CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187

https://doi.org/10.5281/zenodo.6300107

Available online at: http://www.iajps.com Research Article

PREPARATION AND EVALUATION OF GEL INCORPORATED WITH SILVER NANOPARTICLES FROM TAGETES ERECTA

[1]Mrs.Loganayagi V, [2]Senthilkumar. K . L, [3]Vasanthan A, [3]Anandharaj G, [3]Rajamanickam P, [4]V. Swethachi,[4]S. Shanmugapriya,[4] P.Chitra

[1]Assistant Professor, Sri Vijay Vidyalaya College of Pharmacy, Dharmapuri.Tamilnadu.,
[2]Principal. Sri Vijay Vidyalaya College of Pharmacy, Dharmapuri.Tamilnadu.,
[3]Associate Professor, Sri Vijay Vidyalaya College of Pharmacy, Dharmapuri.Tamilnadu.,
[4]B. Pharm Final year Student, Sri Vijay Vidyalaya College of Pharmacy, Dharmapuri.

Article Received: December 2021 **Accepted:** January 2022 **Published:** February 2022

Abstract:

Nanotechnology is one of the most rapidly developing fields of study. Because of their critical uses in biotechnology, bioengineering, textile engineering, water treatment, and metal-based consumer items, the synthesis and characterization of metal nanoparticles such assilver, gold and platinum are growing topic of research. It has been established that silver metal possesses antibacterial properties since ancient times. Due to their unique features and wide range of uses, silver nanoparticles (AgNps) are used. Infections in open wounds and chronic ulcers are treated with silver nanoparticles as well as medical devices, cosmetics, electronics and household appliances, Catalysis, bio sensing, imaging. However, in most of the methods precarious chemicals and low material conversions and high energy requirements are used for the preparation of nanoparticles. So, there is a need to develop high-yield, low cost, non- toxic and environmentally friendly procedures. In such a situation biological approach appears to be very appropriate. Natural material like plants, bacteria, fungi, yeast are used for synthesis of silver nanoparticles.

Key Words: *Targets erecta, silver nanoparticles, antimicrobial activity.*

Corresponding author:

Mrs. Loganayagi V

Assistant Professor, Sri Vijay Vidyalaya College of Pharmacy, Dharmapuri. Tamilnadu. vloganayaki87@gmail.com

QR code

Please cite this article in press ***Loganayagi V*** *et al,* ***Preparation And Evaluation Of Gel Incorporated With Silver Nanoparticles From Tagetes Erecta.,*** *Indo Am. J. P. Sci, 2022; 09(2)*

INTRODUCTION:

Topical gel formulations are a good choice for drug administration since they are less oily and easy to remove from the skin. The topical gel is a localized system for medication delivery via cutaneous, rectal, ophthalmic and vaginal channels. In comparison to other topical route formulations, the skin is the most widespread and easily accessible organ for topical drug administration. Gel formulations are stable, gives greater absorption and bioavailability of drug[1].*Tagetes erecta* (Marigold) is an ornamental plant belonging to the family *Asteraceae.* Flowers (Fig 1) of this plant are used in garlands for social and religious purposes in most of the countries. It is native to Mexico and widely distributed in South East Asia including Bangladesh and India. The flowers are bright yellow, brownish-yellow or orange. Different parts of this plant including flower is used in folk medicine. It has been used for skin complaints, wounds and burns, conjunctivitis and poor eyesight, menstrual irregularities, varicose veins, hemorrhoids, duodenal ulcers etc. [2,3]. The flowers are especially employed to cure eye diseases, colds, conjunctivitis, coughs, ulcer, bleeding piles and to purify blood [7,8]. Repellent and biocide activities of essential oils of *Tagetes Erecta* against mosquito species have been reported [10,15]. and demonstrated antimicrobial properties of gold nanoparticles in floral extract

Figure 1: Marigold flower (*Tagetes erecta*)

MATERIAL AND METHODS:

Chemicals:

Fresh flowers of *Tagetes erecta* (Marigold flower) were purchased from the local market, Hosur, Tamilnadu, India. The sample was authenticated by Central Ayurveda research institute, Bangalore – 560109.

Silver nanoparticles - medical, food & industrial purpose

Carbopol 940 - clear gels, hydro alcoholic gels &creams.

