Journal of Academia Vo. 7, Issue 2 (2019) 159-163

AZADIRACHTA INDICA EXTRACT (NEEM) AS SKIN SOLUTION SOAP

Mazni Musa*, Norul Azilah Abdul Rahman, Nur Rahimah Said**, Nurul Huda Abdul Halim and Jamil Mohamed Sapari

School of Chemistry and Environment, Faculty of Applied Sciences
Universiti Teknologi MARA, Cawangan Negeri Sembilan, Kampus Kuala Pilah, 72000 Kuala Pilah, Negeri Sembilan, Malaysia

Corresponding author: mazni051@uitm.edu.my; nurra1435@uitm.edu.my***

Abstract

A local herb known as neem (semambu) or its scientific name *Azadirachta indica* has been used extensively in traditional treatment due to its medicinal properties. Neem leaves have been used traditionally for treating several epidermal dysfunctions, such as eczema, psoriasis, and acne. Neem is rich in antioxidants and helps to boost immune response in tissues of affected skin area. It also consists of bioactive compounds for antibacterial, antifungal, and anticancer activities. In this study, neem leaves extract was used in producing herbal neem soap as a remedy for curing skin problems. The herbal neem soap was made by blending 36.4% palm oil, 9.1% coconut oil, 27.3% sodium hydroxide, 9.1% neem oil extract, and 18.2% neem aqueous extract which formed a pale yellow soap base. The results of the selected physical and chemical properties of this study show that the moisture content of the soap was 4.02% with 10.60 pH value, 57.40% total fatty matter, and 0.44% free caustic alkali. The results imply that herbal neem soap is suitable for human skin and can be a therapeutic alternative to skin problems.

Keywords: *Azadirachta indica*, herbal soap, skin problems

Article history:- Received: 28 Mac 2019; Accepted: 06 December 2019; Published: 16 December 2019

Introduction

People have been using *Azadirachta indica* (neem) tree as a source of medicine since time immemorial. Numerous compounds can be found from different parts of neem, such as its seed, bark, and leaf. The effectiveness of each part of neem in treating various types of diseases may differ due to their different chemical properties (Biswas et al., 2002).

Neem leaf extract consists of nimbidin, cyclic trisulphide, cyclic tetrasulphide, and polyphenolic flavonoids. These bioactive compounds support antibacterial, antifungal, and anticancer activities. It is also rich in antioxidant which helps develop new skin cell tissues. In Ayurvedic medicines, neem leaf has been used in the treatment of leprosy, eye problems, epistaxis, intestinal worms, anorexia, biliousness, and skin ulcers. Meanwhile, neem oil contains various types of neem limonoids which can prevent mutagenic effect (Alzohairy, 2016; Lakshmi et al., 2015; Hossain et al., 2013; Biswas et al., 2002).

Other compounds involved in the preparation of the herbal soap are palm oil and coconut oil. These compounds are rich in vitamin E, thus help to protect body tissue from damage and heal wounds faster (Sen et al., 2010). Thus the producing of this natural remedy using neem leaves extract could produce an affordable herbal soap that is free of harmful chemicals to the skin.

Methods

Materials

Azadirachta indica (neem) leaves were collected from Kuala Pilah, Negeri Sembilan, Malaysia. The neem leaves were segregated and washed with distilled water. The leaves were dried at room temperature, grinded to small pieces, and kept for further usage (Al-Hashemi & Hossain, 2016).

Distilled water, sodium hydroxide (NaOH), palm oil, and coconut oil were used as received without further purification.

Extract of neem in oil

Grinded leaves measuring 80 g were soaked into 800 mL of palm oil and heated at 120 °C for 3 h. After they have cooled to room temperature, the mixture was then filtrated by using filter paper to remove the leaves residue. The oil filtrate was kept for further experiment.

Aqueous extract of neem

The neem leaves aqueous extraction was prepared by using blending method. Grinded leaves measuring 20 g were taken and placed into a grinder machine filled with 200 mL of distilled water and blended for 5 min. Then the sludge in the mixture was removed by using filter paper. The aqueous filtrate was kept for further experiment.

