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ICAPMA_2017 Synthesis of nanoparticles Fe3O4/PEG/PPy-based on natural iron sand Pintor Simamoraa, C.S. Saragiha, D.P. Hasibuana, Juniastel Rajagukguka,* aPhysics Department, Faculty of Mathematics and Natural Sciences,State University of Medan, 20221, Indonesia Abstract Magnetic nanoparticles of Fe 3O4/PEG/PPy have been synthesized from natural ir on sand by co-precipitation and ultrasonic treatment method.

The nanoparticles were synthesized using HCl as solvent and NH 3 as co-precipitate. The nanoparticles synthesized at 700C in two different treatments. PPy composites we re variated to obtain the magnetic properties of samples. The measurements that have been done for both samples were XRD (X-Ray diffraction) and SEM (Scanning Electron Microscopy).

The XRD results showed that the samples were having a single phase in Fe3O4 and lattice parameter 8.393Å. Based on the results of SEM, the nanoparticles tends to form rough sperical in shape and distribution particles of Fe 3O4/PEG/PPy A, B, C, and D sample were around 42-50 nm, 48-63 nm, 56-67nm and 49-67 nm. © 2018 Elsevier Ltd. All rights reserved.

Selection and/or Peer-review under responsibility of 3rd International Conference on Applied Physics and Materials Applications. Keywords: Nanoparticles; Fe3O4;

Polyethylene Glycol 6000; Polypirrole 1. Introduction Disposal of liquid waste types including coloring materials into an aquatic environment becomes a serious problem at this time.

Where it will obstruct ultraviolet li ght (UV) into the water and reduce the efficiency of photosynthesis in aquatic plants [1]. Besides that, the most of the synthetic dyes are toxic, carcinogenic (causing cancer) and mutant (genetic mutations). Compared with the type of dye anion, the type of cation is more toxic dyes caused this type easily interact with the surface of the negatively charged cell membrane so that it can easily fit into the cell, thus causing health problems.

Therefore, the waste liquid is containing the type of dye must be sterilized before being discharged into the environment. * Corresponding author. Tel.: +62812-60786247; fax: +6261-66140002. E-mail address: juniastel@yahoo.com P. Simamora et al./ Materials Today: Proceedings 5 (2018) 14970–14974 14971 Several technologies have been used to reduce/remove heavy metals from aqueous solutions such as chemical redox followed by precipitation, ion exchange, membrane pr ocesses, elektrodialysis and adsorption [2].

The main drawback of the deposition is large consumption of reagent, high mud composition and not efesien set of metal ions to used directly back. Cation exchange, membranes pro cesses and electrodialysis process are not economically because of their high operational costs [3]. Of these t echnologies, adsorption is a ve rsatile and cost-effective technique to remove contaminants from the water so that the process is attracting attention in recent years [4].

Currently, the nanotechnology has been us ed in many applications such as energy utilization, industry, sensors and maintenance of the environment [5]. This technology is a quick and effective solution to overcome problems that can not be solved using conventional technology. The nanostructured materials have been widely used to absorb heavy metals from water / wastewater and has proven advantageous as an adsorbent for a very large surface area and short diffusion length, causing in a hi gh adsorption capacity and high adsorp tion efficiency.

In recent years, magnetic separation technology has been widely used in the field of separation and adsorption [6]. Therefore, Fe 3O4 can be applied in the field of the envi ronment, especially used as adsorben t in binding heavy metals or dyes. To obtain Iron Oxide (Fe 3O4) in the nanometer scale, then do some methods such as sol-gel, chemical solutions, sonochemical, solvothermal, freeze drying, hydrothermal [7], laser pyrolysis technique , microwave plasma[8] and coprecipitation method [9].

In this study, the manufacture of magnetic nanoparticles do with menggunakna coprecipitation method because this method uses low temperatures and very simple. Two different treatment will be done to make nanoparticles. However, with this met hod has the disadvantage that nanoparticles have been synthesized to be susceptible to agglomeration, to mi nimize polymer additions it can minimize the occurrence of agglomeration. One polymer that can be used is Polyetilen glycol (PEG 6000).

