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Using Reduced Graphene Oxide To Remove Lead From The Environment

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Using reduced graphene oxide to remove lead from the environment

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ABSTRACT

The current study aims to evaluate the adsorption process of the lead element in aqueous solution by means of nanomaterial (reduced graphene oxide) that was prepared from the reduction of graphene oxide GO prepared by the Hummers method “nanomaterial was diagnosed (rGO) and to study its properties and characteristics by means of a scanning electron microscope (SEM) and a microscope. Atomic force (AFM). results showed that the percentage of removal of the element increased with increasing time, and as the results recorded that The highest adsorption was at a concentration of 100 mg of elemental lead. This indicates that the removal rate decreases with increasing the initial concentration of the adsorbent .

1. Introduction

Environmental pollution is at present one of the most serious problems that have found great interest worldwide **(Cdijovic et al., 2010)** The high level of pollution with heavy metals such as chromium, cadmium, lead and others is a problem that threatens the entire ecosystem **(Gradinaru et al., 2011)**. Considering that lead is a very toxic metal that has widespread use and causes great environmental pollution, Sources of exposure to lead include mainly industrial, food, smoking and local sources, as well as sources of lead, gasoline, and home paint **(Thurmer et al., 2002)**. Different treatment methods have been used for these minerals to reduce the percentage of pollution resulting from them. One of the

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most important methods is the use of nanomaterials as a adsorbent to remove these minerals **(Ahmed and Miqat, 2017)**. Nanoparticles have been used in various forms in many fields, including electronics, energy technology, and others **(Lin et al ., 2010)**, but studies on the use of graphene oxide in the treatment of heavy metals are very few, and therefore **this study came to aim** at The use of nanoscale graphene oxide to treat lead from the environment.

2. Materials and methods

- Graphene oxide is prepared by Hummers Method **(Marcano et al, 2010)**
- Graphene oxide reduction: The reduction of graphene oxide was performed by using Ascorbic acid **(De Silva et al., 2018)**

2-1- Diagnosis of Reduced Graphene Oxide (rGO)

Reduced graphene oxide is diagnosed using various techniques such as SEM, AFM.

2-2- Heavy metal (lead) concentration preparation

0.1 g of the toxic element oxide (lead oxide) was prepared and dissolved in 1000 ml of distilled water, then the following dilution was prepared: (100,200,300)) mg / liter of the element lead.

2-3- Experiment of removing heavy metals with nanomaterials

250ml flasks were prepared and lead was added at a concentration of 10,20,30 (PPb), then the volume was completed to 100ml and the pH was adjusted to 6. The solution was distributed in tubes of 10ml, then the nanomaterial was added with a weight of (15, 10, 15 mg), as it was added individually to the tubes and 4 replicates were made for each weight.

2-4-Statistical analysis

The results were analyzed statistically with ANOVA-tow way program. Figures and tables were drawn in Excel program

3. Results and discussion

3-1SEM analysis of rGO reductase graphene oxide :

Surface studies of the shape and size of rGO samples were performed by scanning electron microscopy (SEM) to discover GO reduction with ascorbic acid and rGO (rGO). The results were well reduced in graphene oxide GO with ascorbic acid. After reduction, the reduced graphene oxide rGO appeared as crumpled nanoparticles. The results are consistent with previous studies **(Havener et al ., 2011;Abdolalhad et al., 2013)**

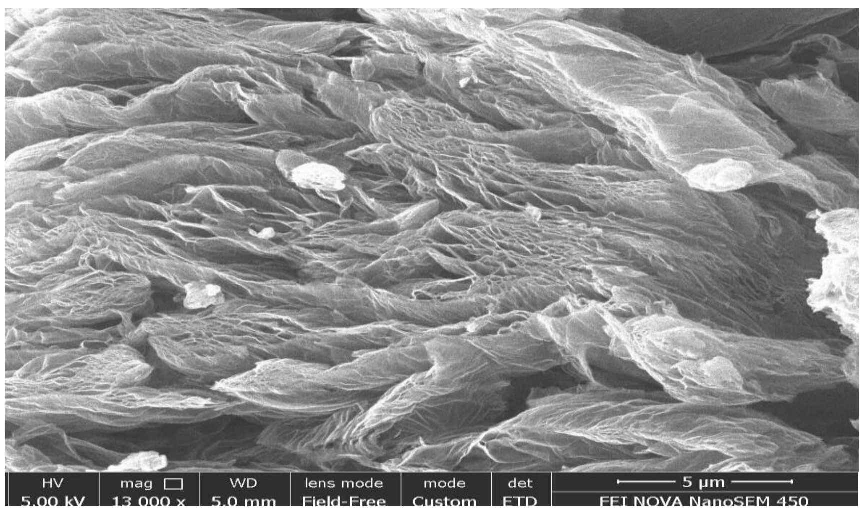


Figure (1): SEM micrograph for fabrication of rGO nanoparticles resulting from the reduction of graphene oxide with ascorbic acid was a multi-layer crumpled nanoparticle shape of 13000X magnification and 5kv voltage