Soap preparation

The mixture of palm oil (400 mL), coconut oil (100 mL), neem oil extract (100 mL), and neem aqueous extract (200 mL) was placed in a 2000 mL beaker. The mixture was then stirred at room temperature for 30 minutes by using mechanical stirring. A 300 mL NaOH was added into the mixture to initiate the saponification process whereby the mixture was stirred until the reaction has completed.The excess of NaOH was removed by washing the neem soap paste with (5–10%) hot water at 90 °C and then was continued washing with 10mL of distilled water. The neem soap paste was poured into a mould and left to dry at room temperature.

pH determination

A neem soap measuring 5 g was produced and cut into small pieces and added to 50 mL of distilled water in a volumetric flask (50 mL) to be dissolved in order to obtain 10% (% mass/V) of neem soap solution. The pH of the neem soap solution was measured by using a pH meter (Mandokhail et al., 2015).

Total fatty matter (TFM) determination

A TFM test was carried out by reacting soap with acid in the presence of hot water. About 5 g of neem soap was added into a beaker containing 75 mL of distilled water. The mixture was heated and then 10mL solution of 15 % sulfuric acid (H_2SO_4) was added. The heating process was continued until a clear solution was obtained. Fatty acids on the surface of the resulting solution was solidified by adding 3.5 g of beeswax and then was reheated. The set-up solution was allowed to cool to form a solid layer of fatty acid on the surface of the reaction solution (Mandokhail et al., 2015). The solid layer was removed, blotted to dry, and weighed to calculate the TFM of the soap by using the following formula:

$$\%TFM = \frac{A - X}{W} x100,$$

Where;
A= weight of wax + oil
X= weight of wax
W= weight of neem soap

Free caustic alkali (FCA) determination

A neem soap measuring 5 g was weighed and dissolved in 30 mL of ethanol. A few drops of methyl orange indicator and 10 mL solution of 20% barium chloride ($BaCl_2$) was added. The resulting solution was titrated against 0.05 M H_2SO_4. The change in colour indicated the end point. The free caustic alkalinity was calculated by using the following formula:

$$FCA = \frac{0.31}{W} xV_a$$

Where;
V_a = volume of titrated acid
W = weight of neem soap

Moisture content (MC) determination

A neem soap measuring 5 g was placed in a tarred moisture dish and dried in an oven (Memmert, Germany) for 2 h at 101 ± 1 ºC. The drying process was repeated until a constant weight was reached (Mandokhail et al., 2015). The percentage of the moisture content was calculated by using the following formula:

$$\%MC = \frac{C_S - C_h}{C_S - C_W} x100$$

Where;
C_w= weight of crucible,
C_h= weight of crucible + sample after heating
C_s= weight of crucible + sample

Results and Discussion

Azadirachta indica (neem) is a tree in the family Meliaceae and it has been used widely in traditional medicine (Al Akeel et al., 2017). Neem leaves (Figure 1) contain various biological active compounds, such as nimbidin, cyclic trisulphide, cyclic tetrasulphide, and polyphenolic flavonoids which are very important in pharmaceutical industry. (Alzohairy, 2016; Lakshmi et al., 2015; Hossain et al., 2013; Biswas et al., 2002). These active compounds were obtained from the leaves by solvent extraction method. The purpose of extraction is to separate soluble active compound in the solvent and leave behind insoluble leaves part called as residue. The aim of this research is to produce a neem soap that is suitable for human skin and helps in curing skin problems by using natural ingredients.

The pale- yellow in colour herbal neem soap (Figure 2) was produced from crude neem leaves extract as its main ingredient. Other ingredients involved in producing the neem soap were palm oil and coconut oil. Both oils contain vitamin A and vitamin E with high saturated fats, which is good for health as well as skin protectant (Nevin & Rajamohan, 2006; Sen et al., 2010). The addition of these oils as ingredients increases the benefit of the soap in protecting skin from aging. Vitamin E protects the skin by acting as a free radical scavenger and stabilising the cell membrane to prevent oxidative damage from the hydrolysis of phospholipids (Masri et al., 2004).