Methyl paraben - Anti fungal agents

Propyl paraben - Anti fungal & Anti microbial agents

Triethanolamine - Industrial and consumer products

Propylene glycol 400 - artificial smoke or fog

All chemicals were purchased from Thomas Baker (chemicals)Pvt Ltd, and Rolex chemicals industries, Mumbai-400002.

Preparation of crude extract:

The marigold flower petals were removed from sepals and dried for two days in decontaminated area, frequently keeping them in sunlight. The dried petals are made into coarse powder using mixer. The coarse powder was defatted with n-Hexane for 6 hours at room temperature. The defatted coarse powder was filtered and the residue was kept aside fordrying at room temperature. 30g of dried powder was constantly refluxed with acetone at 50°C for 30 minutes on water bath. This solution was filtered and made upto 100ml. [21]

Synthesis of silver nanoparticles:

For the manufacture of silver nanoparticles, a 1 mM aqueous solution of silver nitrate (AgNO3) was prepared. Exactly 9ml of 1Mm silver nitrate solution was added to 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9ml acetone extract of *Tagetes erecta* to obtain silver nanoparticles. 1mM concentration of silver nitrate and different concentrations of extracts were used to standardize the optimum concentration of silver nitrate and extract needed for the synthesis of silver nanoparticles. We found 0.42ml of concentration in 1mM silver nitrate solution were found to give the best yield. The nanoparticles were synthesized at room temperature and the formation of nanoparticles was confirmed by checking λ_{max} using UV spectrophotometer. The synthesized silver nanoparticles was purified by centrifugation at 10000 rpm for 15 minutes followed by re-dispersion of the pellets of the silver nanoparticles into acetone. After air drying the purified silver particles was stored at 4°C for further experiment. [21]

Standardization:

For efficient synthesis of silver nanoparticles, effect of boiling time and effect of extract amount to be added to 1mM $AgNO_3$ solution were varied and the best one was selected. The formulation of Silver Nanoparticle was monitored as a function of time of reaction on a spectrophotometer by taking Optical density at 400 to 440 nm at an interval of 1 hour.

UV-Visible spectral analysis:

Silver Nanoparticles were formed by reduction of silver ion; It was monitored by measuring the absorption spectra in the wavelength range of 200-800 nm SHIMADZU UV- 1800 Spectrophotometer. The spectrum was recorded at the maximum absorption wavelengthwas determined. [21]

Particle Size Distribution and Polydispersity Index:

ZETASIZER Version 7.13 was used to calculate the mean particle size of the silver nanoparticle (Malvern Instrument, UK). The mean diameter of the particles at 25°C and a 90-degree angle (n=10) is revealed by this analytical result. The Polydispersity index is a measurement for the width of a particle size distribution, and the mean diameter (z-average) is a light intensity-weighted size of the bulk population obtained from the PCS analysis. [22]**.**

Zeta Potential:

The zeta potential of the synthesised silver nanoparticles was measured by Malvern zeta size Version 7.13 (Malvern Instrument, UK). A suitable amount of sample (50-100 µL)was diluted with 5ml of water (0.45 µm) and injected in the electrophoretic cell of the instrument were a potential value was calculated. [22].

Method for Preparation of Gel:

Carbopol polymers can be easily dispersed in water by stirring at room temperature, the dispersion method was adopted for topical gel production. All of the materials were weighed precisely. Then, with continual stirring, Carbopol 940 was disseminated in 50 mL ofdistilled water. Separately, Methyl paraben and propyl paraben were dissolved in 5 mL distilled water using a water bath. After cooling the solution, Propylene glycol was added. After that, silver nanoparticles were added, and the solution was

combined with Carbopol 940 solution, and the volume was increased to 100 ml using distilled water.

