Scholars Bulletin *(Pharmacy)*
An Official Publication of "Scholars Middle East Publishers" ISSN 2412-9771 (Print)
Dubai, United Arab Emirates ISSN 2412-897X (Online)
Website: http://scholarsbulletin.com/

Formulation Development and Evaluation of Polyherbal Bath Soap

Rakesh K Sindhu*, Gagandeep Kaur
Department of Pharmacognosy and Natural Products, Chitkara College of Pharmacy, Chitkara University, Chandigarh Patiala NH – 64, Rajpura, Patiala, Punjab - 140401, India

***Corresponding author**
Rakesh K Sindhu

Article History
Received: 02.12.2018
Accepted: 11.12.2018
Published: 30.12.2018

DOI:
10.21276/sb.2018.4.12.4

Abstract: The basic aim of our study was to develop and evaluate the polyherbal soap by using different extracts (extracts of neem leaves, papaya leaves, aloe leaves, turmeric and tulsi leaves) having greater antioxidant and antimicrobial potential. Pre-eminently, basic soap was prepared using Coconut oil and NaOH (lye) and the different extracts were incorporated into the basic saponification reaction. The herbal formulation thus prepared was then consigned for the evaluation testing for the analysis of pH, Moisture content, foaming ability, foam retention time, saponification, Total Fatty Matter determination and antimicrobial activity. The results demonstrated that pH 7.5 – 8, moisture contents 8.6%, foam retention time 1.20 minutes, Saponification value was 210.375 mg/ml, 30% TFM for polyherbal soap. Also the evaluation tests showed that the poly herbal soap has satisfactory antimicrobial results as compared to standard antibiotic. Some human infections which are majorly caused due to wounds, acne or blisters; these strains of microorganisms are of greater benefit. Moreover, oils and extracts used are added to treat various skin infections and are perfect for daily usage.
Keywords: Polyherbal Soap, Evaluation, Saponification value, Antimicrobial potential.

INTRODUCTION

Research studies on plant extracts and its antimicrobial properties have greatly escalated in recent years due to fact that these plants have been used as a part of traditional system since the time immemorial.

With the foregoing of time theses plant extracts, seeds, leaves stem have gained an individual importance or in combination in various fields of pharmaceutical sciences and their constituents are being evaluated for their therapeutic activity [1, 2]. Scientist find a great use of these plant derived preparations in the formulation of various ointments, soaps, creams, gels etc. Moreover, the use of scientific chemicals may lead to various health issues which have been overcome by the use of products that are naturally obtained as means of traditional medicines. These biologically obtained pharmaceutical products are often referred to as Natural or herbal Cosmetic product [3]. Therefore, herbal plants are of great importance as they are more safe and effective than chemically derived products [4]. As per WHO approximately 80% population of India rely upon traditional systems of medicines like ayurvedic, unani, siddha and tibbi for day today life health problems [5].

Skin is the most exposed part which needs to be protected from foreign pathogens, [6]. Therefore, a better and a safer product is required for the maintenance of hygiene and cleanliness with less of the side effects such as rashes, redness, itching or any of the kind. Herbal products are enriched with essential nutrients and minerals which are useful to the human body and has minimum side effects. The diverse plant kingdom contains various essential ingredients or phytochemical constituents which not only impart emollient action but also help in restoration, protection and healing of the skin [7]. The ingredients used in the cosmetic or herbal preparation impart antioxidant, antibacterial, antifungal, scrubbing, antispasmodic properties and also have high nutritional value [8].The therapeutic activity is only dependent upon their chemical constituents as plants are very complex in nature. In addition, standardization of herbal drugs is also an essential factor to prevent adulteration of herbal drugs [9].