In this research, it was conducted by making nano Fe3O4 magnetic particles originating from iron sand in the Deli Serdang, North Sumatera. The Iron Oxide nano-particles will be synthesized with polypyrrole (PPy) with coprecipitation method and sonication [10]. Iron Oxide (Fe 3O4) nanoparticles was combined with polypyrrole (PPy) to achieve excellent absorption.

Currently, the polypyrrole (PPy) has attracted much attention due to its unique properties such as have high electri cal conductivity with relative stability good environment, non-toxic, relatively low cost and ease of preparation are advantageous in some applications. For the first time nanocomposite PPy / Fe3O4 used as adsorbent and effectively reduce levels of heavy metals Cr (VI).

Along with the development of nanocomposite technology PPy / Fe3O4 continuously developed. 2. Materials and methodology 2.1. Materials Natural iron sands taken from Buaya River in Deli Serd ang, North Sumatera. Poly pyrrole (PPy) received from sigma-Aldrich, Hidrocloride Acid (Merck 37 %), Amonia Solution (Merck 32%), Polyethylene glycol (PEG 6000) from Merck. Fig 1.

Synthesis Fe3O4 nanoparticles. 14972 P. Simmora et al./ Materials Today: Proceedings 5 (2018) 14970–14974 2.2. Synthesis of Fe3O4 based on natural iron sand by co-precipitation method. The Fe 3O4 nanoparticles through co-precipitation method were prepared by following the procedure.

The first, Natural iron sand was taken from Buaya River in Deliserdang, North Sumatera. The iron sand was synthesized using 250 ml 12 M HCI, stirred for 90 minutes at 300 rpm using ma gnetic stirrer, then filtered using paper filter. Then the filtered iron sands was added 1 mmol of polyethylene gl ycol for 90 minutes. Two glasses of 100 ml 6.5

M Amonia Solution prepared by stirring with 300 rpm at 700C. Until precipitation appeared at the bottom of both glasses. The precipitate materialthen was separated from the solution, washed with aquades until its pH has reached 7, dried it at 100°C for 5 hours, until Fe3O4 nanoparticles powder were obtained as shown in Fig. 1. 2.3.

Synthesis of Fe3O4/PPy nanocomposites The polymerization was carried out in a 500 mL three-necked, round-bottomed flask.

Fe 3O4 (5 g) from the above methods (co-precipitation methods), dispersed in the 300 mL D.I. water and subjected to ultrasonic treatment for 1 h, followed by an addition of pyrrole (Py). The polymerization was initiated by an addition of FeCl 3 (66 g/L) and lasted for 8 h with stirring at 0–50C. The product was washed by D.I.

water and ethanol for 3 times and dried in a vacuum at 550C for 24 h. Based on the type of Fe 3O4 and the amount of Ppy used for the preparation of the composites, Fe 3O4/PPy nanocomposites were named as A (Fe 3O4/PEG, 0 g of pyrrole), B (Fe 3O4/PEG, 2.5 g of pyrrole), C(Fe3O4/PEG, 5 g of pyrrole), D (Fe3O4/PEG, 7.5 g of pyrrole). Fig. 2 shows the structure of Fe 3O4/PPy. Fig. 2. Structure Fe3O4/PPy.

3. Results and discussion The synthesized nanoparticles from natural iron sand that we obtained are black in color shown in Fig. 3 (A) and responsive to external magnetic field. From Fig. 3(B) -(D) the color changes to br own-black. The structures characterization by using XRD are shown in Fig. 4.

It shows that both samples have single phase of Fe 3O4 with cubic spinel structures, and with lattice parameter of 8.393Å. The average particle s size were estimated using Scherrer equation. ?? cos/Bkd ? ? =?? / ? cos? (1) Where d is crystalline size, k is a Scherrer constant, ? is wavelength of the x-ray and B is full width at half maximum (FWHM).