3-2 AFM analysis of rGO reductase graphene oxide

The AFM image of rGO nanoparticles was synthesized by GO reduction of graphene oxide with ascorbic acid, which gave information about the shape of the rGO nanoparticles and the mean diameter and roughness. AFM analysis revealed the three-dimensional shape and average diameter of the nanoparticles. nm) and the AFM image distribution indicated that the rGO grain size was 129.53 nm. (Gurunathan et al., 2014b) showed that LAA-rGO was thicker than GO.

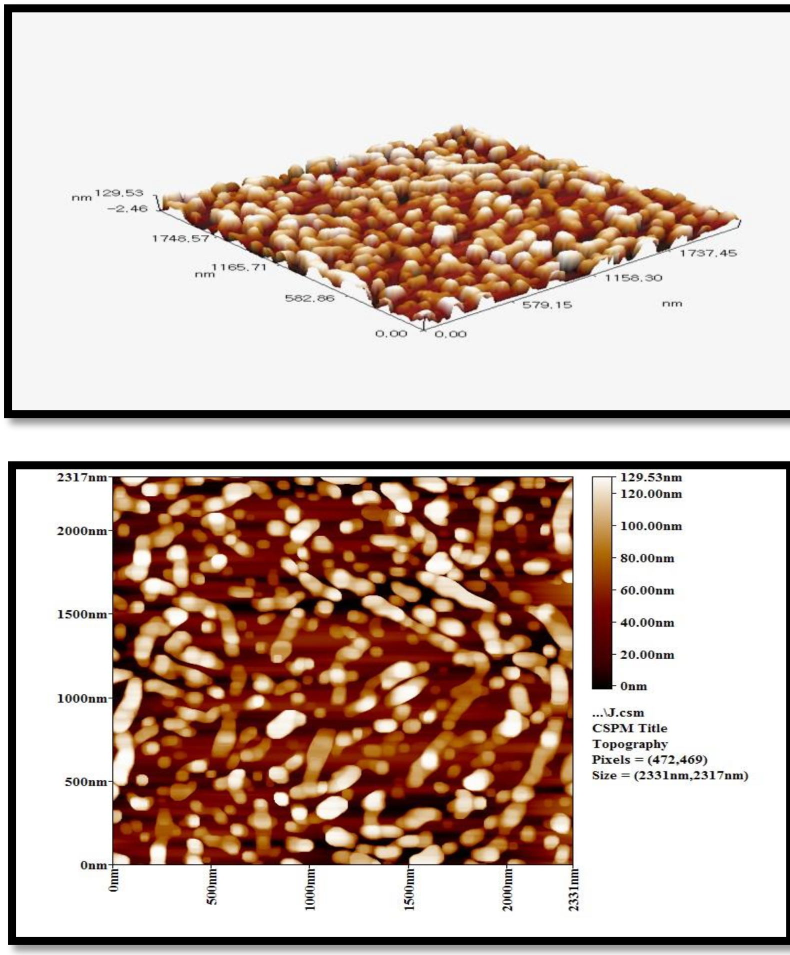
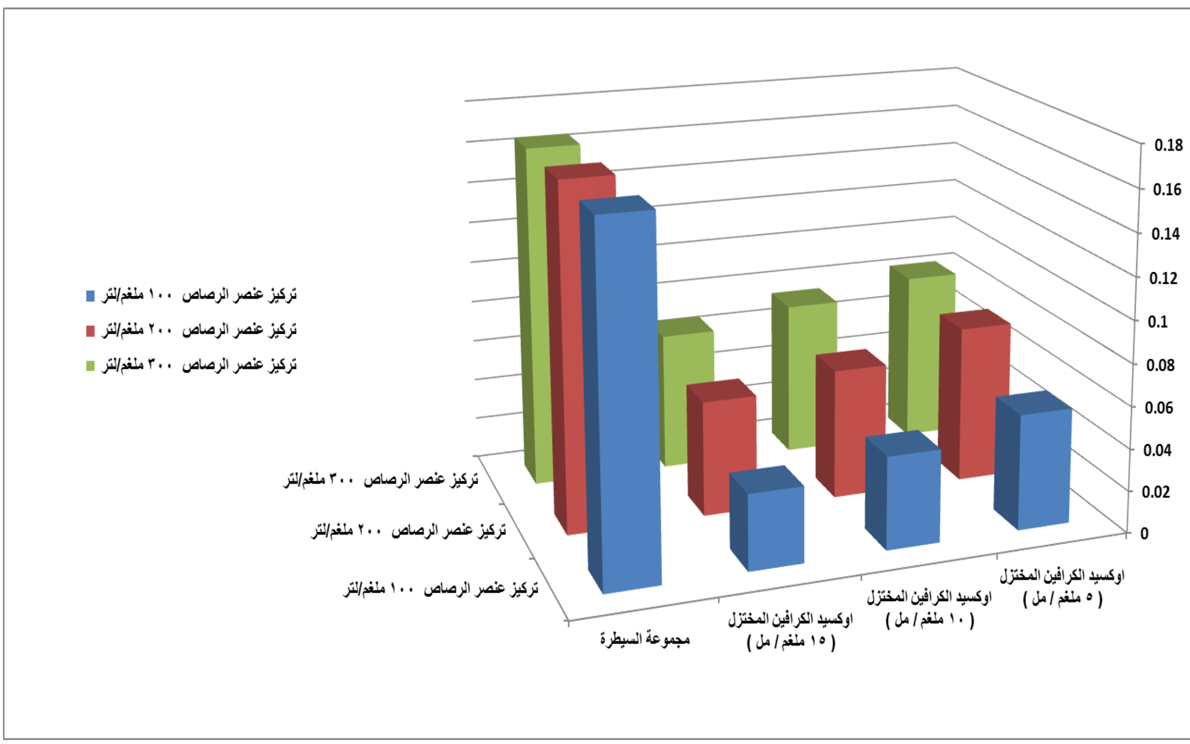