Figure 1. Neem leaves

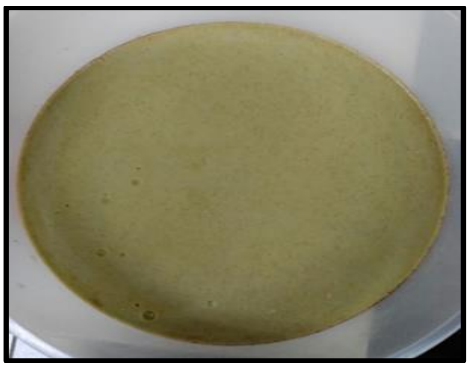

Figure 2. Herbal neem soap

The physicochemical properties of the soap were divided into several criteria, namely pH, total fatty matter (TFM), free caustic alkali (FCA), and moisture content (MC) of the soap. The data of soap prepared from neem seed oil that were formulated in previous studies and commercial soaps were tabulated in Table 1 (Mandokhail et al., 2015).

Table 1. Physicochemical properties of prepared, neem seed oil, and commercial soap

Characteristics	Prepared soap	Neem seed oil soap	Commercial soap
% Total fatty matter	57.4	24.6 – 46.4	92.5 – 97.5
% Free caustic alkali	0.4	0.3 – 6.8	1.3 – 1.4
% Moisture content	4.0	4.4 – 9.8	4.4 – 5.9
pH	10.6	11.0 - 11.6	9.6 – 10.6

TFM describes the quality of the soap produced. The high percentage of TFM shows that the soap is good for dry skin as it re-hydrate and moisturise the skin. A previous study has shown that the best TFM value for dry skin must be higher than 80% (Mak-Mensah et al., 2011). The TFM value of the soap prepared from neem leaves extract was 57.4%, which is higher than the neem seed oil soap that ranged from 24.6–46.4%. This shows that the soap prepared from neem leaves extract was richer in fatty matter as compared to the neem seed oil soap. However, the TFM value was still lower than the recommended value, which may be due to the unreacted NaOH in the mixture during the soap preparation (Mandokhail et al., 2015).

FCA is one of the parameters which specifies the harshness of the soap and prevents the soap from becoming oily (Mandokhail et al., 2015). The FCA value refers to the amount of alkaline-free properties in the soap which can cause skin itch when present in excess value (Warra et al., 2011). The FCA of the soap prepared was 0.44%. This value is considered low and proves that the soap produced is good for sensitive skin.

MC is a parameter that is used in assessing the shelf life of a product. High moisture content in soap could lead to a reaction of excess water with un-saponified fat to give free fatty acid and glycerol in a process called hydrolysis of soap on storage (Onyango et al., 2014). From the values obtained in the analysis, the moisture content of the soap sample was 4.0%. This shows dissimilarities from neem seed oil soap, which may be due to the difference in the soap preparation methods.

A suitable pH for soap bar is important to prevent bacterial colonisation and retain moisture on the skin. The normal pH value for human skin is 5.5. In a previous study, it was recommended that the pH value of soap that is suitable for skin should be within 4–7 (Nix, 2000). In this study, it was found that the pH of the soap produced was 10.60, which is considered high. This value was due to the presence of partial alkali sodium (II) oxide Na_2O, carbonates, and bicarbonates in the soap (Mandokhail et al., 2015; Onyango et al., 2014).

Above all, the comparative study of soaps in Table 1 shows that the soap prepared in this study has better physicochemical properties in terms of FCA and MC percentages. Meanwhile, the pH value was lower compared to neem oil soap, which is comparable to commercial soap. However, further research should be done on the TFM value to improve the quality of the soap.

Conclusion

A herbal soap has been produced successfully from neem leaves extract in this study. The results from the physicochemical properties of the neem soap prepared was compared to neem seed oil soap and commercial neem soap. The results imply that the neem soap produced is suitable for human skin. Moreover, it is a product innovation of a natural medicated soap produced from neem leaves extract that is free from chemicals, such as sodium sulfate (SLS), artificial colourant, and artificial fragrance, thus can be an affordable alternative therapy for consumers who have skin problems.

