Abstract

Nanoparticles are one of the drug delivery tools. They can be used either as drug carriers or as the treatment itself. Using this delivery technique, nanoparticles will minimize the side effects of painful chemical therapy as in cancer cases. Hence, the percentage of the drug uptake will be raised, the bioavailability will be enhanced and the cytotoxicity will be reduced as well.

Several methods have been used to form nanoparticles. One of the simplest ways to form nanoparticles is the chemical reduction reaction in aqueous conditions (the Turkovich method). It is a chemical reaction that occurs between two components. One of them is the nanoparticles precursor, while the other acts as reducing agent. Several researchers change the chemical reagent with natural products that are enriched with reducing agents compounds such as strawberry, cranberry and others. Using this method, which known as green synthesis of nanoparticles, will produce nanoparticles with less toxicity.

In this work, the pomegranate juice and its peels are used as precursor and reducing agent, respectively, to form completely green nanoparticles for the first time. Generally, various concentrations of the pomegranate juice are made followed by adding the peel solution to the juice. The reaction occurred at room temperature and it spent five hours. The absorbance was measured every hour until the reaction ends via UV-visible spectrophotometer. Results indicate that the reaction occurred at two different wavelengths approximately at 408 nm and 513 nm. Using Transmission Electron Microscope (TEM), the presence of the nanoparticles and their actual size will be known. Hence, the conclusion of wither natural products can produce new generation of completely green nanoparticles or not will be drawn.

Introduction

It has been known, without any doubt, that daily consuming natural products such as vegetables and fruits will lower the risk of various serious diseases. Research, done by Max Leenders and his colleagues, ends with a conclusion that the consumption of fruits and vegetables will lower the risk of death [1]. When nanotechnology field began to emerge, scientists have entered a new era of research. They use the nanotechnology tools to improve the limitation of using natural products as a treatment. For instance, curcumin is well known for its antioxidant, anti-inflammatory, and anti-tumorigenic activities; however, when curcumin is used as treatment it shows poor solubility in water and poor oral bioavailability. To overcome of curcumin’s limitation, nanocapsules have been used as carriers for curcumin. When the nanocapsulated curcumin has been used in vivo to treat hepatocellular carcinoma, it shows significant impact to reduce and suppress the cancer cells from growth without harming the normal cells. Thus, the nanocapsulated curcumin can be an alternative anticancer treatment to prevent hepatocellular carcinoma [2].

Other researchers pay attention to the oxidation reduction activities of the natural products. They use these natural products as reducing agents in order to form nanoparticles. This new method, which is known as green synthesis of nanoparticles, reduces the use of toxic chemicals that can harm the environment. Also, the green synthesis of nanoparticle is inexpensive [3]. One of recent researches, done by Tai and his colleague, aims to synthesize “multi-shaped gold nanostructure” using the green synthesis. They used different fruit extracts such as orange, papaya, peach, and lemon as reducing agents to form gold nanoparticles. As a result, gold nanoparticles with different shapes are produced, and they show non-toxic and highly biocompatible results [4].

Although all of previous research tends to use natural products either as a treatment or reducing agent to produce metal nanoparticles, there is no evidence that proves any attempt to use natural products as substrates to produce nanoparticles. This present work aims to design nanoparticles using the completely green synthesis style. It uses pomegranate juice as a source of the particles and the pomegranate peels as a reducing agent.

Materials and Method

This experiment follows the Chauhan and his colleagues procedure because of its simplicity [5]. Three pieces of pomegranate were purchased from grocery (Shoprite), and they were stored in the refrigerator for two days.

a. Preparation of pomegranate juice:

Pomegranate juice (PJ) was obtained via pressing the arils in the blender. Then, it was filtered by Whatman filter paper. The pomegranate juice was diluted into three concentration by deionized water. Hence, three solutions are prepared (100%, 50%, 25%) with 100 ml volume. The other two samples were obtained via centrifugation of 100% pomegranate juice. Thus, sediment and supernatant had been provided two different concentrations.

b. Preparation of pomegranate peels solution:

The peels extract solution (PES) was used as reducing agent. It was prepared in the %10 g concentration. The solution was stirred with magnet for four hours at room temperature. The PES was filtered using Whatman filter paper. Then it was stored at room temperature.

d. Preparation of prospective nanoparticles:

The prospective pomegranate nanoparticles (PPN) were prepared by adding 12.5 ml of PES to 37.5 ml of the pomegranate samples. The reaction occurred at room temperature for five hours. The UV-Visible spectrophotometry was read every hour.

Results and Discussion

UV-Vis spectroscopy is used to track the reaction in the wavelength range 350 nm-600 nm.

The results obtained via UV-visible spectrophotometer assert the occurrence of the reaction at two wavelengths 408 nm and 513 nm. The reaction obviously occurred at two wavelengths as shown in figure 8&9. In order to assert the presence of the nanoparticles and their sizes, TEM results should be obtained.

Conclusion and Further Works

Nanoparticles can be easily generated by the reduction reaction. In this work, purely green nanoparticles are attempted to be synthesized. Although UV-vis results indicate the presence of reaction, TEM results are strongly recommended to advocate the nanoparticles synthesis.

For further works, the antioxidant activity can be measured for the nanoparticles and either they take the pomegranate properties or not. Hence, a recommendation of use these nanoparticles for clinical trial can be made.

References