ADVANTAGES OF HERBAL PREPARATIONS

- Safer usage
- No relative side effects
- Greater acceptability
- Patient friendly
- Better compatible [10]

Herbal ingredients have gained more importance in cosmetic preparations rather than non-herbal ingredients. The herbal ingredients used should not alter the basic formulation properties. Effectiveness formulation is based upon the type of ingredients used

and its composition. The method of preparation for cosmetic preparation which may be synthetic in origin or the herbal formulation is almost same [11-14]. One of the effective formulations in the herbal products are the polyherbal soaps. The objective of this research study is to formulate a polyherbal soap consisting of various plant extracts which impart various properties including antioxidant, antibacterial and emollient action. On the basis of traditional systems of formulations, a basic herbal soap may contain roots *Glycyrrhiza glabra* (skin lightening) or Neem leaves imparting toning, reduction in acne properties. The object of this exercise is for the addition of various plant extracts into one formulation which can be used for various skin types and skin problems [8].

Chemically a mixture of fatty acids is called a soap which made by a process called saponification. It is a process in which an oil (containing fatty acid) and an alkaline substance is mixed together. It acts as an anionic surfactant. The obtained soap is used for various purposes in our daily life for cleaning and washing. Soaps for medicinal use are ofa little variation from the simple soap in which various ingredients of medicinal use are incorporated into a basic soap. This simple variation can be used to produce or formulate substantial formulations having various biological properties. Various other additives are added to soap for imparting various properties to it [15-20]. The additives added in the soap should impart good characteristic, color and fragrance to the prepared soap. Also, they should not affect the properties of the soap too. The lathering and washing of the soap is committed to various fatty acids such as stearic and palmitic acid [21]. Natural foaming agents have replaced synthetic agents such as Sodium lauryl sulphate. Synthetic antibacterial have been replaced by natural ones. This replacement hasled to decrease in associated side effects of synthetic soaps [16, 22]. In an herbal soap all the detergents which are being derived from petroleum is replaced by fatty acids of fat and oil derived from vegetables. In place of colors synthetically derived to the natural color pigments such as turmeric (*Curcuma longa*), curcumin etc [23-24]. Essential oils and plant extracts are taken up in place of synthetic preservatives. Olive oil, Neem oil, Coconut oil, Peppermint oil, lemon, jasmine oil are few oils which are used in soaps of medicinal use [22, 25, 26].

Neem whose botanical sources is *Azadirachta indica*b elongs to family Meliaceae. Neem contains fatty acids such as Myristic, stearic, palmitic, linoleic and stearic acid which impart antiseptic activity and also used in skin diseases. It also contains bitter principle such as Nimbidin, Nimbin, Nimbidol which also impart anti-inflammatory and antiseptic properties. Also have great use in acne specially for oily pore skin. Neem extracts provide great anti-bacterial properties. It heals the cracks that are minute as it has deep penetration into the skin [12]. The polysaccharides contain in Neem reduces skin cancers and reduces tumors [27] Also the inflammation and pain are reducing by the phenolic constituents of *Azadirachta indica* [28]. The polysaccharides present in neem reduces skin cancers and reduces tumors [29]. Additionally, Neem contain an active constituent Azadirachtin which is used a Feeding deterrent. It acts by disrupting the metamorphosis of larvae of insect [30].

Papaya obtained from *carica papaya* belonging to family Caricaceae. It is best known and most cultivated species [31]. The leaves extract of Papaya contains carpaine alkaloid which impart anti-inflammatory and wound healing properties. It works as dynamic antioxidant properties as they are rich in Vit E, C and Vitamin A. It efficaciously used in treatment of allergies as it contains an enzyme called papaintha. Due to presence of enzyme papain it has effective skin lightening properties as well provides skin exfoliation. Also heals conditions such as acne. The leaf extracts rich in alpha hydroxyl acids helps regeneration of skin by breaking the chemical bonds between the dead skin [32].

Aloe Vera with the botanical name *Aloe barbadensis; family* liliaceae have been used widely in various formulations in cosmetology. Aloe gel have been frequently used in the cosmetics. It contains polysaccharides derived by the mucilaginous layer. This opt for better antiallergic and anti-inflammatory properties. The fatty acids present such as cholesterol, Beta sitosterol, lupeol have analgesic as well as antiseptic properties in the herbal soap formulation. Various enzyme being rich in the aloe vera gel such as brady kinase reduces inflammation and used in the acne treatment. Also, it reduces the exposure of skin to the baneful UV and Gamma radiation. Addition to it the it has been used as an effective moisturizer in many cosmetic preparations too [33, 34].

