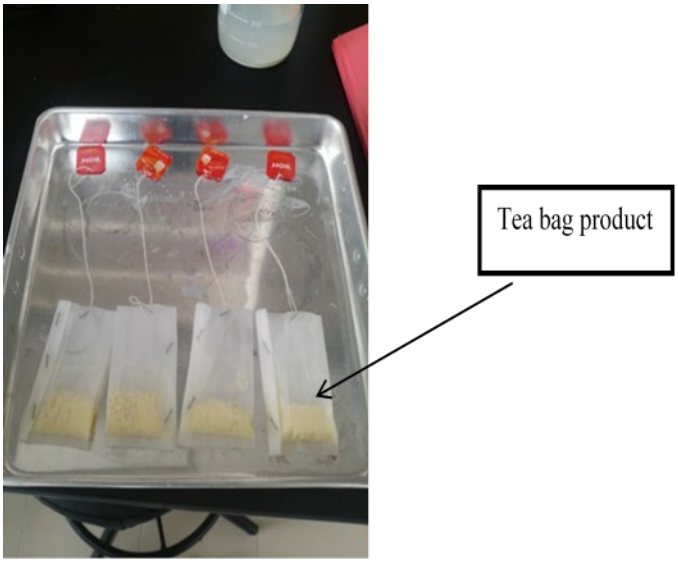


Figure 2: The extraction of homopolymer using tea-bag method (drying process)

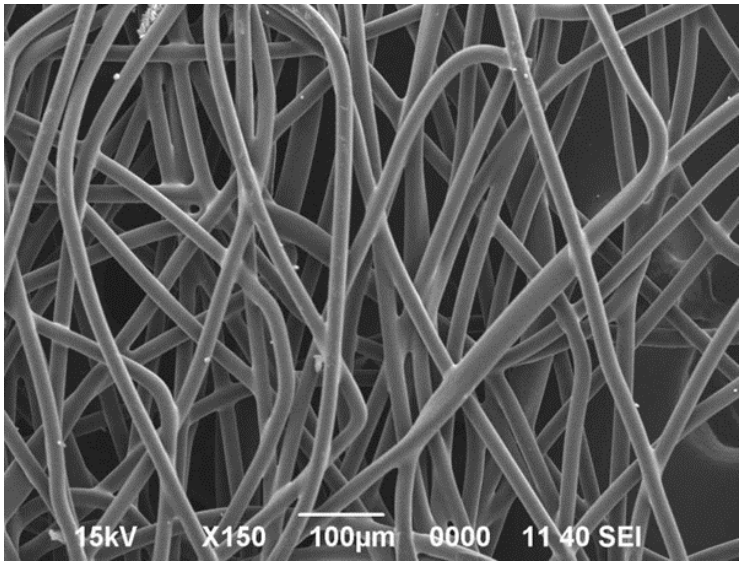
2.1 Scanning Electron Microscope (SEM)

The sample was transferred on SEM stub and sputtered with Platinum/pt. Morphologies of the sample were observed using JSM-6390LV scanning electron microscope (JEOL, Japan) in the magnification range of 500 X to 10,000 X.

