

Green synthesis of emulsified nutraceutical suspensions of *elettaria cardamomum* (elaichi) seeds

Abstract

Herbal based extracts have immense applications in the fields of medicine, therapeutics and nutritional value as excellent nutraceutical and pharmaceutical compounds. From ancient times, *Elettaria cardamomum* seeds have been proposed the most cost effective and safe herbal nutraceutical sources to prepare silver containing herbal suspensions to treat many diseases like cold, cough, flu, stomach infections and skin allergies. It has been observed that green synthesis of *Elettaria cardamomum* seeds based herbal suspensions are found to be safe, eco-friendly and cost effective as compared to any kind of chemical preparations which have noticeable toxic and hazardous effects in treated patients because of use of toxic and allergic organic and organic solvents and release of various by-products during their preparations. So in our study, we focused on use of green method to prepare various emulsifiers mediated *Elettaria cardamomum* herbal nutraceutical suspensions to minimize their respective deleterious effects as cost-effective and eco-friendly approach to synthesise the safe herbal nutraceutical suspensions having improved antioxidant properties. Antioxidant activities of prepared *Elettaria cardamomum* herbal nutraceutical suspensions were studied by FRAP assay.

Keywords: *Elettaria cardamomum*, herbal nutraceutical compounds, antioxidant activity, FRAP assay

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Kirti Rani

Amity Institute of Biotechnology, Amity University, Noida, India

Correspondence: Dr Kirti Rani, Assistant Professor (III), Amity Institute of Biotechnology, Amity University, Uttar Pradesh, Noida, Sec-125, Gautam Buddha Nagar, Noida-201313 (UP), India, Tel +91-120-4392946, +91-9990329492, Email krshama@amity.edu, Kirtisharmak@rediffmail.com

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Introduction

More than 60% of the global population relies on herbal based healthcare products and compounds due to their respective safe administration and *Elettaria cardamomum* (Elaichi) is well known among them known as the 'Queen of Spices'. *Elettaria cardamomum* (Elaichi) is going to be used as a more potent therapeutic herbal medicine from very ancient times because of having excellent antimicrobial and antioxidant activities. Considering the vast vulnerability of plants, many researchers aimed to exploit these herbal sources to produce nano/micro/submicron materials by using safe green technique as a good alternative to conventional methods.^{1,2} In previous studies, *Elettaria cardamomum* was chosen for an in-vitro study in which it was observed effective to prevent platelet aggregation and coagulation when used with epinephrine, ADP and collagen as well as also observed to control diabetes and digestive problems.^{2,3} Various preparations of *Elettaria cardamomum* have been proposed to treat hypertension when administrated in consented patients with calcium antagonists sue to having its excellent gut modulatory diuretic activity and antioxidant activity.^{3,4} Hence, various green methodologies have been chosen to prepare many herbal products/ herbal extracts/herbal suspensions by exploiting various non-toxic and non-antigenic herbal plants and spices which having medicinal properties. These can be used as reducing and capping agents to prepare various metal-based (silver and gold) micro/nano/submicron particles in modified herbal extracts/suspensions by reducing the deleterious effects as most safe method when compared to other their respective conventional chemical preparations.^{5,6} The most lucrative parameters to exploit *Elettaria cardamomum* seeds for our study were ease of availability, easy to prepare, cost-effective synthesis with good therapeutic potency. So, we focused on cost-effective green synthesis of chosen emulsifiers (coconut oil, mustard oil, olive oil and pumpkin seed oil) mediated *Elettaria cardamomum* nutraceutical extracts for

preparing non-toxic and safe herbal suspensions which can be used further for various therapeutic and pharmaceutical applications.

Materials and methods

Preparation of *Elettaria Cardamomum* (elaichi) herbal extracts

10g fresh *Elettaria cardamomum* (elaichi) seeds were boiled for 45mins at 65°C and centrifuged at 5000rpm for 15mins. The extract was decanted and stored at 4°C until further use as untreated/control. 15ml of *Elettaria cardamomum* (elaichi) extract was further treated with 60ml of 0.45g/dl concentrations of 0.1 N silver nitrate solution (AgNO₃) and boiled at 75°C for 30min.^{6,7}

Emulsification of prepared *Elettaria cardamomum* (elaichi) nutraceutical extracts

Aliquots of prepared *Elettaria cardamomum* (elaichi) herbal extract (untreated/control) were further subjected for emulsification by using 0.25ml of coconut oil, mustard oil, olive oil and pumpkin seed oil as natural occurring safe herbal emulsifiers. And reaction mixtures were centrifuged at 5000rpm for 20mins and the supernatant is decanted followed with sonication for 15-20 mins to obtain various aliquots of synthesise emulsified *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions & stored at 4°C until use.⁸

Antioxidant assay of prepared control, 0.1N silver nitrate treated and emulsified *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions

