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Using nanotechnology to removal of pollution from water

Firas Ali Hussein Alhameedawi
University of Al Qadisiyah, college of Science, IRAQ, mohammadchellab@gmail.com

ARTICLE

Using Nanotechnology to Removal of Pollution from Water

Firas A.H. Alhameedawi

University of Al Qadisiyah, College of Science, Iraq

Abstract

In order to refinery the polluted water, there are some method that Nano filter be presented to this issue recently. In this research FEM analysis be applied to simulation of refinery with Nano filters. There were four Nano filter to refinery of nanoparticles in water that are zeolite, Nano carbon, nanotube and Nano magnet. Generally the Nano filter with each material has performance the 80 % up that are suitable to refinery of water. But Nano magnet and Nano zeolite has the best performance in comparison with other nanomaterial. Cavity of Nano filter should be small to better absorption of nanoparticles. But this issue need to cost that should be applied to specified case.

Keywords: Nanotechnology, Nano filters, Refinery, Nanoparticles

1. Introduction

Nano is one of the measurement scales that have -9 powers in calculations. For example 2 Nanometres is means 2×10^{-9} meter. Technology in this scale called to nanotechnology [5]. Nanotechnology refers to variation of matter on an atomic, scale. This issue has importance to many industries. In fact, nanotechnology discussed about comprehensive and applying the new properties of materials and systems in such dimensions that they exhibit new physical effects - largely influenced by the predominance of quantum properties over classical properties [6]. Nanotechnology is a highly interdisciplinary science and is also concerned with disciplines such as materials engineering, medicine, pharmacy and drug design, veterinary medicine, biology, applied physics, semiconductor tools, supramolecular chemistry and even mechanical engineering, electrical engineering and chemical engineering [1]. In a research particle size characterized with term nanometer. So the first system of classification developed with particle size basing that is the first nanometer system basis on nanotechnology that has applicable in separating the nanoparticles [3]. A more generalized description of nanotechnology was subsequently established by the National Nanotechnology Initiative, which defines nanotechnology as the manipulation of matter with at least one dimension sized from 1 to 100 nm Nanotechnology and nanoscience got a boost with two major developments in1980s: the birth of cluster science and the invention of the scanning tunneling microscope (STM). Major current tools for nanotechnology measuring include many devices such as STM, scanning probe microscopes (SPMs), atomic force microscopy (AFM) and molecular beam epitaxy (MBE). Di-agnosis of particles at the nanoscale level contributed extensively to the66production, modification and shaping of structures that were used in different industrial, health and environmental applications [2]. In order to earning clean water, it need to nanotechnology processes that be done. Different kinds of nanomaterial are applied to water treatment processes. This technology has benefits in regards to remediation, desalination, filtration, purification and water treatment. The main features that make nanoparticles effective for water treatment are: [7].

- More surface area.
- Small volume.
- The higher the surface area and volume, the particles become stronger, more stable and durable.

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- Materials may change electrical, optical, physical, chemical, or biological properties at the Nano level.
- Makes chemical and biological reactions easier.

Current commercial water purifiers using nanotechnology include the LifeSaver bottle, Lifesaver Jerrycan, Lifesaver Cube, Nanoceram, and NanoH_2O [4].

In this research, simulation the nanotechnology to removing the pollution from water is done with FEM software that has innovative in nanotechnology science. It applied the ABAQUS software to this issue.

2. Material and methods

FEM Analysis is done for simulation the nanotechnology in water pollution. At first the part of Nano be drawn (Fig. 1). The material of filter should be determine that several material be applies in this research. The effect of each material be investigate in this research. The filter with paricel be assemble in third step (Fig. 2). At final Nano filter be meshed (Fig. 3).

A particular type of filter used in military situations is to remove chemical contaminants from water, such as a 5-inch-diameter CD holder and one-inch thick. Water is pumped from under a carbon nanotube through the filter and then filtered through another tube. These Nano filters can also prevent small particles of gas molecules from passing through chemical attacks during wars. With the help of new technology in smart filters, each molecule reacts to its environment, interacts with other molecules and exchanges information, resulting in an overall desired result (approximately 65% Nano filtration consumables market).

