Data Article

Data on the optimization of the synthesis of green iron nanoparticles using plants indigenous to South Khorasan

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A B S T R A C T

Green synthesis is a novel method for nanoparticle preparation, which is known as an environmentally friendly technique (Wang et al., 2017a, 2017b) [1,2]. This research was carried out to investigate the use and efficacy of Barberry leaf, Elaeagnus angustifolia leaf, Saffron sepal, and Ziziphus jujube leaf extracts as agents for the synthesis of green iron nanoparticles (GINPs). The studied plants are among the native plants abundantly found in South Khorasan, Iran. The data also show the effect and role of important variables in green synthesis process including Fe to extract ratio, extract heating time, and length of time when Fe-extract solution was mixed under ultrasonic waves. The effects of the mentioned variables were measured by weighing the produced nanoparticle and determining the yield of the prepared nanoparticles. Based on the data, with decreasing Fe to extract ratio, the amount of produced GINPs was increased but the yield of the process decreased. Additionally, extract heating time and ultrasonic mixing time had a significant effect on GINPs yield. Based on the results of transmission electron microscopy (TEM) test, the size of GINPs in all of the plant extracts was about 40 nm and smaller.

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The data presented in this paper illustrate the optimization of the process of green iron nanoparticles (GINPs) synthesis using the Barberry leaf, Elaeagnus angustifolia leaf, Saffron sepal, and Ziziphus jujube leaf, which are native plants abundantly found in South Khorasan province, East of Iran. The optimization parameters include Fe to extract ratio, extract heating time, and length of time when Fe-extract solution was mixed under ultrasonic waves. The data on optimization process are presented in Figs. 1–3. Transmission electron microscopy (TEM) was used to measure the size and shape of the synthesized GINPs. The obtained data are presented in Fig. 4.
2. Experimental design, materials, and methods

All the primary chemicals that were used for the synthesis process were purchased from Merck Co, Germany. The distilled water was used for the preparation of the solution. The pH of the solution was adjusted by adding NaOH and HCl 0.1 N.

For the synthesis of the GINPs, we used BL, EAL, SS, and ZJL extracts as the reducing and stabilizing agents [3,4]. A t first, the leaves and sepal of the mentioned plants were collected from agricultural area around of South Khorasan, Iran. Then, the collected raw agents were washed by distilled water several times to remove the dust and any impurities and dried at room temperature. Afterward, in order to investigate the effect of
heating time, the extracts of BL, EAL, SS, and ZJL were prepared by dissolving 12 g of dry plants powder in 200 ml of distilled water and then heated for different times ranging from 30 to 120 min at 80 °C on a heater magnetic stirrer [5–7]. After the precipitation for 1 h, the extracts were filtered by a vacuum pump. Then, a 0.1 M FeCl₂(H₂O)₄ was prepared by adding 3.98 g of solid FeCl₂(H₂O)₄ into 200 ml of deionized water. The effect of Fe to extract ratio (1:1, 1:2, 1:4) was investigated for all the plants. Accordingly, 100 ml of 0.1 M FeCl₂(H₂O)₄ was mixed into 100, 200, and 400 ml of the extract solution, and then the effect of mixing time was investigated to determine the optimum condition. Afterward, the mixed Fe and extract solution was transferred into an ultrasonic bath for forming a fine and efficient amount of GINPs. At this phase, we investigated the optimum ultrasonic time (30, 60, and 120 min) for mixing the solution. The formation of black colored precipitated material was the sign of GINPs synthesis. The synthesized GINPs were separated through the evaporation on a hot plate and collected through washing by distilled water for several times. Then, in order to dry the material, it was transferred into an oven and kept at 60 °C for 12 h. The nanoparticles prepared at all the phases were weighed and the yield was calculated by Eq. (1):

\[
Y \left( \frac{g}{g} \right) = \frac{\text{The amount of obtained GINPs (g)}}{\text{The amount of Fe in the solution (g)}}
\]

Size and shape of the synthesized green iron nanoparticles were analyzed by TEM.
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Transparency document. Supplementary material

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