Journal of Nanomedicine & Nanotechnology

OPEN ACCESS Freely available online

Review Article

Fabrication of PAN/Fe3O4 Nanofibers: Photocatalysis and Characterization Antimicrobial Properties

Mogomotsi N. Ranku[1*], Omolola E. Fayemi[1,2], Elias E. Elemike[1,2,3]

[1]*Department of Chemistry, Faculty of Natural and Agricultural Sciences, North-West University, Mmabatho, South Africa*

[2]*Department of Material Science Innovation and Modelling, Faculty of Natural and Agricultural Sciences, North-West University, Private Bag, Mmabatho, South Africa*

[3]*Department of Chemistry, College of Science, Federal University of Petroleum Resources, Delta State, Nigeria*

ABSTRACT

The present study aimed at green mediated synthesized iron oxides nanoparticles from peel extracts of pomegranate plant which is of immense medical, biological, and environmental value. The synthesized nanoparticles were characterized by using FT-IR, UV-Visible spectroscopy, SEM and TEM. FTIR revealed OH characteristic peaks at 3271 cm-1 and 1600 cm-1from the plant extract which serves as reducing agent for synthesis of Fe3O4 nanoparticles. SEM showed the morphology of Fe3O4 NPs. Photo catalysis studies reveal that Fe3O4/PAN Nano fibers andFe3O4nanoparticles showed increased efficiency towards the degradation of methylene-blue dye, which proof their potential application in waste water treatment. A synthesized Fe3O4 nanoparticle has degradation efficiency of 71.36 % and the Nano fibers exhibited efficiency of 22.68% towards methylene blue (MB) dye. However, further kinetic analysis of the degradation process put PAN/Fe3O4 Nano fibers at a better correlation coefficient of 0.9239 than the Fe3O4 nanoparticles. The green mediatedFe3O4NPs also exhibit an excellent antimicrobial activity against some selected pathogens conducted by disc diffusion method.

Keywords: Photocatalytic; Antimicrobial; Nano Fibers; Pomegranate; Electro Spinning

Materials and Methods

Pomegranate plant from the community, FeSO4 .6H2O, N, N-Dimethylformamide, anhydrous, 99.8% (DMF), and Polyacrylonitrile (PAN) powder obtained from Sigma-Aldrich chemicals. Equipment such as oven, UVvisible spectrophotometer(Agilent Technology, Cary series UV-vis spectrometer, USA), Fourier transformed infrared spectrometer(Agilent Technology, Cary 600 series FTIR spectrometer, USA, Germany), Transmission electron microscopy (Tecnai G2 spirit FEI, USA), high resolution scanning electron microscope (Zeiss Ultra Plus 55 HRSEM were used to characterize the synthesized nanoparticles, polymer nanofibers and their nanocomposite [1].

Plant was washed thoroughly and the peel was cut into pieces and dried up in an oven for 48 h at 40 °C. The dried peel was then blended to a very fine powder, and 20 g powdered was boiled in 250 ml distilled water. The extract was filtered using vacuum pump filter. About 50 ml of 0.05M FeSO4. 6H2O were adding to 50 ml pomegranate extract drop wisely under continuous stirring. The solution was then heated at 80 °C for some minutes until about 2 h at 40°C. The extract was then centrifuged for few minutes at 4°C at 6000 rpm. The suspension obtained was dried for 30 min at 70°C temperature obtain nanoparticles in powder.