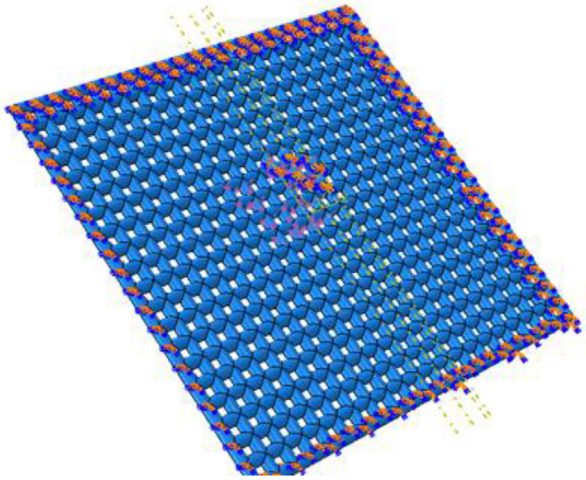

Fig. 2. Assemble the particles and nanofilter.

At Qazvin-Iran Refinery, it has been reported that 4 g/l iron nanoparticles with a diameter of 10–100 nm (average 25 nm) and a specific surface area of 0.31 m 2 g are used to eliminate nitrate. The aqueous media had a very high removal efficiency. Initial concentrations reached 300 to 300 mg/l within 3 h and reached 4–5 mg/l. In this process, pH controlled as a major parameter for nitrate depletion so that no change in nitrate concentration was observed at pH < 4.4 for 3 h. Controlling the pH by acid injection during the reaction in the range of 2–4 increases the speed and efficiency of the reaction. This result be used to validation the simulation that be shown in Table 1.

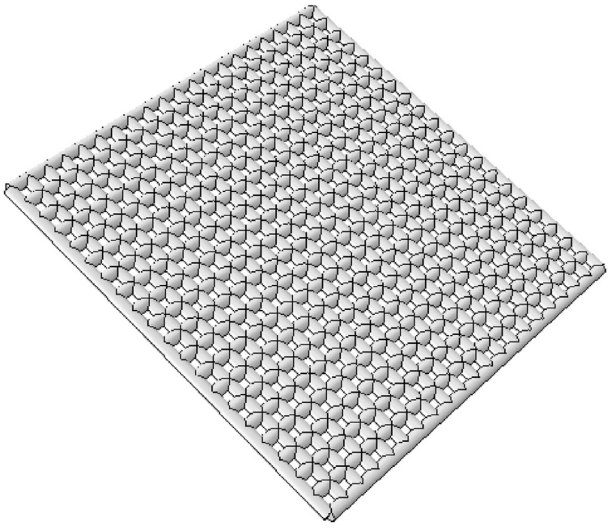

Fig. 1. Part of nanotechnology.

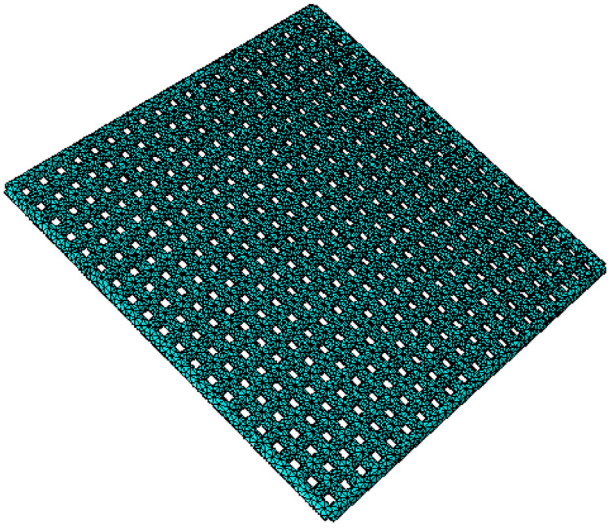

Fig. 3. Meshing the nanofilter.

Table 1. Validation the FEM simulation with experimental data.

Primary specification	Experimental result (Density)	FEM result (Density)
4 gr/Lit Nat ferrous 10–100 nm (avr 25 nm) Primary density = 50–300 mg/Lit	4–5 mg/Lit	4–5 mg/Lit

The results of simulation related to nanofilteration be present in Fig. 4.

