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Original Research Article

Green Synthesis of Omeprazole@AgNPs, Omeprazole Sulfide@AgNPs, Pantoprazole@AgNPs and Pantoprazole Sulfide@AgNPs by Using Leaf Extract of Ruta, Pimpinella Saxifrage and Mango

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ABSTRACT

Application of green chemistry for the synthesis of silver nanoparticles (AgNPs) using extracts of takes off of Ruta, Pimpinella saxifrage, and mango. And also a new method to reproduce new drugs based on silver nanoparticles with omeprazole and omeprazole sulfide and pantoprazole and pantoprazole sulfide with extricates of Ruta, Pimpinella saxifrage, and mango. In this investigation, the plant extricate was used to create natural silver nanoparticles. In this reaction, each drug was carried out with silver nitrate salt with a concentration of 30 ml at room temperature, which changes the color of the compound from green to dark. In expansion, within the second step, silver nanoparticles were included within the narcotic, and an advanced metal nanoparticle from the plant extricates as a silver molecule reducer. The retention crest esteem is between 400-450 nm for the extricate and the color alters to dark compared to silver plasmon retention. FT-IR range appeared that drugs were effectively put on the surface of silver nanoparticles.

Keywords: Green chemistry, Silver nanoparticles, Omeprazole, Omeprazole sulfide, Pantoprazole, Pantoprazole sulfide, Ruta, Pimpinella saxifrage, Mango

Introduction

In recent years, much consideration has been paid to the preparation of nanoparticles as a carrier for medicate conveyance. Carrier nanoparticles, with the plausibility of changing their properties, make strides in the execution of the medication and decrease its side impacts [1]. In the manufacture of nanoparticles, various materials such as polymers, metal particles, lipids, etc [2, 3]. are used to transfer the drugs, which can produce a different shapes and sizes of the particles depending on their production method. Nanoparticle-based drug delivery systems have now entered the pharmaceutical market capable of delivering targeted and simultaneous imaging.

Nano is a cognitive and controlling material in the range of 1 to 100 nm, which causes unusual physical, chemical, and biological properties, and allows for new and unique applications [4]. These particles have greatly contributed to the development and improvement of many pharmaceutical products. The nano dimensions in these particles facilitate the easy passage of the biological membrane and affect the cell physiology, by reducing the diameter, increasing the contact surface, and the impact and penetration of these particles [5].

One of the applications of using silver nanoparticles helps with the preparation of wound recuperation and avoidance of contamination, just like the dermal treatments are the infiltration of silver into the wound, absorbed by the epidermal edge of the wound, aggregation within the wound remainders, and eventually the exchange to the fringe circulation framework [6, 7]. Finally, the foremost critical application of silver nanoparticles is as the carrier of the drug and the gene since nanoparticles increase the entry of drugs into the body, deliver synergistic effects against microorganisms, and cause an increment in effectiveness [8].

Pantoprazole ($C_{16}H_{15}F_2N_3O_4S$), first sold under the brand name Protonix, is a medication used for the treatment of stomach ulcers, short-term treatment of erosive esophagitis due to gastroesophageal reflux disease (GERD), maintenance of healing of erosive esophagitis, and pathological hypersecretory conditions including Zollinger–Ellison syndrome [9]. It may also be used along with other medications to eliminate Helicobacter pylori. Effectiveness is similar to other proton pump inhibitors (PPIs). It is available by mouth and by injection into a vein [10].

Ruta (commonly known as rue) could be a sort of strongly scented evergreen subshrubs, 20–60 cm tall, within the family Rutaceae, local to the Mediterranean locale, Macaronesia, and southwest Asia. There are maybe 8 to 40 species within the sort. It is local to the Balkan Landmass. It is presently developed all through the world in gardens, particularly for its bluish clears out, and in some cases for its resilience to hot and dry soil conditions. It is additionally developed as a restorative herb, as a condiment, and to a lesser degree as a creepy crawly repellent. The effective compounds in ruta are alkaloids of acridine, quinozoline, and quinoline [11]. The essential oil of this plant is also used a lot, and the most important composition of the essential oil of the aerial part of the plant is nonan 2-one [12].

