International Journal of Life Science Research Archive

ISSN: 0799-6640 (Online)

Journal homepage: https://sciresjournals.com/ijlsra/

(REVIEW ARTICLE)

Check for updates

Glycyrrhiza glabra assisted green synthesis of metallic nanoparticles with different applications: A review

Rakshanda Bairagi * and Shriniwas Patil

Alard College of Pharmacy, Marunje-411 057, PCMC, Pune.

International Journal of Life Science Research Archive, 2023, 04(01), 036–039

Publication history: Received on 23 November 2022; revised on 07 January 2023; accepted on 09 January 2023

Article DOI: https://doi.org/10.53771/ijlsra.2023.4.1.0157

Abstract

Several attempts have been made for green synthesis of nanoparticles of different metals, revealing the significance of plant extract in reducing metal source to nanoparticles and applications in various scientific domains.

This article focus on the applications on licorice root extract in synthesis of nanoparticles of various metals like gold, zinc, silver etc. *Glycyrrhiza glabra* is a general herb of the Asian region belonging to family fabaceae and it is commonly used in the diet. Roots of this plant show range of activities including antioxidant, antimutagenic level. And respective research attempts, this metallic nanoparticles were evaluated for one or more applications like anticancer, antibacterial, antioxidant activity etc.

Use of *Glycyrrhiza glabra* polar extract indicated involvement of its polar phyto-compounds in reducing the metal source as stabilizing the nanoparticles. Inconclusion it could be noted that metal nanoparticles have better antimicrobial, antioxidant, anticancer and nematicidal potential over the aqueous root extract.

Keywords: Licorice; Nanoparticles; Antioxidant activity; Anticancer activity; Green synthesis

1 Introduction

Glycyrrhiza glabra L., also known as licorice root, is a fabaceae family member and common plant. It is also known as Western licorice, and it is said to one of the earliest plants utilized. In the medicinal field. It is popular plant in the Asian region and is widely used in the cooking. The triterpenoid glycyrrhizin contained in it is responsible for its sweet flaour; it is 50 times sweeter than sucrose. Carbohydrate is restricted by the roots, which are long, cylindrical, thick and multi-branched. They are lengthy, cylindrical, thick, and multi-branched, limiting the variety of secondary metabolities such as amino acids, resins, and carbohydrates. The root has a variety of actions, including antioxidant, antimutagenic and cortisol lowering properties. Licorice helps decrease blood cholesterol, improves memory, and act as antidepressant. Until now, licorice has provided approximately 400 different chemical constituents, including approximately 300 flavonoids including chalcones, isoflavones, flavones, flavonols and beyond 20 triterpenoids which have sparked considerable interest due to their structural variety and important bioactivities. These metabolic compounds are widely recognized for their licorice related pharmacological effects. In Indian Ayurveda system, it is also used to treat throat infection, inflammation in eyes and liver diseases. Licorice has antiviral, anticancer, antidiabetic, antiallergenic, and expectorant activities.

A nanoparticles, also known as an ultrafine particle, is a matter particle with a dimension of 1 nm and 100 nm. The phrase is sometimes used for bigger particles with diameters of up to 500 nm, as well as fibers and tubes with diameters of less than 100 nm and just two direction. Nanotechnology has emerged as one of the most exciting and crucial frontier

* Corresponding author: Rakshanda Bairagi

disciplines in recent years, attracting considerable interest from scientists and researchers. Nanotechnology is being used in every scientific discipline, including pharmaceutical engineering, food, agricultural, and biomedicine. In addition bio-imaging and medication delivery, research in other fields like electronics, biology, medical treatment in thriving. Licorice root contain fatty acids (oleic acid, palmitic acid, linoleic acid), minerals (calcium, potassium, silicon, phosphorus, sulphur , iron) , hormones (auxin,gibberllin), dietry fiber (cellulose, hemicellulose) [1].

