



FORMULATION AND EVALUATION OF POLYHERBAL CREAM

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ABSTRACT

In the present era, a large number of population rely on the traditional system of medicine and ayurvedic system, which is mostly plant based due to the wide applicability of the plant materials, now a day the development of herbal and ayurvedic preparation is increasing progressively. Specially, the incorporation of the medicinal plant materials in pharmaceutical dosage forms is gaining much important pharmaceutical creams are semi solid preparations. It has been mentioned as a remedy for treatment of various infectious diseases and ailments. The cream that was produced was proven to be natural, stable, and safe. Based on the folkloric use, the present contain medicinal agents intended for external application, the aim to formulate and development polyherbal face cream comprising extracts of *Clitoria ternatea*, *Aloe barbadensis miller*, *Curcuma longa*, *Hibiscus rosa sinensis*, *Prunus amygdalus* oil, *Coca nucifera*, *Azadirachta indica*. The formulate cream showed stability parameters like visual appearance, nature, fragrance, homogeneity, pH, viscosity, consistency, spreadability, easy of removal, non-greasy, no evidence of phase separation. It can serve to protect the skin from reactive oxygen species created by UV radiation and environmental toxin, thus protecting the skin from photo aging. From the result can be concluded the polyherbal face cream providing localized and systemic effect at the site of application. The Present investigation suggests that this cream is a suitable candidate for further clinical trials.

KEYWORDS: Polyherbal face cream, *C. ternatea*, *Aloe vera*, *C. longa*, *H. rosa sinensis*, *P. amygdalus* oil, *C. nucifera*, *A. indica*.

INTRODUCTION

The term "medicinal plant" include various types of plants used in herbalism ("herbology" or "herbal medicine"). It is the use of plants for medicinal purposes, and the study of such uses. The word "herb" has been derived from the Latin word, "herba" and an old French word "herbe". Now a days, herb refers to any part of the plant like fruit, seed, stem, bark, flower, leaf, stigma or a root, as well as a non-woody plant. Earlier, the term "herb" was only applied to non-woody plants, including those that come from trees and shrubs. These medicinal plants are also used as food, flavonoid, medicine or perfume and also in certain spiritual activities. Plants have been used for medicinal purposes long before prehistoric period.^[1]

Despite considerable progress in the treatment of skin infection by antifungal, antibacterial, antioxidant, anti-inflammatory agents, search for newer and novel therapeutic drugs and formulations continues. In recent times there has been renewed interest in the herbal

remedies as the existing synthetic drugs have several limitations. Medicinal plants are an integral part of human health care system. India is one of twelve leading bio-diversity centers with presence of over 45,000 different plant species. There has been resurgence in uses of herbal medicine in the past few years, not only among the traditional medicinal users but also among the modern consumers of herbal products. Herbal preparation called "Phytopharmaceuticals" or "phytomedicine" are preparation made from different parts of plants. Many countries have included herbal products in their National Health Programs and National Health Schemes as an important alternative for treatment of various ailments.^[2] The difference in the mode of usage of these herbal products from past to present can be noticed when we glance at the various standardized and formulated herbal products in the markets. The WHO has also recognized the integrated system of medicine to reach the goal of health for all. Therefore, it now becomes important to validate their traditional herbal medicine as potential therapeutic agents and bring

international acceptance. As per the WHO definition of herbal medicines, these are formulations prepared as finished herbal products or mixture herbal products which may contain excipients in addition to the active herbal ingredients. The increasing prevalence of multidrug resistant strains of fungi and the recent appearance of strains with reduced susceptibility to drugs raises the specter of untreatable fungal infections and adds urgency to the search for new infection-fighting strategies. Contrary to the synthetic drugs, antimicrobials of plant origin are not associated with many side effects and have an enormous therapeutic potential to heal many infectious diseases. There are many potential plants with medicinal properties in the repertoire of traditional systems of Indian medicines such as Ayurveda, Unani and Siddha, *Acorus calamus* and *Withania somnifera* are two such plants that have been used traditional for the treatment of skin ailments. Scientific data was observed to be very empiric and hence there is a need for more extensive research on these indigenous plants and development of herbal products using current methodologies and modern techniques.^[3]