The mango leaves are formed in shape, and yellow or red flowers was clustered. Its fruit, called mangoes or mangoes, is circular, sweet and sweet, and includes a generally huge core. Mangoes contain substances such as benzoic corrosive and citric corrosive, which are yellowish. This natural product has approximately 15% tannin. Its center is tall in fat, starch and gallic corrosive. Too, mangoes are wealthy in fiber, and vitamin C, vitamin A. And cancer prevention agents. This natural product moreover fortifies the gastrointestinal tract and the kidneys and avoids frailty or frailty due to its tall press substance. Mango trees develop to 35–40 m (115–131 ft) tall, with a crown sweep of 10 m (33 ft). The trees are long-lived, as a few examples still natural product after 300 years [13].

Experimental

Plant materials and extraction

Plants were collected from Do Sangar village South-West of Rasht city in Guilan province of Iran. The leaf of the plants was dried.

Preparation of the leaf extract

Here, 5 g of the plant fruits with 80 ml distilled water was added and shaken for 48 h at 4°C, in a light-proof box. The samples were centrifuged at 12,000 × g for 10 min at 4°C. The extract was dryer and freezer. Finally, the extract solution was sterilized by 0.22 micron syringe filter and stored at -20°C freezer.

Synthesis of silver nanoparticles

To synthesize silver nanoparticles (SNPs), 5 mL of the leaf extract was mixed with 90 mL of 1 mM silver nitrate solution and heated in a water bath, set at 70 °C for 15 min. a color change from yellow to brown designates the formation of colloidal SNPs.

AgNO3 (99.9%), polyvinylpyrrolidone (PVP), pure pantoprazole and pantoprazole sulfide purchased from Merck. The FT-IR spectra recorded as KBr pellets with a Nicolet IR 100 instrument. The UV-Vis absorption spectra in range 200–800 nm in EtOH measured with a Shimadzu UV-2550 spectrophotometer.

A one-pot procedure for the synthesis of AgNPs whit 4 drugs(pantoprazole, pantoprazole sulfid, omeprazole, omeprazole sulfide) with leaf extract:

A solution of AgNO3 (0.082 g, 0.48 mmol) in ultrapure H2O (10 mL) prepared. To this solution were added 0.03 g PVP in 5.0 mL ultrapure H2O ,and then the mixture was stirred heavily for 30 min in an ice bath. A leaf extract (5 mL) added to the aqueous solution. On complete addition of leaf extract, the resulting mixture further stirred for 30 min at room temperature. Then, solution of pantoprazole (0.331 g, 0.96 mmol) in EtOH (10 mL) added to the reaction vessel, and then the mixture stirred for a further 4 h ,and the color of the solution turned to dark brown. The suspension obtained then centrifuged at 10,000 rpm for 15 min and the precipitate was washed three times with double distilled H2O to remove any water-soluble impurity. After that, To remove excess omeprazole and reducing agent, the precipite was washed three times using EtOH. . The precipite was then dried in an oven at 60 °C for 10 h so the pale black powder obtained. The above reaction was repeated separately for each plant and drug so the results obtained reported.

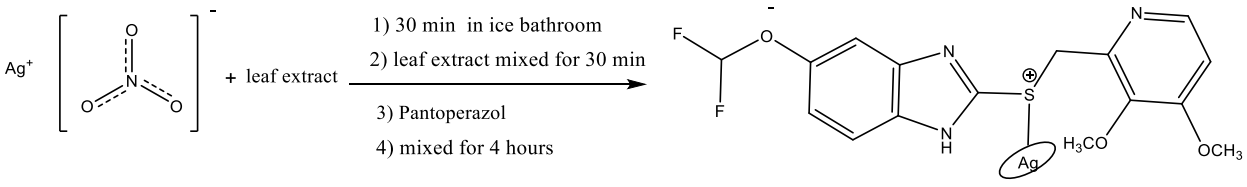

Figure 1. the reaction structure

Characterization of silver nanoparticles

The formation of silver nanoparticles monitored periodically by UV–Vis spectra in a wavelength range of 200– 800 nm at a resolution of 1 nm using Shimadzu spectrophotometer. The FT-IR spectra recorded as KBr pellets with a Nicolet IR 100 instrument potassium bromide

should start as a continuation to introduction on the same page. All-important materials used along with their source shall be mentioned. The main methods used shall be briefly described, with references. New methods or substantially modified methods may be described in sufficient detail. The statistical method and the level of significance chosen shall be clearly stated.