In licorice root, some chemical constituents are present like Liquiritin, Glycyrrhizin , Glycyrrhetic acid and Isoliquiritin (fig.1)

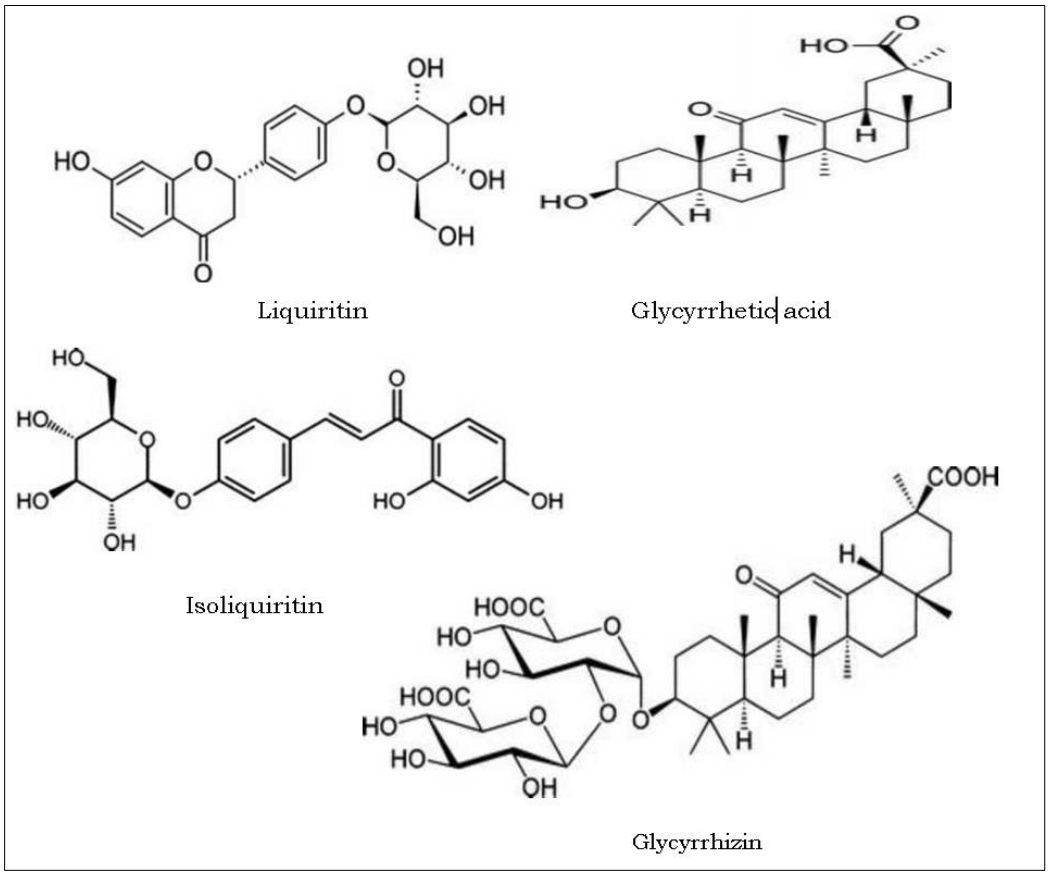

Figure 1 Chemical constituents present in Liquorice

2 Green Synthesis of Nanoparticles

2.1 Gold Nanoparticles

In 2020, Al-Radadi prepared extract from root of a licorice plant. He used $HAuCl_4.3H_2O$ as a donor. The characterizations of Au nanoparticles were done by UV- Vis, FT-IR, SEM, TEM, EDX, XRD, DIS. Then some biological activities like antimicrobial activity, anticancer activity were performed. From antibacterial activity, it was observed that synthesized Au nanoparticles from licorice root extract shows good antibacterial activity against Gram negative bacteria. On evaluation of antifungal activity, it was observed that Au nanoparticles exhibit more active against *P. citrinum* i.e. 21 + 0.21 and less active towards *C. albicans* i.e. 15±0.21. Licorice root extract was highly dangerous against a flavus and least dangerous towards *C.albicans*. Gold nanoparticles used as a good nystatin standard antifungal agent. From anticancer activity, Au nanoparticles used upon MCF-7 (breast cancer), HePG-2 (liver) cell lines by applying MTT method [1].