Finally, a sufficient amount of Triethanolamine (TEA) was added to the mixture while swirling continuously to achieve the desired gel strength. The pH of the gel formulation was then calculated after it was weighed.[23]

Table 1: Gel composition for 100g

S.NO	Drug/ Chemical name	Amount
1	Silver nanoparticles	0.02g
2	Carbopol 940	1g
3	Methyl paraben	0.2ml
4	Propyl paraben	0.1ml
5	Triethanolamine	1.5ml
6	Propylene glycol 400	5ml
7	Water	Up to 100ml

RESULTS AND DISCUSSION:

Green Synthesis of Silver Nanoparticles:

Green synthesis of silver nanoparticles was prepared from Marigold flower plant extract. On mixing plant extract with the silver nitrate solution, a change in the solution colour from pale yellow to dark yellow was observed which indicates the reduction of silver ions and formation of silver nanoparticle

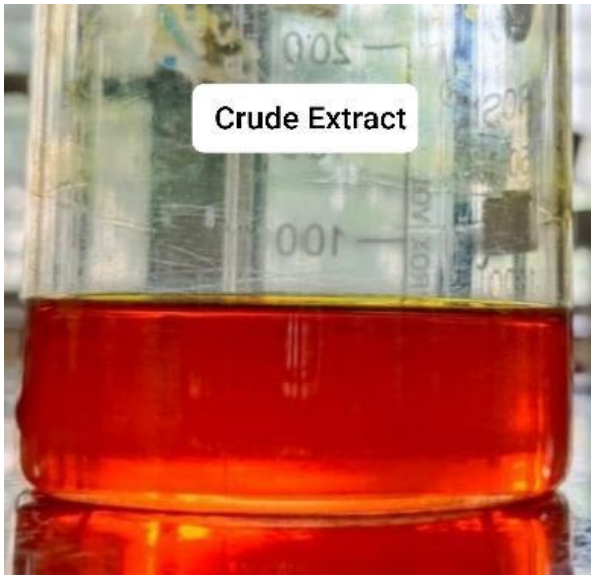

Figure 2: Crude extract

Standardization:

Various concentrations of 1Mm silver nitrate and flower extract were prepared ranging from 0.1 to 0.9ml. Among the above concentration 0.4ml (9ml silver nitrate and 0.4ml herbal extract) concentration was finalized for the synthesis of silver nanoparticles by UV Spectroscopy. (Fig 3)

Figure 3: Colour changes in the reaction mixture.

Characterization of Silver Nanoparticles:

The UV absorption Spectrum of 0.4ml concentration of *Tagetes eracta* has shown abetter peak specific in the range in 440 nm and the λ_{max} was found. (Fig 4,5)

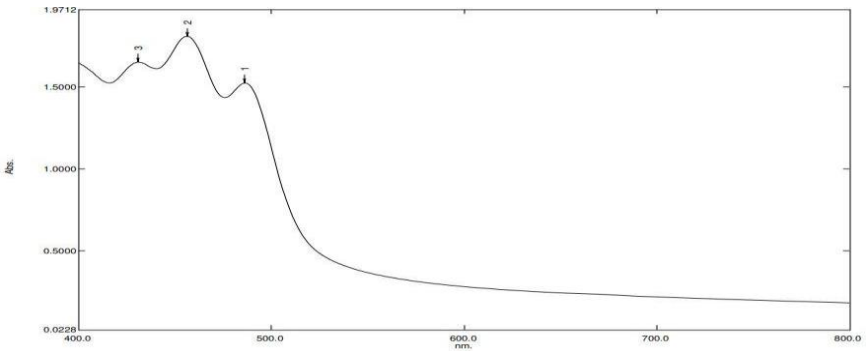

Figure 4: UV- visible spectrum of biosynthesized Tagetes erecta - AgNPs at 440nm

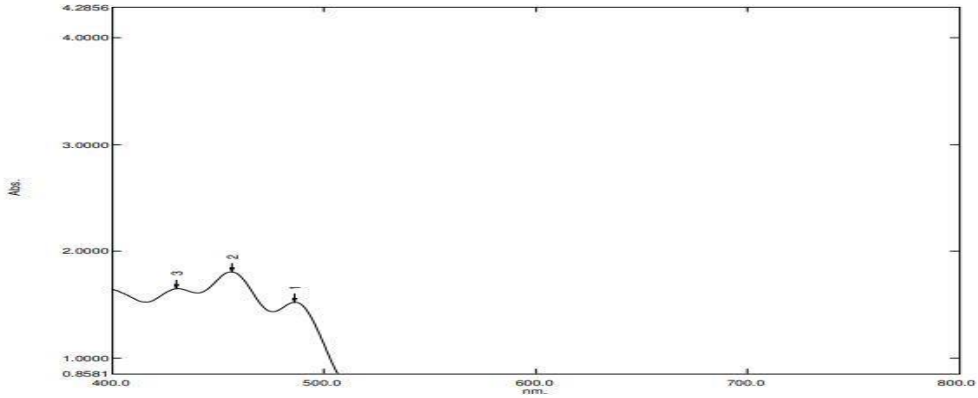

Figure 5: Absorbance maxima of silver nitrate.