Acknowledgement

The authors would like to thank Universiti Teknologi MARA (UiTM) Cawangan Negeri Sembilan, Kampus Kuala Pilah, Malaysia for providing the opportunity, facilities and financial support to accomplish this study splendidly.

References

Al Akeel, R., Mateen, A., Janardhan, K., & Gupta, V. C. (2017). Analysis of anti-bacterial and anti-oxidative activity of Azadirachta indica bark using various solvents extracts. *Saudi Journal of Biological Sciences*, 24(1), 11-14.

Al-Hashemi, Z. S. S., & Hossain, M. A. (2016). Biological activities of different neem leaf crude extracts used locally in Ayurvedic medicine. *Pacific Science Review A: Natural Science and Engineering*, *18*(2), 128-131.

Alzohairy, M. A. (2016). Therapeutics role of Azadirachta indica (Neem) and their active constituents in diseases prevention and treatment. *Evidence-Based Complementary and Alternative Medicine*, 2016.

Biswas, K., Chattopadhyay, I., Banerjee, R. K., & Bandyopadhyay, U. (2002). Biological activities and medicinal properties of neem (Azadirachta indica). *Current Science-Bangalore*, 82(11), 1336-1345.

Francine, U., Jeannette, U. & Pierre, R.J. (2015) Assessment of antibacterial activity of Neem plant (Azadirachta indica) on Staphylococcus aureus and Escherichia. *Journal of Medicinal Plants Studies*, 3(4), 85-91.

Hossain, M. A., Al-Toubi, W. A., Al-Sabahi, J. N., Weli, A. M., & Al-Riyami, Q. A. (2013). Identification and characterization of chemical compounds in different crude extracts from leaves of Omani neem. *Journal of Taibah University for Science*, 7, 181–188.

Krishnasamyet, A., Sundaresan, M., & Velan, P. (2015). Rapid phytosynthesis of nano-sized titanium using leaf extract of Azadirachta indica. *International Journal of Chem Tech Research*, 8(4), 2047-2052.

Lakshmi, T., Krishnan, V., Rajendran, R., & Madhusudhanan, N. (2015). Azadirachta indica: A herbal panacea in dentistry–An update. *Pharmacognosy Reviews*, 9(17), 41.

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.

Mandokhail, F., Jamil, N., Riaz, M., Masood, Z., Ahmed, S., Asif, B., Sham-Ud-Din, G., Noor, G., Rehman, N., Zahid, S., Bano, A., Dil Murad, F., Shakeel, D., & Mengal, F. (2015). Study of physica; and chemical properties of local neem (azadirachta indica) soap with branded soaping relation to their impact on skin. *Am-Euras. J. Toxicol. Sci.,* 7(4), 239-242.

Masri, R., Ismail, R., & Ahmad, S. (2004). Palm-based cosmetic products with palm vitamin E. *MPOB Information Series*, 245.

Nevin, K. G., & Rajamohan, T. (2006). Virgin coconut oil supplemented diet increases the antioxidant status in rats. *Food chemistry*, *99*(2), 260-266.

Nix, D. H. (2000). Factors to consider when selecting skin cleansing products. *Journal of Wound Ostomy & Continence Nursing*, *27*(5), 260-268.

Onyango, P. V., Oyaro N., Aloys O., lida M., & Wesley M. O., (2014). Assessment of the physicochemical properties of selected commercial soaps manufactured and sold in Kenya. *Open Journal of Applied Sciences*, 4, 433-440.

Pankaj, S., Lakeshwar T., Mukesh B., & Vishnu B. (2011) Review on neem (azadirachta indica): Thousands of problems one solution. *National Research Journal of pharmacy*, 2(12), 97-102.

Sen, C. K., Rink, C., & Khanna, S. (2010). Palm oil–derived natural vitamin E α-tocotrienol in brain health and disease. *Journal of the American College of Nutrition*, 29(3), 314S-323S.

Warra, A.A., Wawata L.G., Gunu S.Y. and F.A., & Atiku (2011). Soap preparation from soxhlet extracted Nigerian cotton seed oil. *Advances in Applied Science Research*, 2(5), 617-623.