Herbal Creams are topical preparations usually for application to the skin. They are also applied unto the mucous membranes such as the rectum or vagina. They are semi solid emulsions which are oil-in-water (O/W) or water-in-oil (W/O) type. Creams are often composed of two phases. Oil-in-water (O/W) emulsions are most useful as water washable bases, whereas water-in oil (W/O) emulsions are emollient and cleansing agents. An emulsifying agent is used to disperse the aqueous phases in the oily phase or viceversa.^[4]

Cream formulation was semisolid formulations intended for topical application. The cream formulations were prepared by using various herbal extracts, herbal oils,

and various excipients. Cosmetic products are used for the protection of skin from various endogenous and exogenous harmful agents along with enhancing the beauty and making skin attractive. The only use of cosmetic is not developing an attractive external appearance but also achieving longevity of good health by reducing skin disorders. The cosmetics which are meant for skin care nourishes the health, texture and moisturizes the skin.^[5]

The synthetic or natural ingredients present in skin care formulation that supports the health, texture and integrity of skin, moisturizing, maintaining elasticity of skin by reduction of type I collagen and photoprotection etc. This property of cosmetic is due to presence of ingredients in skin care formulation, because it helps to reduce the production of free radicals in skin and manage the skin properties for long time. The cosmetic products are the best choice to reduce skin disorders such as hyper pigmentation, skin aging, skin wrinkling and rough skin texture etc.^[6]

The plant parts used in cosmetic preparation should have varieties of properties like antioxidant, anti-inflammatory, antiseptic, emollient, antiseborrheic, antikerolytic activity and antibacterial etc. Herbal products claim to have less side effects, commonly seen with products containing synthetic agents.

Therefore, the purpose of this study was to develop herbal cosmetic cream by mixing the extracts of *Clitoria ternatea*, *Aloe barbadensis* miller, *Curcuma longa*, *Hibiscus rosa sinensis*, *Prunus amygdalus* oil, *Coc nucifera*, *Azadirachta indica* to produce multipurpose effect on skin such as fairness, sunscreen, antiaging and antiwrinkle properties.^[7]

MATERIALS AND METHODS

CLITORIA TERNATEA



Toxonomy	
Kingdom	Plantae
Subkingdom	Viridiplantae
Order	Fabales
Family	Fabaceae
Subfamily	Faboideae
Division	Tracheophyta
Subdivision	Spermatophytes

Superdivision	Embryophyta
Genus	Clitoria
Species	Clitoria ternatea
Uses	Anti oxidant, anti microbial, memory enhancer, nootropic, antistress, anxiolytic, antidepressant, anticonvulsant, tranquilizing and sedative agent
Phytochemical constituent	kaempferol, quercetin and myricetin glycosides as well as anthocyanins

ALOE VERA



Taxonomy	
Kingdom	Plantae
Subkingdom	Tracheobionta
Order	Asparagales
Family	Asphodelaceae(liliaceae)
Sudfamily	Asphodeloideae
Division	Magnoliophyta
Superdivision	Spermatophyta
Genus	Aloe L.
Species	Aloe vera
Uses	treat skin injuries (burns, cuts, insect bites, and eczemas), antimicrobial, and wound healing properties.
Phytochemical constituent	anthraquinones, chromones, anthrones, phenolic compounds, flavonoids, tannins, steroids, and alkaloids

CURCUMA LONGA



Taxonomy	
Kingdom	Plantae
Subkingdom	Tracheobionts
Order	Zingiberales
Family	Zingiberaceae
Division	Mangoliophyta
Superdivision	Spermatophyta
Genus	Curcuma
Species	Longa
Uses	skin cancer, treatment of acne, blemishes, dark spots and hyperpigmentation, and

	to address skin conditions such as eczema and psoriasis.
Phytochemical constituent	Digalloyl-hexoside, Caffeic acid hexoside, Curdione, Coumaric, Caffeic acid, Sinapic acid, Quercetin-3-D-galactoside, Casuarinin, Bisdemethoxycurcumin, Curcuminol, Demethoxycurcumin, and Isorhamnetin, Valoneic acid.

HIBISCUS ROSA SINENSIS

Taxonomy	
Kingdom	Plantae
Subkingdom	Tracheobionts
Order	Malvales
Family	Malvaceae
Subfamily	Malvoideae
Division	Mangoliophyta
Superdivision	Spermatophyta
Genus	Hibiscus
Species	Rosa-sinensis
Uses	antioxidant activity, skin cancer, hyperpigmentation, treatment of acne, blemishes.
Phytochemical constituent	tannins, anthraquinones, quinines, phenols, flavanoides, alkaloids, terpenoids, saponins, cardiac glycosides, protein, free amino acids, mucilage, essential oils and steroids.