Results and discussion

UV–Vis spectra analysis

The reduction of silver nitrate to silver nanoparticles by the three extracts of (Ruta, Pimpinella saxifrage, Mangoe) with all nano drugs confirmed by measuring the UV–Vis spectrum of the colloidal solution. The silver nitrate solution added to the yellow aqueous leaf extract and heated for 15 min at 70 °C. The color change to black confirmed the formation of silver nanoparticles.

This color change was due to the reduction of Ag+ to Ag° by various biomolecules present in the leaf extract. The absorption spectra of silver nitrate, leaf extract and the silver nanoparticles with pantoprazole recorded and are depicted in table 1.

Table 1. The absorption spectra of Pantoprazole, the leaf extract of Ruta, Pimpinella saxifrage, Mango

extract	Density (mL)	$AgNO_3$ (mM)	Peak of UV-Vis
Ruta	5	1	-
	10		-
	15		-
	5	2	-
	10		-
	15		450
	5	3	-
	10		452
	15		465
Pimpinella	5	1	-
saxifrage	10		-

	15		-
	5	2	462
	10		445
	15		450
	5	3	455
	10		460
	15		450
Mango	5	1	-
	10		-
	15		-
	5	2	-
	10		421
	15		432
	5	3	465
	10		472
	15		455

Table 2. The absorption spectra of omeprazole sulfide, the leaf extract of Ruta, Pimpinella saxifrage, Mangoe

extract	Density (mL)	$AgNO_3$ (mM)	Peak of UV-Vis
Ruta	5	1	-
	10		-
	15		-
	5	2	-
	10		-
	15		450
	5	3	-
	10		452
	15		450
Pimpinella	5	1	-
saxifrage	10		-
	15		-
	5	2	460
	10		455
	15		450

	5	3	465
	10		455
	15		450
Mango	5	1	-
	10		-
	15		-
	5	2	460
	10		455
	15		450
	5	3	465
	10		472
	15		480

FT-IR Spectroscopy analysis

FT-IR Spectroscopy analysis for silver nanoparticles by the three extracts of (Ruta, Pimpinella saxifrage, Mangoe) with Pantoprazole and Omeprazole Sulfide confirmed.

In Figure 2, shows the results of FTIR analyses of silver nanoparticles of pantoprazol by Ruta leaf extract. The Symmetrical and asymmetric aromatic rings of C-C stretching at 1473, 1429 and 1593 cm−1 were observed in the spectrum. also, the stretching vibrations groups S=O and C=N appeared respectively in 1624 , 1201 cm−1. Signals is appearing in areas 1153,1268 and 2830-2949 cm-1 Related to tensile vibrations N-H and tensile vibrations C-H-aliphatic.

Therefore, the emergence of similar signals, along with the displacement in their position and intensity, proves the successful attachment of silver to the drug pantoprazole.

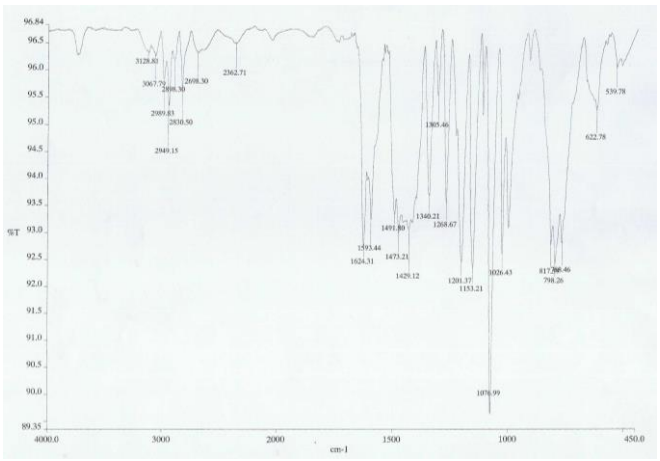

Figure 2. FT-IR Spectroscopy analysis for silver nanoparticles by the three Ruta extract with Pantoprazole