MATERIALS AND METHODS

Material Collection

Ingredients were purchased from the local market as shown in table 1. Fresh leaves of Neem, Papaya and Aloe vera were collected from herbal garden of Chitkara University, Rajpura, Patiala, Punjab, India. Collected leaves were washed and cleaned with water to remove foreign materials.

Preparation of Neem Extract

Azadirachta indica leaves were obtained from Chitkara University, Rajpura, Punjab and were cleaned thoroughly. Aqueous extract of neem was prepared by triturating the leaves.

Preparation of papaya extract

Papaya leaves were obtained from Chitkara University, Rajpura. They were cleaned thoroughly

with fresh water. Aqueous extract of *carica papaya* was prepared by triturating the leaves in a motar pestle.

Table-1: Ingredients

Ingredients	Part used	Properties
Extract of neem	Leaves	Antibacterial
Extract of papaya	Leaves	Antioxidant
Aloe Vera gel	Whole part plant	Moisturizer
Lemon Juice	Fruit	Rich in Vitamin c

Preparation Method for Polyherbal soap

The reaction between an alkali (like Sodium Hydroxide) and any neutral fatty acid is the basic saponification reaction. In this reaction neutral fatty acid used was coconut oil and alkali used is sodium hydroxide (lye). Weighed 10 g of coconut oil in a beaker. Weighed separately 4g of neem extract, 4g of papaya extract, 4g of Tulsi extract and added lemon juice in a beaker separately and mixed well. In another beaker, prepared the basic saponification reaction by adding 6g of NaOH in 10 ml of distilled water and 5 ml of ethanol. Added the extract solution in the solution of lye and mixed well with the help of magnetic stirrer. This mixture of extract and lye was then poured over coconut oil involving basic soap formation with continuous stirring on a magnetic stirrer without heating involving the cold process of soap formation. Cooled down the mixture in a petri plate. In order to remove any foreign impurities, the prepared soap was given a salt washing by passing through 300 ml of saturated solution of sodium chloride. Acid washing was also given twice by %mL 0.1N dilute HCl. The soap was then allowed to solidify and kept at room temperature. The soap was then evaluated on various physical and chemical parameters to check it efficacy, stability and any changes in it characteristics [35-40].

EVALUATION PARAMETERS

Determination of color and clarity

The color clarity of the prepared soap was check against a white back ground [8].

pH:

About 10g of the soap preparation was weighed. It was then dissolved in 100ml of distilled water in a volumetric flask. This is 10% soap solution. pH of the formulation was determined by a pH paper as well as pH meter to be accurate[8].

Foaming ability

About 1 g of the soap was dissolved in distilled water in about 50ml taken in measuring cylinder of 100ml. It was then shaken for about 2 min and allowed to stand still for 10 min. After 10 min measured the foam height. Repeated the same for 3 times for mean readings [21].

Foam Retention Time

25ml of 1% soap solution was taken into measuring cylinder. It was then shaken 10 times. Then recorded the foam at 1interval for 5 minutes [21].

Determination of Moisture content

About 10g of the sample under study were accurately weighed and transferred to a tarred china dish of known weight and kept in hot air oven at 100 – 105°C for an hour. Then, the sample was weighed along with china dish to deduct the actual weight of tarred china dish. The weight of the content was noted to calculate the percentage moisture content [44].

Moisture content = (Difference in weight/initial weight) x 100

Total Fatty Matter Determination:

In the presence of hot water, soap is reacted with acid the total fatty mater is determined. 10g of the soap was weighed and 150 ml of distilled water as added and it was then heated. It was then dissolved in 15% of conc. Sulphuric acid (about 20ml) along with heating. It was heated until a clear solution is obtained. About 7g of beeswax was dissolved to obtain the solidified fatty acids on the surface itself and for meant to cool down [41]. Obtained cake was dried and weighed and following calculations was carried out.

$$TFM = (A - X)/W \times 100$$

A= weight of wax+ oil,
X= weight of wax,
W= weight of soap.