PRUNUS AMYGDALUS OIL

Taxonomy	
Kingdom	Plantae
Order	Rosales
Family	Rosaceae
Genus	Prunus
Species	P.amygdalus
Uses	soothe the skin and treat minor wounds and cuts, various skin diseases like eczema, pimples, facial neuralgia
Phytochemical constituent	catechin, dihydrokaempferol, kaempferol, quercetin, gallic acid, and resveratrol

COCA NUCIFERA

Taxonomy	
Kingdom	Plantae
Order	Arecales
Family	Arecaceae
Subfamily	Arecoideae
Genus	Cocos L.
Species	C.nucifera
Uses	antibacterial, antifungal, antiviral, eczema, moisturizing dry skin
Phytochemical constituent	catechins, epicatechins, tannins, and flavonoids

AZADIRACHTA INDICA

Taxonomy	
Kingdom	Plantae
Order	Sapindales
Family	Meliaceae
Genus	Azadirachta
Species	A.indica
Uses	skin diseases, Treats Acne ,Nourishes Skin, Treats Fungal Infections, Antioxident.
Phytochemical constituent	azadirachtin, nimbolinin, nimbin, nimbidin, nimbidol, salannin, and quercetin.

METHODS**Collection of plant material**

The raw material for extraction included plant Clitoria ternatea, Aloe barbadensis miller, Curcuma longa, Hibiscus rosa sinensis, Prunus amygdalus oil, Coca nucifera, Azadirachta indica. These plant material were collected from the local areas.^[8]

Preparation of the polyherbal extract

Clitoria ternatea, Hibiscus rosa sinensis, Azadirachta indica was collected and shaded under the sun for a week and powdered to 80% to stores Air dried coarsely powdered of plant materials were extracted with ethanol (95%) using soxhlet apparatus for 4-5 hrs. All the extracts were concentrated at low pressure by rotary flash evaporator and finally air-dried.



The soxhlet apparatus was used to separate and extraction of particular chemical constituent of given plant material by using separate chemicals.^[9]

Extraction

The shade dried and coarsely powdered whole flower of *Clitoria ternatea* and *Hibiscus rosa sinensis*, gel of aloe vera, leaf of *Azadirachta indica* were extracted using water. The extract was then filtered and concentrated in the vacuum at 40-50 °C produced a crude extract. This filtrate was used for the preparation of cream.^[10]

Types of Extaction

Soxhlet extraction,
Microwave Assisted extraction,
Sonication extraction,
Supercritical Fluid extraction,
Aqueous alcoholic extraction,
Ultrasound extraction,
Maceration,
Percolation,
Decoction,
Digestion,
Infusion.

❖ SOXHLET EXTRACTION

Soxhlet extraction is an exhaustive extraction technique widely applied to analytes that are sufficiently thermally stable. The extraction solvent is continuously cycled through the matrix, by boiling and condensation, with the sample being collected in the hot solvent.

❖ MICROWAVE ASSISTED EXTRACTION

Microwave-assisted extraction (MAE) is a process of using microwave energy to heat solvents in contact with a sample in order to partition analytes from the sample

matrix into the solvent. The ability to rapidly heat the sample solvent mixture is inherent to MAE and the main advantage of this technique.

❖ SONICATION EXTRACTION

Sonication is the act of applying sound energy to agitate particles in a sample, for various purposes such as the extraction of multiple compounds from plants, microalgae and seaweeds. Ultrasonic frequencies (> 20 kHz) are usually used, leading to the process also being known as ultrasonication or ultra-sonication.^[11]

❖ SUPERCRITICAL FLUID EXTRACTION

Supercritical fluid extraction (SFE) is the process of separating one component (the extractant) from another (the matrix) using supercritical fluids as the extracting solvent. Extraction is usually from a solid matrix, but can also be from liquids.

❖ AQUEOUS ALCOHOLIC EXTRACTION

Alcohol extraction is a commonly used extraction method for cannabis to create cannabis oil and concentrates. Two types of alcohol are normally used for cannabis extraction: isopropyl or ethanol.