In Figure 3, shows the results of FTIR analyses of silver nanoparticle of pantoprazole by mango leaf extracts. The Symmetrical and asymmetric aromatic rings of C-C stretching at 1473, 1429 and 1593 cm−1were observed in the spectrum. also, the stretching vibrations groups S=O and C=N appeared respectively in 1624 , 1201 cm−1. Signals appearing in areas 1153,1268 and 2830-2949 cm-1 Related to tensile vibrations N-H and tensile vibrations C-H-aliphatic.

Therefore, the emergence of similar signals, along with the displacement in their position and intensity, proves the successful attachment of silver to the drug pantoprazole.

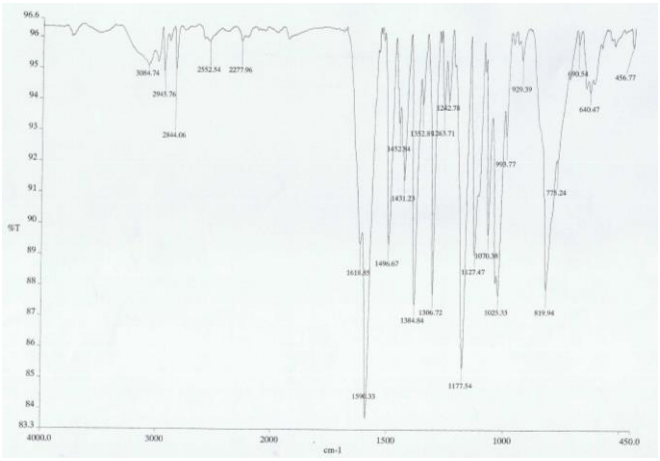

Figure 3. FT-IR Spectroscopy analysis for silver nanoparticles by the three *Mangoe* extract with Pantoprazole

In Figure 4, shows the results of FTIR analyses of silver nanoparticle of pantoprazole by Pimpinella saxifrage leaf extract. The Symmetrical and asymmetric aromatic rings of C-C stretching at 1473, 1429 and 1593 cm^{-1} were observed in the spectrum. so, the stretching vibrations groups S=O and C=N appeared respectively in 1624 , 1201 cm−1. Signals appearing in areas 1153,1268 and 2830-2949 cm^{-1} Related to tensile vibrations N-H and tensile vibrations C-H-aliphatic .

Therefore, the emergence of similar signals, along with the displacement in their position and intensity, proves the successful attachment of silver to the drug pantoprazole.

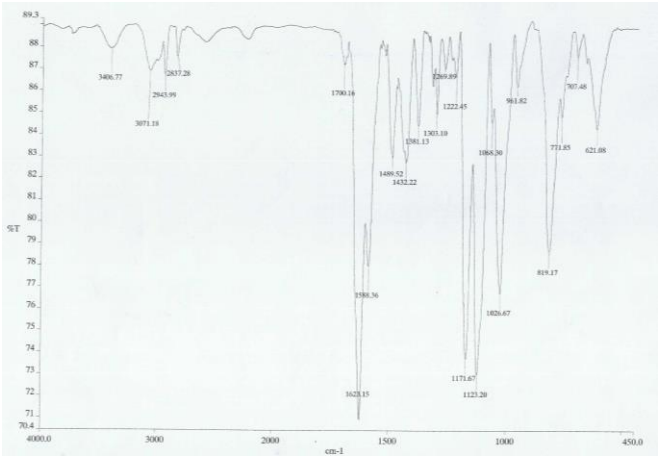

Figure 4. FT-IR Spectroscopy analysis for silver nanoparticles by the *Pimpinella saxifrage* extract with Pantoprazole

In figure 5, shows the results of FTIR analyses of silver nanoparticle of omeprazole sulfide by Ruta leaf extract. The Symmetrical and asymmetric aromatic rings of CC stretching at 1452, 1384 cm^{-1} were observed in the spectrum. also, the stretching vibrations groups S=O and C=N appeared respectively in 1618 , 1203 cm^{-1} . Signals appearing in areas 1107 , 2890-2919 cm^{-1} Related to tensile vibrations N-H and tensile vibrations C-H-aliphatic .