The pattern of bare Fe 3O4/PEG and Fe3O4/PEG/PPy nanocmposites were shown in Fig. 4 where measured by XRD instrument. It can be seen from the XRD pattern that Fe 3O4 diffraction peaks have been maintained well in addtion of PPy and indicates the deposition of conductive polymer layer has no negative influence on the crystaline structure of nano Fe3O4. The particles size calculated using Scherrer equation were 30.44 nm, 41.28 nm, 49.72 nm and 45.89 nm for A until D samples respectively.

Based on these results, it is clearly that the nanoparticles had been succesfully synthesized from natural iron sands us ing this technique.The structural morphology of nanoparticles was observed with high resolution by the Scannig Electron Mocroscope (SEM). The nanoparticles tends to form rough sperical in shape. The diameter was in the range of 100 nm. As shown in Fig. 3(a)-(d). Particles size distribution of Fig.

5(a) varied around 42 nm – 50 nm, (b) varied around 48 nm – 63 nm, (c) varied around 56 nm-79 nm and (d) varied around 49 nm-67 nm. P. Simamora et al./ Materials Today:

Proceedings 5 (2018) 14970–14974 14973 Fig. 3. (A) Nanoparticles Fe 3O4/PEG, (B) Nanoparticles Fe 3O4/PEG/PPy 2.5 g, (C) Nanoparticles Fe 3O4/PEG/PPy 5 g, (D) Nanoparticles Fe3O4/PEG/PPy 7.5 g. Fig. 4. XRD pattern of (A) sample Fe 3O4/PEG (B) sample Fe 3O4/PEG/PPy 2.5g, (C) sample Fe 3O4/PEG/PPy 5g, (D) sample Fe 3O4/PEG/PPy 7.5 g. The values are consistent with the particles size that we calculated using Scherrer equation.

Average particles size of (d) sample is smaller than the (c) sample. This is due to (c) sample was agglomeration as shown Fig. 5(c). The nanoparticles Fe3O4/PEG/PPy composites was also exhibited larger size without changing their sperical shapes. 4. Conclusions Magnetic nanoparticles of Fe 3O4/PEG/PPy have been synthesized from natural iron sand by co-precipitation and ultrasonic treatment method.

PPy composites were variated to obtain the magnetic properties of samples. The XRD results showed that the samples were having a single phase is Fe 3O4, cubic spinel and lattice parameter is 8.393Å. Based on the results of SEM, the nanoparticles tends to form rough sperical in shape and distribution particles of 14974 P. Simmora et al./

Materials Today: Proceedings 5 (2018) 14970–14974 Fe3O4/PEG/PPY A, B, C, and D sample were arround 42-50 nm, 48-63 nm, 56-67nm and 49-67 nm. The nanoparticles Fe3O4/PEG/PPy composites was also exhibited larger size without changing their sperical shapes. Fig. 5. SEM imaging of nanoparticles (a) nanoparticles Fe3O4/PEG,(b) nanoparticles Fe3O4/PEG/PPy 2.5

g, (c) nanoparticles Fe3O4/PEG/PPy 5 g, (d) nanoparticles Fe3O4/PEG 7.5 g Acknowledgements The authors would like to acknowledg e the Directorate of Research and Community Services, the Directorate General of Higher Education that has funded this Prime Re search Universities.

In add ition, authors's gratitude is also adressed to the Rector and Chairman of the Resear ch Institute of the State University of Medan and other related parties that have supported the research until its completion. References [1] J. Hu., G.Chen., I.M.C. Lo., "Water research ; Elsevier 39 (2005) 4528-4536. [2] M. Bhaumik., A. Maity., V.V. Srinivasu., M.S. Onyango., J.of Hazar Mater 190 (2011) 381-390. [3] N.R. Bishnoi, M. Bajaj., N. Sharman and A. Gupta., J. Bio.Tech.

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