2.2 Zinc Nanoparticles

In 2020, Al-Shaheen et al. prepared Zinc nanoparticles from licorice root extract. They used $ZnSO_4.7H_2O$ as a precursor. Characterization of Zn nanoparticles was done by UV-visible spectroscopy, FT-IR, AFM, Granularity cumulation distribution etc. Further they studied the effect on Zn NPs on seed germination of Sorghum bi-color of two varieties

(Enkathn and Robeh) via determination of seed germination percentage, shoot length, root length, seedling length and Root-shoot ratio etc at 3 different concentrations of both licorice extract and colloidal solution of Zn nanoparticles (25% ,50% and 75%). About 25 % concentration of Zn nanoparticles show the better shoot length as analyzed with that of 50% and 75% concentration. These two concentration of 50% and 75% show the existence of hairy roots in order to the smallness of roots. About 25% of Zn nanoparticles was tested for toxicity in *S.bicolor* seed priming field. From this work it is observed that Zn nanoparticles can be used for enhancing agricultural efficiency [2].

2.3 Silver Nanoparticles

In 2012, S. Dinesh et. al. tried the green synthesis of Ag nanoparticles using licorice root extract. $AgNO_3$ is used as a donor. Characterizations of Ag nanoparticles were done by UV-Vis spectra, SEM, EDX, XRD, TEM, FT-IR etc. [3]

In 2016, Sreelakshmy et. al. was tried the green synthesis of Ag nanoparticles using licorice root extract and $AgNO_3$ as a precursor. Characterizations were done by UV-Vis spectra, XRD, TEM, FT-IR etc. . FT-IR analysis was execute to recognize the all biomolecules which are present in licorice root which is accountable for capping leading to systematic stabilizations of Ag nanoparticles.

Further researchers performed an activity. The In-vitro antiulcer activity of Ag nanoparticles was evaluated by two methods i.e agar disc method and microbroth diffusion method against *H. pylori*. It is observed that Ag nanoparticles can be used in gastric ulcer therapy [4].

In 2016, another researchers team Osveliaa E. Rodriguez - Luis et. al. synthesized Ag nanoparticles using methanolic extract of licorice roots. The characterizations was done by TEM, Vis- NTR spectrometer, DLS, XRD,FT-IR , TGA. Then they perform antimycotic & antibacterial activities against *Enterococcus faecalis* and *candida albicans* growth. These activities are evaluate by Kirby& Bauer method and cell viability, MTT assays. Ag nanoparticles reduce the bacterial & fungal growth in the absence of remarkable cytotoxic effect on human epithelial cell. According to this, it is observed that Ag nanoparticles can be used to control oral biofilms [5].

In 2016, again another researchers, Kotakadi et. al. tried the green synthesis of Ag nanoparticles using licorice root extract. $AgNO_3$ is used as a donor. Characterizations were done by UV-Vis, FT-IR, XRD, AFM etc. further they studied, microcarrier culture of high quality growth at non identical concentration of biosynthesized Ag nanoparticles. This was the first report of biosynthesized Ag nanoparticles on microcarrier culture of CD 34 positive stem cells. So, human CD 34 positive stem cells grown on Ag which can be useful to treat chronic disease. In regenerative medicine fix up the exhausted and failing organ system [6].

In 2018, Anburaj and Jothiprakashan tried the green synthesis of Ag nanoparticles using licorice extract. $AgNO_3$ is used as a donor. Characterizations were done by UV-Vis spectroscopy, FT-IR analysis, SEM etc. The existence of glabridin which is responsible for antimicrobial efficiency specify by HPLC analysis. HPLC analysis also show the existence of bioactive constituents which is responsible for microbial activity. Inhibitory effect was found to be highest in 400 µl of synthesized Ag nanoparticles in opposition to *Bacillus sp*. (24mm) , *S. epidermis* (23 mm), *P. aeruoginosa* (22 mm) [7].

In 2019, Cai et. al. synthesized Ag nanoparticles from licorice root extract and $AgNO_3$ used as a donor. Characterizations were done by TEM, UV-Vis, FT-IR, XRD etc.they perform antibacterial activity. Water soluble polysaccharides are extracted from licorice root. Which is utilized in photo-induced synthesis of Ag nanoparticles.Acquired Ag nanoparticles were integrate into biopolymeric film of curdlan. Which is the origin of antibacterial biomaterials [8].