Saponification Value

Saponification Value Can be defined as no. of potassium hydroxide which is required to saponify fat/oil of 1g. Weighed about 2g of oil in a conical flask. Added 0.5 M of potassium hydroxide to the above oil and heated it for 55 degrees with continuous stirring on a water bath. Temperature was increased into 100 degrees and boiled for about I hr. Performed titration using phenolphthalein as an indicator and excess of potassium hydroxide was measured [8]. Readings were noted down saponification value is calculated by:

Saponification value= Avg Vol of KOH *28.056/Weight of oil (g)

Antibacterial Properties

Antibacterial property was evaluated for the prepared soap by well diffusion method [39, 41]. Microorganism was used *E. coli*. About 1g of soap was soap mixed in sterilized water. Different concentration of the soap solutions were prepared (5, 10, 20, 50 mg/mL). The standard antibiotic ampicillin was taken to compare antibiotic potential. The plates were incubated for 24 hours at 37 ºC and zone of inhibition was calculated as shown in table 3.

Experimental study by *In vivo* efficacy

Six volunteer groups (n=6) were involved for *in vivo* efficacy study of polyherbal hand soap formulation. Volunteers with wounded or damaged skin were excluded from study.

RESULTS AND DISCUSSION

The results of formulation number 6 as shown in table 2, which demonstrated that pH 7.5 – 8, the pH of testing of soap is necessary not only for the purpose of improving soaps quality but to regulate the pH level which shall not contribute to the hardness of skin. According to NAFDAC regulatory requirements on cosmetics, soaps and detergents high pH levels in the 9 to 11 range or low in the 3 to 5 level are considered deleterious to the skin [42]. Moisture content was 8.6%, foam retention time 1.20 minutes, Saponification value was 210.375 mg/ml, TFM for polyherbal soap was 30%. TFM shows quantity of fatty material present in the soap, i.e., it is shows quality of soap. If the TFM is more, better the quality of the soap. TFM value is lower due to presence of unreacted NaOH in the blend. However, dry skin needs soap which is high in TFM [43]. For antimicrobial potential plates were incubated for 24 hours at 37 ºC and zone of inhibition was calculated as shown in table 3 and figure 1. The skin carries large numbers flora of bacteria, mainly Gram-positive picked up from the various objects with which it comes in contact, of these natural flora, *Staphylococcus aureus* is normally found on the hands, face and in deep layers of the skin is possibly the most commonly encountered and very undesirable. *Staphylococcus aureus* is ubiquitous and are not easily eliminated mainly in the deeper skin layers, sebaceous gland, sweat gland, and the hair-follicles by routine washing and scrubbing even with some antiseptic soap. Thus, the effectiveness of the this herbal soap against *Staphylococcus aureus* is very significant and could be harnessed in the containment of the organism implicated as the commonest etiologic agent of boils, breast abscess, carbuncles, infantile-impetigo [44].

Table-2: Different formulations of Polyherbal Soap

Sr. No.	Ingredients	F1	F2	F3	F4	F5	F6	F 7
1.	Coconut oil	12g	10g	8g	10.5g	11g	10g	10g
2.	PLE	5g	5g	4g	4g	3.5g	4g	4g
3.	NLE	5g	5g	3g	4g	3.5g	4g	4g
4.	TLE	5g	5g	3g	4g	3.5g	4g	4g
5.	NaOH	6g	5.5g	7	6.5	5g	6g	8g
6.	Ethanol	5ml	6ml	10ml	7ml	8ml	5ml	5ml
7.	Distilled water	5ml	6ml	8ml	7ml	8.5ml	10ml	8ml

Papaya leaves extract (PLE), Neem leaves extract (NLE), Tulsi leaves extract (TLE)