Particle Size, Polydispersity Index and Zeta Potential:

Using the zeta sizer in dynamic light scattering mode, the average particle size was determined. The average particle size was found to be 82.70 nm, indicating that the silver ions had been converted to nanoparticles. The silver nanoparticle's polydispersity index (PDI)was found to be 0.509. (Fig 6) Using the Malvern zetasizer, the zeta potential was determinedto be -11.0 mV. (Fig 7)

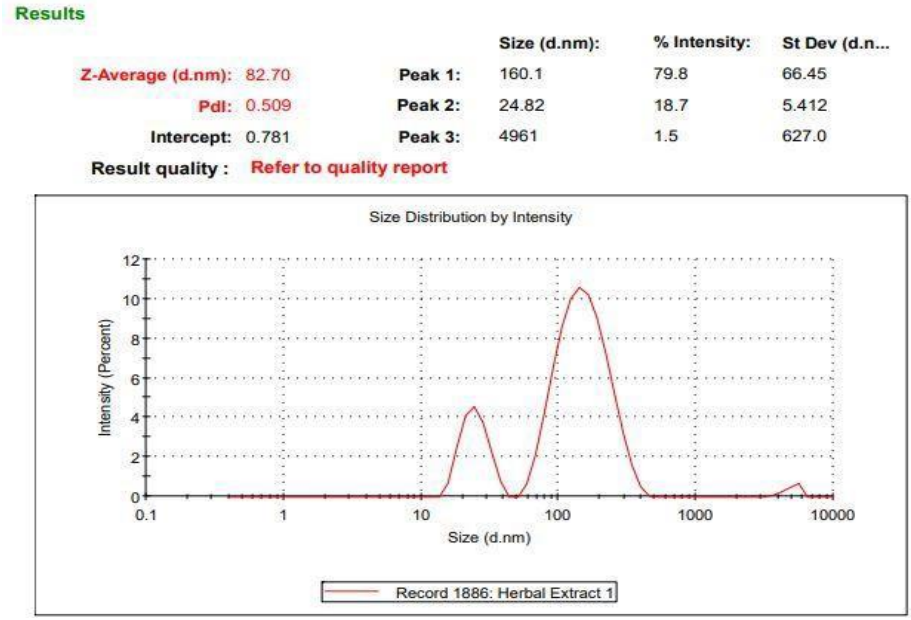

Figure 6: Results of Particle size and PDI.

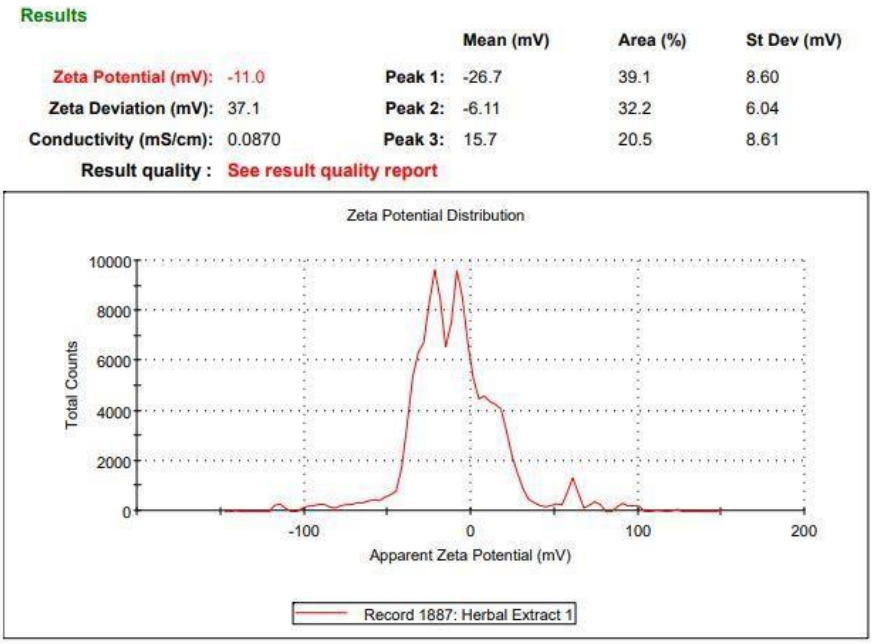

Figure 7: Results of Zeta Potential.