Figure (2) : Atomic force microscopy analysis of reduced graphene oxide resulting from GO reduction with ascorbic acid showing three dimensions of nanoparticles.

Variation of the ability of graphene oxide (rGO) to remove heavy metals (Pb, As, Cd) from their solutions. Lead (Pb) at concentrations of (100,200,300) mg / liter.

Table (1) and figure (3) showed that graphene oxide (rGO) in all its concentrations 5,10,15) has the ability to remove elemental lead at concentrations of 100,200,300 , where the highest removal of nanocarpine oxide was in a concentration of 15 mg and the lowest removal was at a concentration of 5 mg.

P value	LSD	Control group	Graphene oxide 15mg / ml	Graphene oxide 10 mg / ml	Graphene oxide 5mg / ml	The nanoparticle / Heavy elements	ت
0.0002	**0.0032**	**0.1647 L**	0.03575 h	0.044 D	0.055 A	**Lead 100 mg / L**	**1**
0.0002	**0.0032**	**0.1647 L**	0.055 j	0.06225 E	0.0755 B	**Lead 200 mg / L**	**2**
0.0002	**0.0032**	**0.1647 L**	0.0665 k	0.0745 F	0.0825 C	**Lead 300 mg / L**	**3**
			0.00003	**0.00003**	**0.00003**	**P value**	



Figure(3): Results of the efficacy of reduced graphene oxide ((rGO) at concentrations of (5, 10, 15) mg / ml in removing elemental lead at concentrations of (100, 200, 300) mg / liter.

The results of the statistical analysis showed that when the concentrations of nanomaterials (reduced graphene oxide) increased, this would lead to an increase in the percentage of removal, as it was observed that the highest percentage of removal was at a concentration of 15 mg of reduced graphene oxide, and the reason for this is due to the increase in the concentration of the nanomaterial will Increase its surface area, and thus its adsorption capacity becomes high **(Thomes and Raja., 2006).**

These results are consistent with previous studies **(Kanel et al., 2005) (Kumar et a, 2014)**.Through the results of the current study, it was also observed that the highest adsorption was at a concentration of 100 mg / L of elemental lead. These results are consistent with previous studies **(Sharma et al., 2015) (Mustaqeem et al., 2015)**, which means that the percentage of removal decreases with increasing the initial concentration. For the adsorbent .

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