Therefore, the emergence of similar signals, along with the displacement in their position and intensity, proves the successful attachment of silver to the drug omeprazole sulfide.

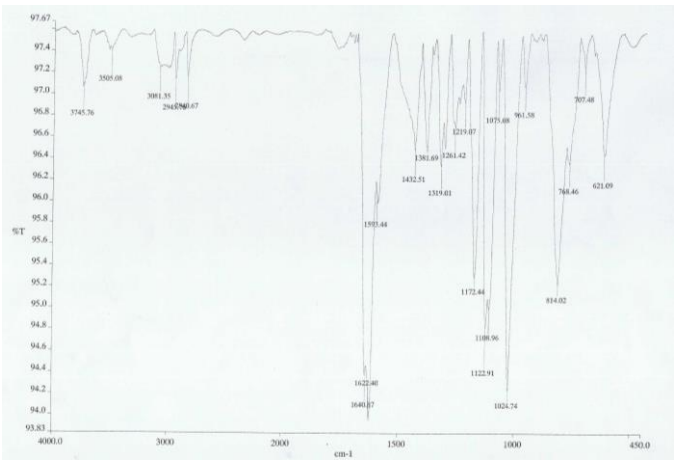

Figure 5. FT-IR Spectroscopy of Ag@Omps with Ruta leaf extract

In Figure 6. shows the results of FTIR analyses of silver nanoparticle of omeprazole sulfide by mango leaf extract. The Symmetrical and asymmetric aromatic rings of C-C stretching at 1473, 1429 and 1593 cm−1were observed in the spectrum. also, the stretching vibrations groups S=O and C=N appeared respectively in 1624 , 1201 cm−1. Signals appearing in areas 1153,1268 and 2830-2949 cm-1 Related to tensile vibrations N-H and tensile vibrations C-H-aliphatic.

Therefore, the emergence of similar signals, along with the displacement in their position and intensity, proves the successful attachment of silver to the drug omeprazole sulfide.

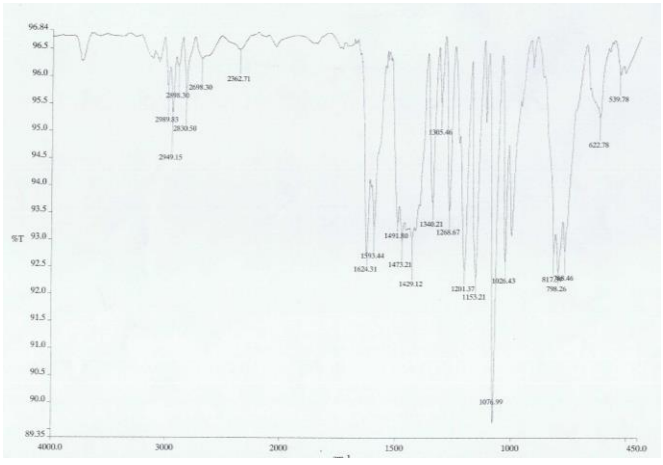

Figure 6. FT-IR Spectroscopy of Ag@Omps with Mango leaf extract

In Figure 7, shows the results of FTIR analyses of silver nanoparticle of omeprazole sulfide by Pimpinella saxifrage leaf extract. The Symmetrical and asymmetric aromatic rings of C-C stretching at 1473, 1491 and 1591 cm−1 were observed in the spectrum. also, the stretching vibrations groups S=O and C=N appeared respectively in 1625 , 1203 cm−1. Signals appearing in areas 1154,1269 and 2831-2949 cm-1 Related to tensile vibrations N-H and tensile vibrations C-H-aliphatic.

the emergence of similar signals, along with the displacement in their position and intensity, proves the successful attachment of silver to the drug omeprazole sulfide.