Spectroscopy characterization such as UV-vis was performed on Perkin Elmer Lambda 650 UV-visible spectrometer, and Fourier-transform infrared spectroscopy (FTIR.) The absorbance scans

Correspondence to: Mogomotsi N. Ranku,Department of Chemistry, Faculty of Natural and Agricultural Sciences, North-West University, Mmabatho, South Africa, Tel: +27183892440; E-mail: Omolola.Fayemi@nwu.ac.za

Received: February 15, 2020; **Accepted:** March 02, 2020; **Published:** March 10, 2020

Citation: Mogomotsi MNK (2021) Fabrication of PAN/Fe3O4 Nanofibers: Photocatalysis and Characterization Antimicrobial Properties. J Nanomed Nanotech.12:560.

were run over the wavelength range of 200 to 800 nm. The morphological and size measurement was also performed on scanning electron microscope (SEM), transmission electron microscopy (TEM) characterization were performed. Image J software was used to measure the diameter of the nanofibers and the TEM image of the nanoparticle [2]. Electrochemical characterization of the synthesized nanoparticles and its polymer Nano fibers was carried out by using cyclic voltammetry (CV). Cyclic voltammetry measurements were carried out by using drop sense software driven mini PGSTAT 302. The screen print electrode consists of three electrodes which are Ag/AgCl as reference electrode, counter electrode and a carbon working electrode. The carbon electrode (working electrode) was modified using the drop-dry method. Separate drop of Fe3O4NPs, PAN and Fe3O4/PAN were cast on the electrode respectively and dried in the oven for 2 min at temperature of 50 °C. The voltammogram for the bare and modified SPC electrode were measured in 5 mM potassium hexacyano-ferrate (III) (K3Fe (CN)6)solution prepared in 0.1 M phosphate buffer solution (PBS) as a supporting electrolyte [3].

According to Garg, Singh, and Raja, (2017) organizational climate represent employees' perception of organizational policies, practices and procedures, it is a pattern of interactions and behaviors that support the organization. As noted in some literature, the climate of an organization is as a surface manifestation of culture, it is oriented with human behavior (Ehrhart, Schneider, and Macey, 2013). Organizational climate influence employees' level of commitment in the organization, yet there are very few studies that discuss the extent to which it influences human behavior. This paper agrees that organizational climate forms the thread of labyrinth of ideas that galvanize the relationship among employees that give meaning of what people do in an organization which determines the extent to which they are willing to work. Some characteristics of organizational climate is that it is rule oriented, strict procedures and perception about stability or instability. The measuring of organizational climate in the journal of Contemporary Criminal Justice (2019), begins with series [4].

Professional Biography

Omolola Esther Fayemi has her expertise in synthesis, characterization and application of nano-based materials through both chemical and green mediated synthesis [6]. The synthesized nanomaterials are applied in electrochemical sensors for analytes in biological and environmental medium and also for wound dressing. She is very passionate about her work. She has postgraduates and postdoctoral fellow under her leadership. She is a young researcher having collaborations with scholars in local and internationally institutions [5].

REFERENCES

1. Amzat I, Ni Z, Hu Y, Liang W, Ou C, He J, et al. Clinical characteristics of coronavirus disease in China. N Engl J Med. 2020;382(18):1708-1720.
2. Arent D, Chen X, Cai Y, Xia J, Zhou X, Xu S, et al. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. JAMA Intern Med.2020;180(7):934-943.
3. Baron-Cohen S, Masci PG, Ahmadi N, Tondi L, Koutli E, Aimo A, et al. Predictors of adverse prognosis in COVID-19: A systematic review and meta-analysis. Eur J Clin Invest. 2020;50(10):e13362.
4. Bowman P, Johnson SR, Fraenkel L, Arasaratnam RJ, Baden LR, Bermas BL, et al. American college of rheumatology guidance for the management of rheumatic disease in adult patients during the covid-19 pandemic: version 2. Arthritis Rheumatol. 2020;72(9):e1-e12.
5. Canzona J. Covid-19: Remdesivir has little or no impact on survival, WHO trial shows. BMJ. 2020; 371(1):m4057.
6. Colarelli SM, Senefeld JW, Klassen SA, Mills JR, Johnson PW, Theel ES, et al. Effect of convalescent plasma on mortality among hospitalized patients with covid-19: initial three-month experience. MedRxiv Prepr Serv Health Sci. 2020;3(1):25-33.