3.0 Result and Discussion

3.1 Homopolyacrylonitrile removal using tea bag extraction method

The remain of ungrafted polyacrylonitrile (homopolymers-AN) was removed by using tea bag extraction method. Weights of poly (AN-*g*-MCC), before and after removing homopolymer, were measured in order to calculate final weight of polymer after removing homopolyacrylonitrile. The morphology of tea bag (Figure 3 (a)), grafted materials (Figure 3 (c) and (d)), before and after removing homopolyacrylonitrile, and homopolyacrylonitrile (Figure 3) were analysed using scanning electron microscope (SEM). Figure 3 showed the SEM micrograph of tea bag before extraction process (Figure 3 (a)) which is clear in colour. Meanwhile, the tea bag after extraction process showed the residue of homopolyacrylonitrile that attached on the tea bag surface (Figure 3 (b)). Figure 3 (c) and (d) showed the poly (AN-*g*-MCC) after tea bag method extraction which is clearer with only the grafted material onto cellulose backbone. The free space areas between grafted materials indicated that the rooms left by homopolymer particles (AN) that had been dissolved by dimethyl sulfoxide (DMSO) during tea bag method extraction. The homopolyacrylonitrile can be observed in Figure 4 that showed its rough surface. Similar observations have been reported by Kaewtatip and Tanrattanakul [5]. in their study of cassava starch grafted with polystyrene. Gadhave et al., [6] also show the same remarks in their study on the blend of polyvinyl alcohol and starch.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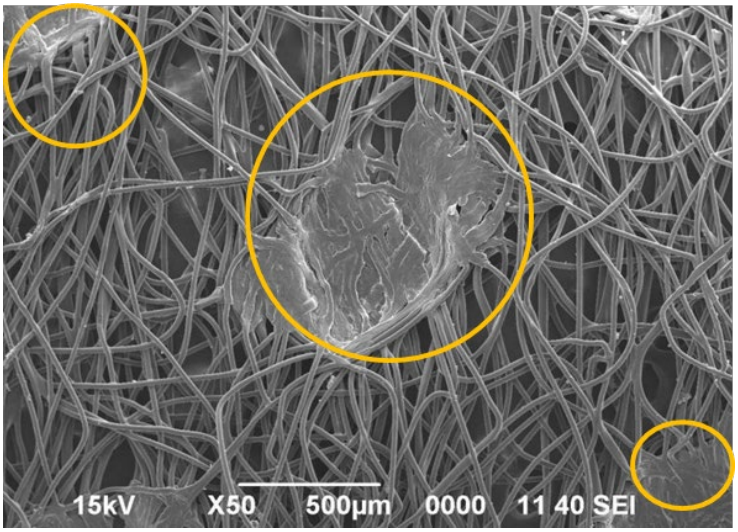
(a)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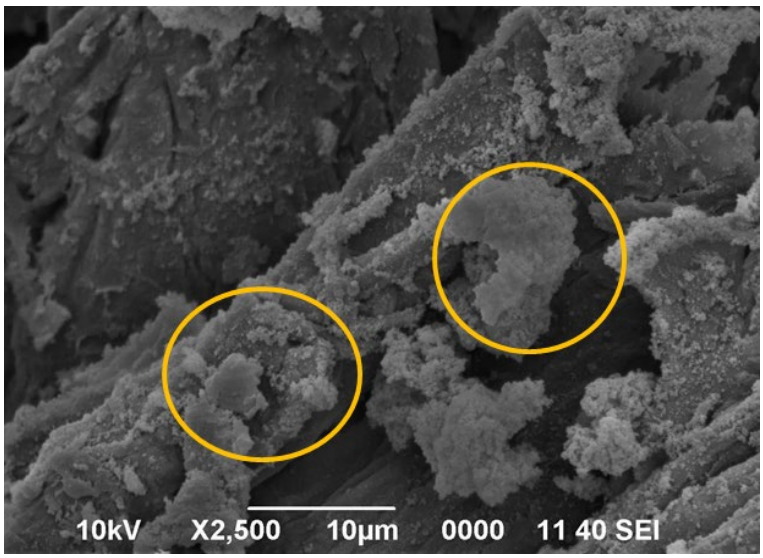
(b)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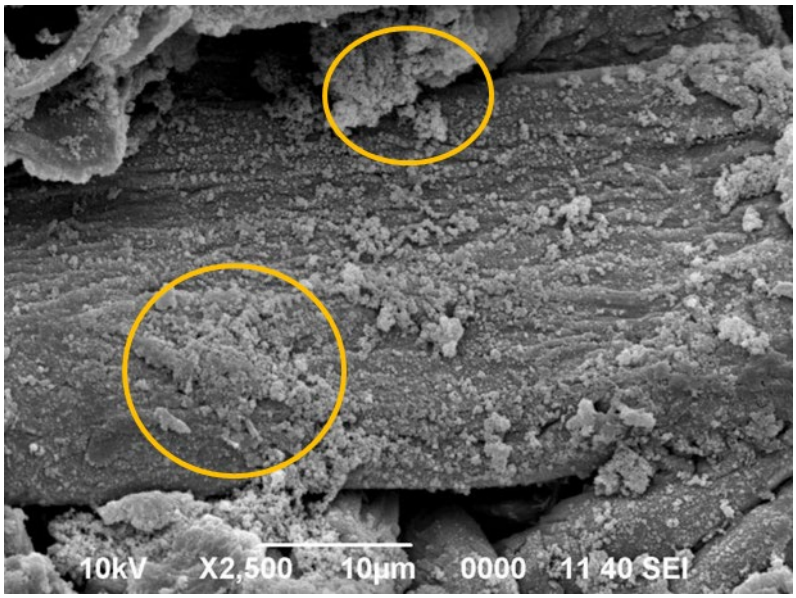
(c)