3. Results

Due to protect to simulation in validation from Qazvin refinery, the simulation be done to different nanoparticles. In ferrous nanoparticle there was four Nano filter (Zeolite, Polymer, Nano magnet and Nanotube) that performance of each other be present in Fig. 5. Result is that to ferrous nanoparticle the best material to Nano filter is zeolite. This nanomaterial has the best performance in among 4 Nano filters. Variation of nanoparticles be done with aluminium (Fig. 6), cupper (Fig. 7) and carbon (Fig. 8). To Nano aluminium, Nano magnet filtration has the best performance. This result be obtained to Nano cupper particle that Nano magnet has suitable performance. In Nano carbon particles that the zeolite Nano filter has the best performance.

In the case of quadruple filters, they all perform well above 80%, which is generally important for Nano filters. None of the Nano filter has poor performance and is therefore suitable for all cases with a yield above 80% absorption. But in the two cases of copper and aluminum nanoparticles, the performance of Nano magnets was better than the others. It seems that due to their magnetism properties and their better connection, they can absorb smaller particles. On the other hand, both

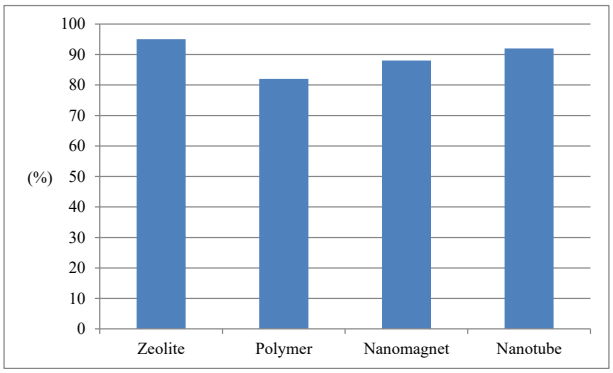

Fig. 5. Performance of Nano filter to water containing Nano ferrous.

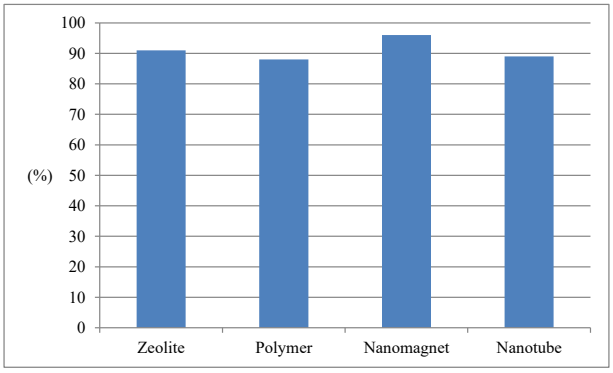

Fig. 6. Performance of Nano filter to water containing Nano aluminium.

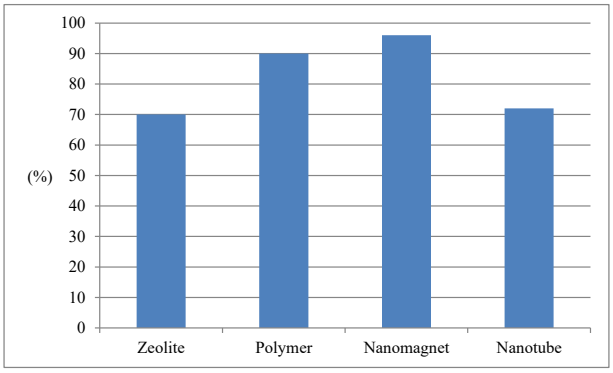

Fig. 7. Performance of Nano filter to water containing Nano cupper.