❖ ULTRASOUND EXTRACTION

Ultrasound leads to the localized damage to the plant tissues termed as erosion. This erosion may also be attributed to the implosion of the cavitation bubbles on the surface of plant tissues. The eroded part facilitates the contact of solvent, increasing the yield of extraction.^[12]

❖ MACERATION

Maceration is the chemical removal (dissolving) of muscles and other soft tissues in a specimen while leaving the sclerotized or chitinized parts that are needed for identification.

❖ PERCOLATION

Percolation extraction is a conventional extraction method used in the processing of u0-itraditional Chinese medicines. After medicinal material powder is placed in a percolation tank, the extraction solvent is continuously added, and percolation extract is collected simultaneously. The percolation equipment is simple.

❖ DECOCTION

Decoction is a method of extraction by boiling herbal or plant material (which may include stems, roots, bark and rhizomes) to dissolve the chemicals of the material. It is the most common preparation method in various herbal-medicine systems.

❖ DIGESTION

The process of decomposing a solid sample into a liquid state by dissolving it using reagents such as strong acids, alkalis, or enzymes. The mixture of sample and reagent is usually heated to the point of boiling which greatly speeds up the dissolution process.^[13]

Table 1: Composition of Polyherbal Cream.

Formula% w/w					
Ingredients	F1	F2	F3	F4	F5
Stearic acid	12	10	15	18	15
Cetyl alcohol	2	4	3	2	3
Trietanolamine	1.5	1.0	2.0	1.5	1.5
Neem oil	1.5	1.5	1.5	1.5	1.5
Glycerol	3	3	3	3	3
Almond oil	4	4	4	4	4
Methyl paraben	0.02	0.02	0.02	0.02	0.02
Water	q.s	q.s	q.s	q.s	q.s
Coconut oil	0.15	0.15	0.15	0.15	0.15
Rose water	q.s	q.s	q.s	q.s	q.s

Table 2: pH of cream base.

Formulation	PH
F1	6.7
F2	6.8
F3	6.5
F4	6.4
F5	6.5

Drug Formulation

The appropriate base was selected from tablet and cream was formulated. The Evaluation of cream.

The evaluation of herbal cream was following.

Physical evaluation

Formulated herbal cream was further evaluated by using the following physical parameters. Color, Odor, Consistency, and state of the formulation.

a) Color

The color of the cream was observed by visual examination.

b) Odor

The odor of cream was found to be characteristics.

c) Consistency

The formulation was examined by rubbing cream on hand manually. The cream having smooth consistency. Cream did not leave greasy substances on skin surface after application.

d) State

The state of cream was examined visually. The cream having a semisolid state.^[14]

pH

pH of prepared herbal cream was measured by using digital pH meter. The solution of cream was prepared by using 100 ml of distilled water and set aside for 2 h. PH was determined in three time for the solution and the average value was calculated.

Spreadability

Spread ability of formulated cream was measured by placing sample in between two slides then compressed to uniform thickness by placing a definite weight for a definite time. The specified time required to separate the two slides was measured as Spreadability. Lesser the time taken for separation of two slides result shown

better Spreadability. Spreadability was calculated by the following formula.

Spread ability = $\frac{M}{S} \times \frac{1}{t}$ Where S= Spreadability M= Weight tide to the upper slide L= Length of glass slide T= Time taken to separate the slides.^[15]

Washability

Formulation was applied on the skin and then ease extends of washing with water was checked. Results were shown in table 2 Non-irritancy test Herbal cream formulation was evaluated for the non-irritancy test. Observation of the sites was done for 24 h 28. Results were shown in table 2.

Viscosity

Viscosity of cream was done by using Brooke field viscometer at the temp of 25 °C using spindle no. 63 at 5rpm.

Phase separation

The prepared cream was transferred in a suitable wide mouth container. Set aside for storage, the oil phase and aqueous phase separation were visualizing after 24h.

Saponification value

Take 2 gm of the substance and reflux it with the 25 ml of 0.5 N alcoholic KOH for 30 minutes. Then add 0.1 ml of phenolphthalein as a indicator and titrate it with the 0.5 N HCL. Saponification value = $\frac{(b-a) \times 28.05}{W}$

a =volume of titrate,

b =volume of titrate,

w =weight of substances in grammar.