Physical evaluation of various gel formulation:

The topical formulation gel is preferred both in cosmetic and pharmaceutical preparations due to its faster release rate of drug substances. Gel has various advantages because of its thixotropic property, greaseless, easily spreadable, easily removable, emollient, non-staining and compatible with several excipients. The physicochemical parameter such as homogeneity, presence of any foreign particles and fibres washing availability, pH and spreadability are evaluated visual inspection results indicate that prepared topical gel formulation has uniform colour distribution and free from any lumps, fibers and foreign particles. The formulation was easily washable. (Fig 8)

Figure 8: Placebo gel and silver nanoparticle gel.

Spreadability:

The spreadability of a topical preparation determines its bioavailability and therapeutic efficacy. The spreadability is measured in seconds and is based on the top slide slipping off the gel under a particular stress. The time it takes to separate the two slides is shorter, indicating that the topical formulation is more spreadable. The spreadability value was found to be 1.5±0.1 (g.cm/sec). (Fig 9)

Figure 9: Spreadability test of the developed AgNP Gel

TABLE2: Results of evaluation tests.

Trial	Appearance	Spreadability (g.cm/sec)	P_H	Homogeneity	Feel after Application
T1	Pale yellow	1.52	6.8	Homogeneous	Cooling effect
T2	Pale yellow	1.56	6.4	Homogeneous	Cooling effect
T3	Pale yellow	1.6	6.5	Homogeneous	Cooling effect

n=3

Extrudability:

Extrusion of gel from the tube is important during application and for the patientcompliance. The values of Extendibility of different formulation was found to be between 79-84. (Fig 10)

TABLE 3: Results of Extendibility test.

Trial	Wt. of formulation (g)	Wt. of Gel Extruded (g)	Extendibility (%)	Grade
T1	8.52	6.8	79.81	Good
T2	7.9	6.5	82.27	Good
T3	8.0	6.7	83.75	Good

n=3

Figure 10: Extrudability test of the developed AgNP Gel

CONCLUSION:

The present study reveals a simple, rapid and economical method to synthesize silver nanoparticles from *Tagetes eracta*. Silver nanoparticle of *Tagetes eracta* in an aqueous gel base can be used as an appropriate formulation for the antimicrobial activities.

REFERENCES:

1. Rafiuddin , 2013 Z.Z. Rafiuddin Bio-conjugated silver nanoparticles from Ocimum sanctum and role of cetyltrimethyl ammonium bromide Colloids Surf. B,Biointerfaces , 108 (2013), pp. 90-94.
2. Pal et al., 2007 S. Pal, Y.K. Tak, J.M. Song Does the antibacterial activity of silver nanoparticles depend on the shape of the nanoparticle? A study of the Gram negative bacterium Escherichia coli Appl. Environ., 73 (2007), pp. 1712-1720.
3. Lee and El-Sayed, 2006 K.S. Lee, M.A. El-Sayed Gold and silver nanoparticles in sensing and imaging: sensitivity of plasmon response to size,