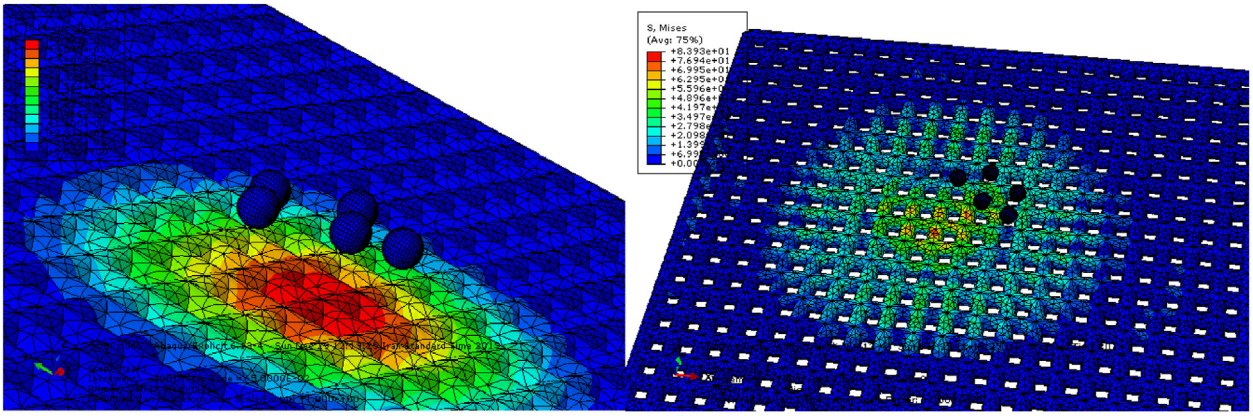

Fig. 4. Filtration of nonferrous.

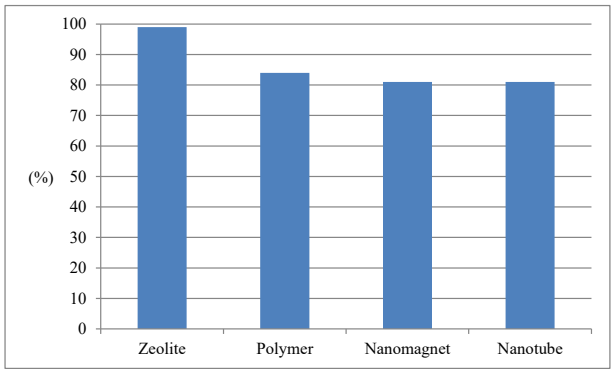

Fig. 8. Performance of Nano filter to water containing nonocarbon.

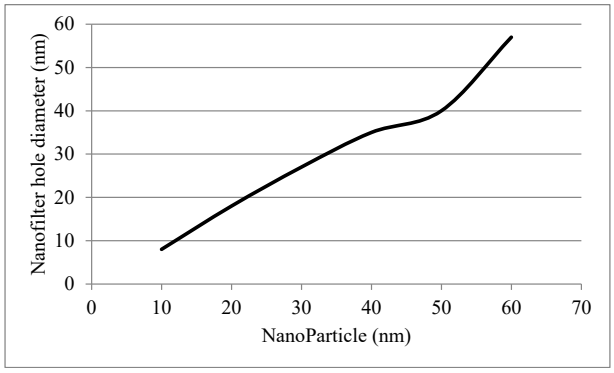

Fig. 9. Relation between Nano filter diameters with nanoparticle to the best performance.

carbon and iron nanoparticles were better absorbed by the zeolite Nano filter, although the Nano magnet also performed well. However, magnetism and zeolite can be considered suitable in the manufacture of filtration. It is recommended that only these two materials be used in Nano filter fabrication if economical.

In other hand, average of nanoparticle diameters has related to Nano filter size. Figure 8 shows the relation between two parameters (see Fig. 9).

However, the direct relationship between Nano filter size and nanoparticle size was almost obvious. If the water nanoparticles are smaller in size, naturally smaller Nano filter is needed to absorb them. It would seem that in the economic design it would be better to produce Nano filter with a larger harp hole in the case of larger nanoparticles, and only in the case of smaller nanoparticles would think of producing smaller nanoparticles, which is naturally more expensive.

4. Conclusion

Due to using nanoparticle in Nano filter production the cavity is so small and has better performance in absorption of nanoparticles. This property is general to Nano filtration. Result that the filtration with nanoparticle has high performance generally. But the nanomaterial has effect in absorption percentage. Nano magnet has the best performance in four properties that be investigated in this research. Zeolite property that has suitable performance to production of Nano filters. But two other property Nano polymer and nanotube has weak performance in comparison with Nano magnet and Nano zeolite, but has upper 80 (%) performance that it result the nanoparticle is suitable to producing the Nano filter to refinery the polluted water. In practicable simple, QAZVIN water refinery shown the excellent performance in refinery of polluted water in this city.

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