Acid value

Take 10 gm of the cream dissolved in accurately weighed in 50 ml mixture of the equal volume of alcohol and solvent ether. Then attached the flask with the condenser and reflux it with the slow heating until the sample gets completely dissolve then add 1 ml of phenolphthalein and titrate it with 0.1 N NaOH until it gets faint pink color appears after shaking in 20 seconds.

Acid value = $\frac{n \times 5.61}{w}$

w =weight of the substances

n =the number of ml in NaOH required.

Test applied for acid value and saponification value.^[16]

Dye test

The scarlet red dye is mixed with the cream. Place a drop of the cream on a microscopic slide then covers it with a cover slip, and examines it under a microscope. If the disperse globules appear red the ground colorless. The cream is o/w type. The reverse condition occurs in w/o type cream i.e. the disperse globules appear colorless.^[17]

Homogeneity

Table 3: Homogeneity was tested via the visual appearance and test.

Physical Evaluation	
Colour	Creamy Whitey
Odour	Pleasant
State	Semi-solid
pH	6.9
Spreadability	7.9g.cm/sec
Washability	Easily washable
Viscosity	5rpm
Phase separation	No phase separation

Table 4: Adverse effect of Formulation.

Formulation	Irritant	Edema	Redness/Rashes	Erythema
F1	Nil	Nil	Nil	Nil
F2	Nil	Nil	Nil	Nil
F3	Nil	Nil	Nil	Nil
F4	Nil	Nil	Nil	Nil
F5	Nil	Nil	Nil	Nil

RESULT

pH of the cream

The pH of the cream base was found to be in range of 6 to 7. All the formulations of cream base were shown pH nearer to skin require.(Table 2).

Irritant test

The formulation of cream F5 shows no redness edema inflammation and irritation during irritancy studies. These formulations are safe to use for skin (Table 4).

Viscosity

The viscosity of cream in the range of 27020-27054 cps which indicates spreadability of cream. In our study f1, f3 and f4 depicted easily spreadable by small amounts of shear, while F2,F5 were not easily spreadable on skin. But F3 shows good spreadable property than other formulations.^[18]

Table 6: evaluation of herbal cream.

Formulation	pH	Acid value	Saponification value	Adverse effect	Room Temperature	Accelerated Temperature
Herbal cream	6.9	6.4	26.3	Nil	Acceptable	Acceptable

DISCUSSION

Melanin is the primary determinant of human skin colour. Regular use of herbal face cream can reduce the production of melanin. The principle constituents present in have potent antioxidant and anti-tyrosinase, play a synergistic action on reduction of melanin production. The antibacterial property of A.indica produces protection from bacterial infection. The antifungal

Acid value and Saponification value

The result of acid value and saponification value of all formulation of cream base were represented (Table5) shows satisfactory values.

Table 5: Acid and Saponification value.

Parameter	F1	F2	F3	F4	F5
Acid value	6.3	5.9	6.5	5.1	5.4
Saponification value	26.7	26.4	25.4	25.3	27.2

Dye test

This dye confirms that all formulations were o/w type emulsion cream. But formulation F3 shows more stable in o/w type emulsion. So we select F3 cream base for further study.

Homogeneity

All formulations produce uniform distribution of extracts in cream. This confirmed by visual appearance and touch (Table 3).

Appearance

When formulation were kept for long time, it found that no change in colour of cream.

After feel

Emolliency, slipperiness and amount of residue left after the application of fixed amount of cream was founded.

Type of smear

After application of smear, the type of smear formed on the skin were non greasy.

Removal

The cream applied on skin was easily removed by washing with tap water.

Cream

From above study, the F3 base was selected for the preparations of herbal cream, and the compositions of cream has illustrated on (Table 6). The physical evaluation and stability of polyherbal cream has shown in (Table 6), results were considerable and acceptable.^[19]

property of C. ternatea produces protection from fungal infection. The vitamin E present in P.amygdalus oil and its antioxidant property protect the skin from premature ageing. For improvement of herbal cream of whitening effect in skin should be well hydrated and protected from environmental damage. We assure that the herbal face cream can produce excellent properties of anti-oxidant,

anti-inflammatory, anti-bacterial and anti-fungal properties of the ingredients.^[20]