shape, and metal composition J. Phys. Chem. B, 110 (2006), pp. 19220-19225.
4. Nair and Laurencin, 2000 L.S. Nair, C.T. Laurencin Silver nanoparticles: synthesis and therapeutic applications J. Biomed. Nanotechnol., 3 (2007), pp. 301-316.
5. Jain et al., 2008 P.K. Jain, X. Huang, I.H. El-Sayed, M.A. EL-Sayed Noble metals on the nanoscale: optical and Photothermal properties and some applications in imaging, sensing, biology, and medicine Acc. Chem. Res., 41 (2008), pp. 1578-1586.
6. Alizadeh et al., 2013 H. Alizadeh, M. Salouti, R. Shapouri Intramacrophage antimicrobial effect of silver nanoparticles against Brucella melitensis 16M Sci. Iranica F, 20 (3) (2013), pp. 1035-1038.
7. Sathyavathi et al., 2010 R. Sathyavathi, M.B. Krishna, S.V. Rao, R. Saritha, D.N. Rao Biosynthesis of silver nanoparticles using Coriandrum sativum leaf extract and their application in nonlinear optics Adv. Sci. Lett., 3 (2010), pp. 138-143.
8. Venkatesham et al., 2014 M. Venkatesham, D. Ayodhya, A. Madhusudhan, N.V. Veera Babu, G. Veerabhadram A novel green one-step synthesis of silver nanoparticles using chitosan: catalytic activity and antimicrobial studies Appl. Nanosci., 4 (2014), pp. 113-119.
9. Rangnekar et al., 2007 a.Rangnekar, T.K. Sarma, A.K. Singh, J. Deka, A. Ramesh, A. Chattopadhyay Retention of enzymatic activity of alpha-amylase in the reductive synthesis of gold nanoparticles Langmuir, 23 (2007), pp. 5700-5706.
10. .Ahmad et al., 2013 T. Ahmad, I.A. Wani, N. Manzoor, J. Ahmed Biosynthesis, structural characterization and antimicrobial activity of gold and silver nanoparticles Colloids Surf. B, Biointerfaces, 107 (2013), pp. 227-234.
11. Sumana et al., 2013 T.Y. Suman, D. Elumalai, P.K. Kaleena, S.R.R. Rajasree GC–MS analysis of bioactive components and synthesis of silver nanoparticle using Ammannia baccifera aerial extract and its larvicidal activity against malaria and filariasis vectors Ind. Crops Prod., 47 (2013), pp. 239-245.
12. Kotakadi et al., 2014 V.S. Kotakadi, S.A. Gaddam, Y.S. Rao, T.N.V.K.V. Prasad, A.V. Reddy, D.V.R.S. Gopal Biofabrication of silver nanoparticles using Andrographis paniculata Eur. J. Med. Chem., 73 (2014), pp. 135-14.
13. Vidhu and Philip, 2014 V.K. Vidhu, D. Philip Spectroscopic, microscopic and catalytic properties of silver nanoparticles synthesized using Saraca indica flower Spectrochim. Acta Part A, Mol. Biomol. Spectrosc., 117 (2014), pp. 102-108.
14. Gupta,gupta GD. Formulation Development and evaluation of anti-inflammatory potential of Cordia oblique topical gel on animal model. Pharmacognosy Journal. 2017; 9(6s):s93-s98.
15. Wichtl, 1994 M. Wichtl Herbal Drugs and Phytopharmaceuticals Scientific Publisher, Stuttgart (1994) 446.
16. Krishnamurthy et al., 2012 N.B. Krishnamurthy, B. Nagaraj, B.L. Malaka, L. Liny, R. Dinesh Green synthesis of gold nanoparticles using Tagetes erecta L. (marigold) flower extract and evaluation of their antimicrobial activities Int. J. Pharm. Biosci., 3 (1) (2012), pp. 212-221
17. Kirtikar and Basu, 1994 K.R. Kirtikar, B.D. Basu Indian Medicinal Plants Lalit Mohan Basu, Allahabad (1994).
18. Manjunath, 1969 B.L. Manjunath The Wealth of India, Raq Material CSIR, New Delhi(1969).
19. Singer, 1987 J.M. Singer Investigation of the mosquito larvicidal activity of the oil of marigolds Diss. Abs. Int. B, 47 (12) (1987), p. 4886.
20. Wells et al., 1992 C. Wells, W. Bertsch, M. Perich Isolation of volatiles with insecticidal properties from the genes Tagetes (Marigold).
21. M Padmaa Paarakh and Preethy Ani Jose Department of Pharmacognosy ane Pharmaceutics, Bangalore September 2020.
22. Ashour AA, El- Gowelli DRHM, HEl- Kamel. A. Green synthesis of silver nanoparticles using cranberry powder aqueous extract: Characterization and Antimicrobial properties. lnt J Nanomedicine.2015;10:7207-21.
23. Gupta,gupta GD. Formulation Development and evaluation of anti-inflammatory potential of Cordia oblique topical gel on animal model. Pharmacognosy Journal. 2017; 9(6s):s93-s98.