Table-3: Antimicrobial property of herbal soap

Concentration (mg/mL)	***E. coli* Zone of Inhibition (mm)**
5	NI
10	6.0
20	9.5
50	12.5
Positive Control (µg) (Ampicillin)	21.0

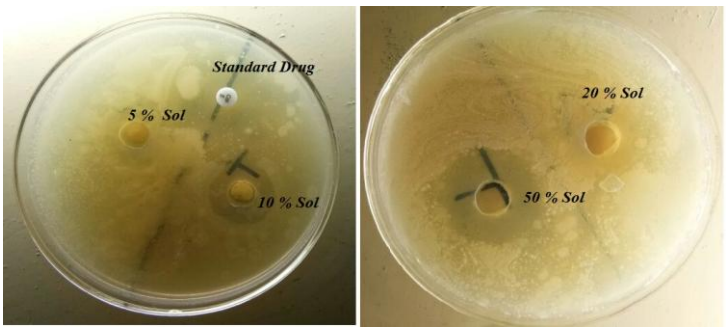

Fig-1: Antimicrobial potential of Soap solution's different concentrations on E coli

CONCLUSION

Physicochemical parameters such as color, odour, texture, pH, total fatty matter, moisture content, hardness and foam test were evaluated; these parameters will serve as standardization of the Herbal Soap. The outcome of this study leads to the formulation of a polyherbal extract soap which had potent anti-fungal and antibacterial properties against various bacteria anti-fungal infections. Also, this formulation can be used in daily use without causing any skin irritation Some human infections which are majorly caused due to wounds, acne or blisters; these strains of micro-organisms are of greater benefit. Moreover, oils and extracts used are added to treat various skin infections and are perfect for daily usage**.**

Conflict of interest statement: The authors declared no conflict of interest.

ACKNOWLEDGE

The authors are grateful to Dr. Madhu Chitkara, Vice Chancellor, Chitkara University, Rajpura, Patiala, India, Ashok Chitkara, Chancellor, Chitkara University, Rajpura, Patiala, India and Dr. Sandeep Arora, Director, Chitkara College of Pharmacy, Chitkara University, Rajpura, Patiala, Punjab, India for support and institutional facilities.