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CONCLUSION

From above discussion it is concluded that on combining the extracts of Aloe vera, *C. ternatea* in different ratio to get multipurpose effect such as whitening, antiwrinkle, antiaging and sunscreen effect on skin. As we know that it is not possible to increase the extent of efficiency of medicinal and cosmetic property of single plant extract, but by combining the different plant extracts it can be possible to increase the efficacy of extracts. In this regard, we mixed the extracts of Aloe vera, *C. ternatea*, *C. longa*, *H. rosa sinensis*, *P. amygdalus* oil, *C. nucifera*, *A. indica* to improve as well synergize the cosmetic properties of prepared products compare to individual extracts. Further research will carry out to check scientifically the synergistic action of selected formulation. These studies suggest that composition of extracts and base of cream of F3 and F5 are more stable and safe; it may produce synergistic action.^[21]

REFERENCE

1. SK Uddandu sahib, Aduri prakash reddy, K Rajithe, B Sravani, B Vanitha, World Journal Pharmacy and Pharmaceutical Science, 2018; 7(5).
2. Jargalsaikhan B, Ganbactar N, Urtnasan M, Uranbileg N, Begzsura D, Biopharmacological Journal, 2019; 12.
3. N Shilpika Nagula, Nasreen begum, G Rakesh, K Shirisha, P Srivarsha, International Journal of Science and Research, 2022; 5(3).
4. Margaret O, Llomnanya, Thomas Akhimien, Chinelo Aghaizn, Oluwatobiloba Adeyinka and Tolulope Ajayi, 2018.
5. Ashish Aswal, Mohini Kalra and Abhiram, Scholars Research Library, 2013.
6. Ganta Manasa, T Satynarayana, Kamal Pasha N, Bhashpitha, R Komadhi, R Jhansi, SK Forhana,, International Journal of Pharmaceutical Research and Application, 2021; 6(5).
7. Ram Kumar Sahu, Ami troy, Pradeep Kushwah, Manish Khare, Rajini Mudotiya, Research Journal of Topical and Cosmetic Science, 2012; 3(1).
8. Raja babu, Amit semwal, Shilpa Sharma, Sachin kumar and Arif khan, World Journal of Pharmaceutical Research, 2022; 11(8).
9. Somnath D Bhinge, Mangesh A Bhutkar, Dheeraj S, Randive, Ganesh H Wadkar, Sanjeeva Y Kamble, Pooja D Kalel, Sneha, S Kadam, Journal of Research in Pharmacy, 2018.
10. Pratik Balasaheb Panhalkar, Pawar Ganesh Kalyan, Cholke Pravin, International Journal of Emerging Technologies and Innovative Research, volume-9, issue-12.
11. Kumar, D., Rajora, G., Parkash, O., Himanshu, Antil, M. & Kumar, V. International Journal of Advanced Scientific Research, 2016.
12. Anushree jyotishi, Pradeep kumar Mohanty, Vishal shrivastava, Akhlesh kumar singhai and Sourabh Malviya, International Journal of Pharmacy and Life Science, 2022.
13. Yadav N And Yadav R, International Journal of Recent Scientific Research, 2015; 6(5).
14. Raja babu, Amit semwal, Shilpa Sharma, Sachin kumar and Arif khan, World Journal of Pharmaceutical Research, 2022; 11(8).
15. Vibhavari M chatur, Nazma M Ansari, Sanket K Joshi, Sanjay G Walode, Journal of Drug Delivery and Therapeutics, 2022.
16. Jargalsaikhan B, Ganbactar N, Urtnasan M, Uranbileg N, Begzsura D, Biopharmacological Journal, 2019; 12.
17. Prashant Chavan, Mallinath kalshetti, Nikhil Navindgikar, International Journal of Current Pharmaceutical Research, 2022; 12(4).
18. Pal Arti, Soni Manish, Patidar Kalpana, International Journal of Pharmaceutical & Biological Archives 2014.
19. SK Uddandu sahib, Aduri prakash reddy, K Rajithe, B Sravani, B Vanitha, World Journal Pharmacy and Pharmaceutical Science, 2018; 7(5).
20. D Bhinge, Mangesh A Bhutkar, Dheeraj S, Randive, Ganesh H Wadkar, Sanjeeva Y Kamble, Pooja D Kalel, Sneha, S Kadam, Journal of Research in Pharmacy, 2018.
21. Pratik Balasaheb Panhalkar, Pawar Ganesh Kalyan, Cholke Pravin, International Journal of Emerging Technologies and Innovative Research, volume-9, issue-12.