(d)

Figure 3: (a) The morphology of tea bag before extraction process (b). The morphology of tea bag after extraction process (The circle area exhibited the residue of homopolymer onto tea bag) (magnification between 50 X and 150 x). (c) poly (AN-*g*-MCC) after removal of homopolymer using tea bag extraction method. (The circle area shows the free space area that occupied by AN (homopan) before extraction process) (at magnification 2500X - 10,000 X).

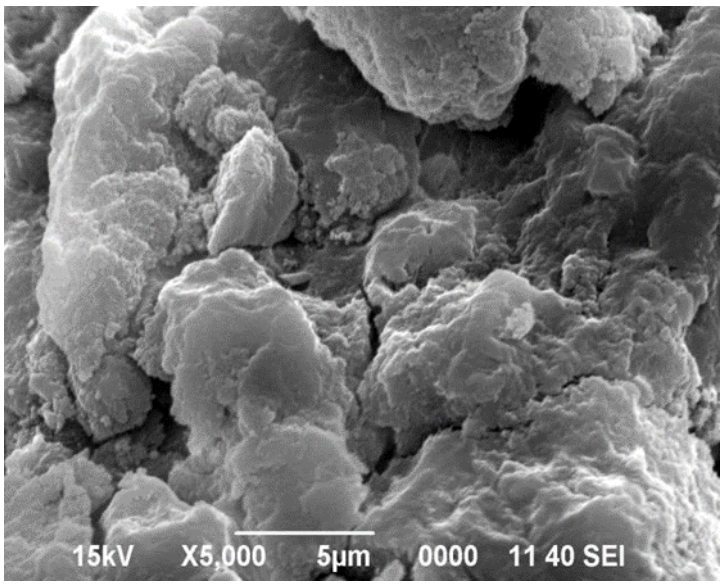


Figure 4: Homopolyacrylonitrile (magnification 5000X).

3.2 Observation on colour appearance of polymer before and after modification of grafted polymer

Figure 5 (a) showed that the colour of microcrystalline cellulose before grafted with acrylonitrile was white and bright. After the grafting process between microcrystalline cellulose and acrylonitrile, the colour of the powder (Figure 5 (b)) became a bit yellowish compared with the sample of cellulose before grafting process. The colour of the powder eventually turned to light brown after the synthesis process with amidoxime (Figure 5 (c)). The difference colour appearance indicated that the grafting was already occurred on the cellulose backbone due to thermochromic chemical modification reaction during polymerisation process. Other than that, the modified polymer also changes it colour because the reaction between the hydroxy groups of microcrystalline cellulose and form a covalent bond [7][8].

Figure 5: The colour appearance of (a) the Microcrystalline cellulose, (b) poly (AN-*g*-MCC) and (c) AO modified poly (AN-*g*-MCC).

1.0 Conclusion

The morphology (scanning electron microscope) of the tea bag shows that the homopolymer from the grafting mixture of acrylonitrile and microcrystalline cellulose was successfully separated. The color of the powder also shows the difference before and after the grafting process. The tea-bag method extraction can be chosen as the method in removing non-grafted (homopolymer) material as it cheap and also reducing the use of chemical elements.

2.0 Acknowledgement

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3.0 References

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