REFERENCES

1. Meléndez, P. A., & Capriles, V. A. (2006). Antibacterial properties of tropical plants from Puerto Rico. *Phytomedicine*, *13*(4), 272-276.
2. Thongdon-a, J., & Inprakhon, P. (2009). Composition and biological activities of essential oils from Limnophila geoffrayi Bonati. *World Journal of Microbiology and Biotechnology*, *25*(8), 1313-1320.
3. Batubara, I., Mitsunaga, T., & Ohashi, H. (2009). Screening antiacne potency of Indonesian medicinal plants: antibacterial, lipase inhibition, and antioxidant activities. *Journal of wood science*, *55*(3), 230-235.
4. Sindhu, R. K., & Arora, S. (2012). Phytochemical and Pharmacognostical Studies on Murraya koenigii (L) spreng. Roots. *Drug Invention Today*, *4*(1).
5. Londhe, J., Jagtap, S. D., Doshi, C., & Jagade, D. (2015, February). Formulations of herbal hand wash with potential antibacterial activity. In *National Conference "ACGT* (Vol. 2015, pp. 13-14).
6. Patel, C. J., Tyagi, S., Kumar, U., Pinkesh, P., Chaudhari, B., Patel, S., & Mangukia, D. (2013). Importance of different herbal plants in field of cosmetics: a recent review. *J. Drug Discov. Therapeut*, *1*, 19-27.
7. Ruckmani, K., Krishnamoorthy, R., Samuel, S., & Kumari, H. L. J. (2014). Formulation of Herbal Bath Soap from Vitex negundo Leaf Extract. *Journal of Chemical and Pharmaceutical Sciences ISSN*, *974*, 2115.
8. Pandey, S., Seth, A., Tiwari, R., Singh, S., Behl, H. M., & Singh, S. (2014). Development and evaluation of antimicrobial herbal cosmetic preparation. *African Journal of Pharmacy and Pharmacology*, *8*(20), 514-528.
9. Kamboj, V. P. (2000). Herbal medicine. *Current science*, *78*(1), 35-39.
10. Bronaugh, R. L., & Maibach, H. I. (Eds.). (2002). *Topical absorption of dermatological products* (Vol. 21). CRC Press.
11. Tarun, J., Susan, J., Jacob Suria, V. J. S., & Criton, S. (2014). Evaluation of pH of bathing soaps and shampoos for skin and hair care. *Indian journal of dermatology*, *59*(5), 442.
12. Ruckmani, K., Krishnamoorthy, R., Samuel, S., & Kumari, H. L. J. (2014). Formulation of Herbal Bath Soap from Vitex negundo Leaf Extract. *Journal of Chemical and Pharmaceutical Sciences ISSN*, *974*, 2115.
13. Brewster, B. (2006). Watering holes in the stratum corneum cosmetics and toiletries stratum corneum, *Cosm Toiletr Mag*. 3,22-26.
14. Sujith. (2011). Generalre view on herbal cosmetics. *Int JDrug Formul Res*. 2(5)…..
15. Bartels, T., Bock, W., Braun, J., Busch, C., Buss, W., Dresel, W., ... & Kubicki, F. (2005). Lubricants and lubrication. *Ullmann's Encyclopedia of Industrial Chemistry*.
16. Ribeiro, A. S., Estanqueiro, M., Oliveira, M. B., & Sousa Lobo, J. M. (2015). Main benefits and applicability of plant extracts in skin care products. *Cosmetics*, *2*(2), 48-65.
17. Kareru, P. G., Keriko, J. M., Kenji, G. M., Thiong'o, G. T., Gachanja, A. N., & Mukiira, H. N. (2010). Antimicrobial activities of skincare preparations from plant extracts. *African Journal of Traditional, Complementary and Alternative Medicines*, *7*(3).
18. Ungphaiboon, S., Supavita, T., Singchangchai, P., Sungkarak, S., Rattanasuwan, P., & Itharat, A. (2005). Study on antioxidant and antimicrobial activities of turmeric clear liquid soap for wound treatment of HIV patients. *Songklanakarin Journal of Science and Technology*, *27*(2), 269-578.
19. Ruckmani, K., Krishnamoorthy, R., Samuel, S., & Kumari, H. L. J. (2014). Formulation of Herbal Bath Soap from Vitex negundo Leaf Extract. *Journal of Chemical and Pharmaceutical Sciences ISSN*, *974*, 2115.
20. Kaur, M. (2014). Investigating and Exploiting the Antibacterial Potential of Clove Eugenia caryophyllyum Extracts while Utilizing it to the Maximum to Develop Liquid Soap against Drug Resistant Bacteria Causing Skin Diseases. *International Journal of Pharmaceutical & Biological Archive*, *5*(5).
21. Kuntom, A., Kifli, H., & Lim, P. K. (1996). Chemical and physical characteristics of soap made