Total antioxidant activity of various prepared emulsified *Elettaria cardamomum* (elaichi) suspensions was performed by using Ferric reducing antioxidant power (FRAP) assay measured at 700nm.⁹

Results and discussion

Antioxidant activity was studied by using FRAP assay of prepared untreated (control), 0.1N silver nitrate treated and various emulsified *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions at different concentrations ranging from 5g/dl, 10 g/dl, 15g/dl, 20g/dl. Reduction of Fe^{3+} ions was studied by measuring the absorbance at 700nm to observe increasing antioxidant activity by increasing concentration of prepared samples (Table 1).^{6,8} Olive oil

and pumpkin seed oil mediated emulsified *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions were found to have good antioxidant property as compared to silver nitrate treated suspension, control (untreated suspension), coconut oil treated and mustard oil treated herbal nutraceutical suspensions (Olive oil treated>Pumpkin oil treated> 0.1N Silver nitrate treated>Control>Coconut oil treated>Mustard oil treated). These observations were very much comparable to previous findings (Figure 1).⁸⁻¹⁰

Table 1 Absorbance of prepared control, 0.1N silver nitrate treated, emulsified *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions at 700nm (FRAP assay)

Samples concentrations (1-6)	5g/dl	10g/dl	15g/dl	20g/dl
1. Untreated herbal suspension (Control)	0.266	0.271	0.596	0.652
2. 0.1 N Silver nitrate treated herbal suspension	0.271	0.309	0.59	0.8
3. Coconut oil treated herbal suspension	0.23	0.235	0.34	0.503
4. Mustard oil treated herbal suspension	0.106	0.15	0.25	0.34
5. Olive oil treated herbal suspension	0.356	0.401	0.477	0.853
6. Pumpkin seed oil treated herbal suspension	0.333	0.405	0.499	0.802

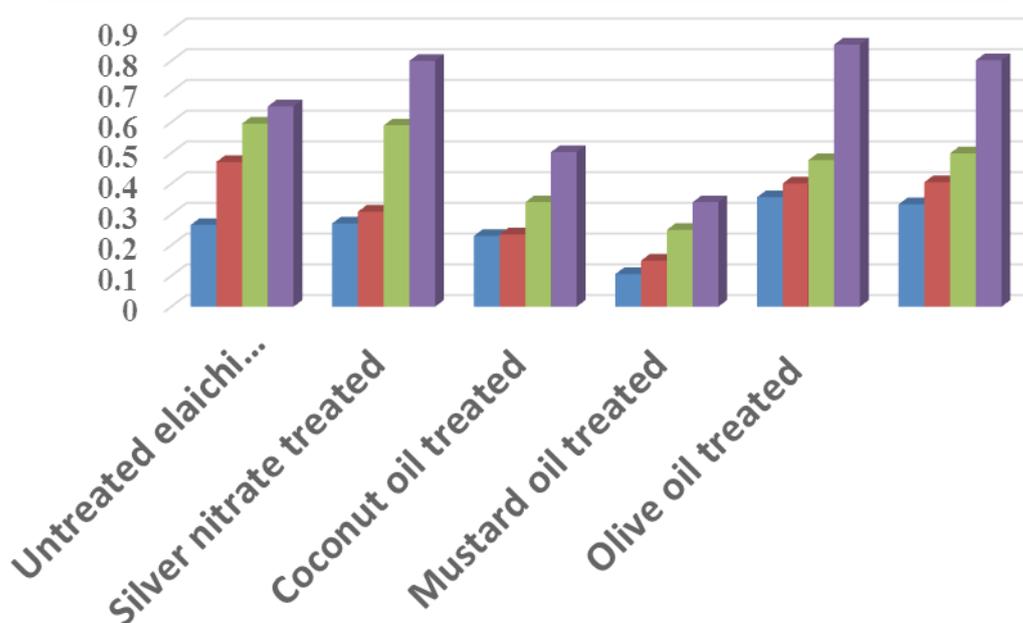


Figure 1 Comparative Antioxidant activity analysis of control, 0.1 N silver nitrate treated, coconut oil treated, mustard oil treated, olive oil treated, pumpkin oil treated *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions.

Conclusions

In our study, we synthesised cost effective and green synthesis derived non-toxic and non-antigenic emulsified *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions by using natural emulsifiers like coconut oil, mustard oil, olive oil and pumpkin oil and further tested for their respective antioxidant potency by using FRAP assay. And, prepared various herbal *Elettaria cardamomum* (elaichi) herbal nutraceutical suspensions found to have good antioxidant activity due to which these can be further purposed for various clinical and pharmaceutical applications as safe green technology derived cost effective herbal bioagents for the preparation of microparticles/ submicron particles/nanoparticles bound chosen drugs/chemical

components/ biological components for site specific targeted drug delivery systems.

Acknowledgments

None.

Conflicts of interest

The author declares that there is no conflict of interest.

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