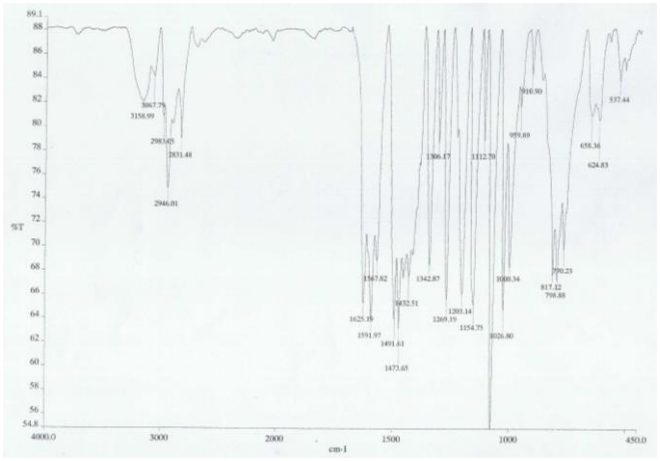

Figure 7. FT-IR Spectroscopy of Ag@Omps with Pimpinella saxifrage leaf extract

Conclusion

According to the reactions, that pantoprazole and omeprazole sulfide performed was between the 4 nano drugs. The reducing agent of silver nitrate to silver ion was plant extract. Pimpinella saxifrage and mango extracts had better performance than Ruta. The use of plant extracts to reduce silver is an environmentally friendly agent.

References

1. Benita, S., Microencapsulation: methods and industrial applications. 2005: Crc Press.
2. Arias, J.L., Nanotechnology and drug delivery, volume one: nanoplatforms in drug delivery. Vol. 2. 2014: CRC Press.

3. Ahmad, M.Z., et al., Metallic nanoparticles: technology overview & drug delivery applications in oncology. Expert opinion on drug delivery, 2010. 7(8): p. 927-942.
4. Kreyling, W.G., M. Semmler-Behnke, and Q. Chaudhry, A complementary definition of nanomaterial. Nano today, 2010. 5(3): p. 165-168.
5. Martirosyan, A., A. Bazes, and Y.-J. Schneider, In vitro toxicity assessment of silver nanoparticles in the presence of phenolic compounds–preventive agents against the harmful effect? Nanotoxicology, 2014. 8(5): p. 573-582.
6. Shahverdi, A.R., et al., Synthesis and effect of silver nanoparticles on the antibacterial activity of different antibiotics against Staphylococcus aureus and Escherichia coli. Nanomedicine: Nanotechnology, Biology and Medicine, 2007. 3(2): p. 168-171.
7. Wong, K., Silver nanoparticles in medicine: is the panacea here. Nanomedicine: Nanotechnology, Biology and Medicine, 2012. 8(6): p. 935-940.
8. Nagal, A. and R.K. Singlab, Nanoparticles in different delivery systems: a brief review. organ, 2013. 1: p. 4.
9. Dabney-Smith, K., et al., Severe esophagitis healed in less than a week with intravenous pantoprazole. Journal of clinical gastroenterology, 2003. 36(1): p. 78-79.
10. Thompson, W., et al., Effect of a proton pump inhibitor deprescribing guideline on drug usage and costs in long-term care. Journal of the American Medical Directors Association, 2016. 17(7): p. 673. e1-673. e4.
11. Rethy, B., et al., Investigation of cytotoxic activity on human cancer cell lines of arborinine and furanoacridones isolated from Ruta graveolens. Planta medica, 2007. 73(01): p. 41-48.
12. Srivastava, S., S. Srivastava, and K. Halwe, New coumarins and limonoids of Ruta graveolens. Fitoterapia (Milano), 1998. 69(1): p. 80-81.
13. Nabhan, G.P. and G.P. Nabhan, Urban Growers and Rare Fruits. Food from the Radical Center, 2018: p. 123-133.

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