from distilled fatty acids of palm oil and palm kernel oil. *Journal of the American Oil Chemists' Society*, *73*(1), 105-108.
22. Shivanand, P., Nilam, M., & Viral, D. (2010). Herbs play an important role in the field of cosmetics. *International Journal of PharmTech Research*, *2*(1), 632-639.
23. Sowbhagya, H. B., Smitha, S., Sampathu, S. R., Krishnamurthy, N., & Bhattacharya, S. (2005). Stability of water-soluble turmeric colourant in an extruded food product during storage. *Journal of Food Engineering*, *67*(3), 367-371.
24. Hadden, W. L., Watkins, R. H., Levy, L. W., Regalado, E., Rivadeneira, D. M., Van Breemen, R. B., & Schwartz, S. J. (1999). Carotenoid composition of marigold (Tagetes erecta) flower extract used as nutritional supplement. *Journal of agricultural and food chemistry*, *47*(10), 4189-4194.
25. Wijetunge, N. K., & Perera, B. G. K. (2016). Preparation of medicinal soap products using the leaf extracts of *Punica granatum* (Pomegranate). *Int J Pham Biol Sci*. 6(2),7-16.
26. Cowan, M. M. (1999). Plant products as antimicrobial agents. *Clinical microbiology reviews*, *12*(4), 564-582.
27. Mustafa, M. (2016). Antibacterial Efficacy of Neem (Azadirachta indica) Extract against Enterococcus faecalis: An in vitro Study. *The journal of contemporary dental practice*, *17*(10), 791-794.
28. Subapriya, R., & Nagini, S. (2005). Medicinal properties of neem leaves: a review. *Current Medicinal Chemistry-Anti-Cancer Agents*, *5*(2), 149-156.
29. SaiRam, M., Sharma, S. K., Ilavazhagan, G., Kumar, D., & Selvamurthy, W. (1997). Immunomodulatory effects of NIM-76, a volatile fraction from Neem oil. *Journal of ethnopharmacology*, *55*(2), 133-139.
30. Anonymous. (1992). National Research Council. Neem: A Tree for Solving Global Problems; National Academy Press: Washington, DC, USA.
31. Jean, J., Soucy, J., & Pouliot, R. (2011). Effects of retinoic acid on keratinocyte proliferation and differentiation in a psoriatic skin model. *Tissue Engineering Part A*, *17*(13-14), 1859-1868.
32. Aravind, G., Bhowmik, D., Duraivel, S., & Harish, G. (2013). Traditional and medicinal uses of Carica papaya. *Journal of Medicinal Plants Studies*, *1*(1), 7-15.
33. Sharrif Moghaddasi, M., & Res, M. (2011). Aloe vera their chemicals composition and applications: A review. *Int J Biol Med Res*, *2*(1), 466-471.
34. Surjushe, A., Vasani, R., & Saple, D. G. (2008). Aloe vera: a short review. *Indian journal of dermatology*, *53*(4), 163.
35. Asante, F. A. (1993). *The Chemistry of three indigenous seeds and their extraction, nutritional and industrial potentials of their oils* (Doctoral dissertation, MPhil thesis. Department of Biochemistry, KNUST, Kumasi).
36. Saad, A. H., Gamil, S. N., Kadhim, R. B., & Samour, R. (2011). Formulation and evaluation of herbal handwash from Matricaria chamomilla flowers extracts. *Int. J. Res. Ayur Pharm*, *2*, 1811-1813.
37. Natcha, W., & Pranee, I. (2013). Stability of turmeric constituents in natural soap. *Sci Asia*. 477-485.
38. Afsar, Z., & Khanam, S. (2016). Formulation and evaluation of poly herbal soap and hand sanitizer. *Int Research J Pharm*.7(8), 54-57.
39. Kathuria, N., & Singh. K. P. (2015). Antibacterial activities of leaves extract of Indian butter tree (*Madhuca indica*). *Int Res J Pharm.* 6(12),12-15.
40. Momoh, H., Habila, J. D., Ayo, G., & Ndukwe, G. I. (2015). The leave extracts of *Heera insignis* (Del) inhibits resistance bacteria, fungi and Mycobacterium Bovis. *Int Res J Pharm.* 6(12),793-796.
41. Debnath, S., Babu, M. N., Dega, M., Bharathi, K., Jyothsna, T., Revathi, D., & Kumar, T. S. (2011). Formulation and Evaluation of Liquid Soap Containing Herbal Antimicrobial Agent. *Research Journal of Pharmacognosy and Phytochemistry*, *3*(5), 225-231.
42. Warra, A. A. (2013). A report on soap making in Nigeria using indigenous technology and raw materials. *African Journal of Pure and Applied Chemistry*, *7*(4), 139-145.
43. Mak-Mensah, E. E., & Firempong, C. K. (2011). Chemical characteristics of toilet soap prepared from neem (Azadirachta indica A. Juss) seed oil. *Asian J Plant Sci Res*, *1*(4), 1-7.
44. Esimone, C. (2007). Evaluation of the antiseptic properties of *Cassia alata* based herbal soap. *The Internet J Alt Med*. 6, 1-5.