In 2022, Kanika Rani Et.al. Using *in vitro* method, they examine the Nematicidal potential of GRAg nanoparticles against *M. incosnita*. They also studied about active uptake of FTIC labelled GRAg nanoparticles by nematode and their effect on selected genes which is involved in oxidative stress and DNA damage. In this hatching inhibition and mortality assays were included. [9]

3 Conclusion

Metal nanoparticles have a very wide range of scientifically proven uses in various fields. To overcome the environmental challenges posed by chemical method and costlier machines, harmful for environment, big requirements in physical method for synthesized nanoparticles. An ecofriendly approach has been developed involving the use of plant extracts for green synthesis of various nanoparticles. Licorice root contain numerous metabolic compounds. Based on this review, it can be concluded that licorice root extracts can be used for green synthesis of nanoparticles of

different metal (silver, gold & zinc) having wide range of applications in various scientific domains, including antimicrobial, anticancer, antimycotic, and photocatalytic activities.

Compliance with ethical standards

Acknowledgments

We, the authors of this review article are thankful to Managerial Board, Alard College of Pharmacy, Marunje, for encouragement and providing library and internet facilities for carrying out this review.

Disclosure of conflict of interest

No conflict of interest.

References

[1] Al-Radadi, N.S., 2021. Facile one-step green synthesis of gold nanoparticles (AuNp) using licorice root extract: Antimicrobial and anticancer study against HepG2 cell line. Arabian Journal of Chemistry, 14(2), p.102956.

[2] Al-Shaheen, M.A., Owaid, M.N. and Muslim, R.F., 2020. Synthesis and Characterization of Zinc Nanoparticles by Natural Organic Compounds Extracted from Licorice Root and their Influence on Germination of Sorghum bicolor Seeds. Jordan Journal of Biological Sciences, 13(4).

[3] Dinesh, S., Karthikeyan, S. and Arumugam, P., 2012. Biosynthesis of silver nanoparticles from Glycyrrhiza glabra root extract. Arch Appl Sci Res, 4(1), pp.178-87.

[4] Sreelakshmy, V., Deepa, M.K. and Mridula, P., 2016. Green synthesis of silver nanoparticles from Glycyrrhiza glabra root extract for the treatment of gastric ulcer. J Develop Drugs, 5(152), p.2.

[5] Rodríguez-Luis, O.E., Hernandez-Delgadillo, R., Sánchez-Nájera, R.I., Martínez-Castañón, G.A., Niño-Martínez, N., Sánchez Navarro, M.D.C., Ruiz, F. and Cabral-Romero, C., 2016. Green synthesis of silver nanoparticles and their bactericidal and antimycotic activities against oral microbes. Journal of Nanomaterials, 2016.

[6] Kotakadi, V.S., Gaddam, S.A., Venkata, S.K., Sarma, P.V.G.K. and Sai Gopal, D.V.R., 2016. Biofabrication and spectral characterization of silver nanoparticles and their cytotoxic studies on human CD34+ ve stem cells. 3 Biotech, 6(2), pp.1-11.

[7] Anbujraj A and Jothiprakasam., 2018. Glycyrrhiza glabra as a potential synthesizer of silver nanoparticles and their mocrobicidal action. Int. J. pharm. Sci . Rev. Res., 51(1): 137-145.

[8] Cai, Z., Dai, Q., Guo, Y., Wei, Y., Wu, M. and Zhang, H., 2019. Glycyrrhiza polysaccharide-mediated synthesis of silver nanoparticles and their use for the preparation of nanocomposite curdlan antibacterial film. International journal of biological macromolecules, 141, pp.422-430.

[9] Rani, K., Devi, N., Banakar, P., Kharb, P. and Kaushik, P., 2022. Nematicidal potential of green silver nanoparticles synthesized using aqueous root extract of Glycyrrhiza glabra. Nanomaterials, 12(17), p.2966.