Indonesian Journal of Pharmaceutics
IdJP
ISSN : 2597-8748

Vol. 6, Issue 2, 2024 (109-118)
http://journal.unpad.ac.id/IdJP

Topical Formulation of Herbal Nanocosmetics for Anti-Aging

Patihul Husni*[1], Mikhania Christiningtyas Eryani[2]

[1]Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy, Universitas Padjadjaran, Jatinangor 45363, Indonesia
[2]Faculty of pharmacy, Jember University, Jember, Indonesia

Submitted: 03/08/2024, Revised: 07/08/2024, Accepted: 10/08/2024, Published: 14/08/2024

ABSTRACT

Skin aging is a biological process that involves a decline in skin function. Regarding prevention and inhibition of skin aging, use of cosmetic products is an option to avoid skin aging because it can improve texture and function of skin. Recently, development of a topical formulation of herbal nanocosmetics for anti-aging has grown increasingly popular. This review is aimed to summarize and describe topical formulation of herbal nanocosmetics for anti-aging application. In addition, this review also shows several studies performed by researchers in development of topical formulation of herbal nanocosmetics for anti-aging. The data were collected from published journals in the range of 2011-2023. Study result showed that nanoemulsion, nanostructured lipid carriers (NLC), solid lipid nanoparticles (SLN), niosomes, liposomes, ethosomes, and transfersomes are nanotechnology methods used to prepare herbal nanocosmetics for anti-aging in the cream or gel dosage form. In conclusion, herbal nanocosmetics combine the benefits of herbal extracts with nanotechnology which can be used to enhance the effectiveness of natural ingredients for anti-aging effect.

Keywords: topical, herbal, nanocosmetics, anti-aging

*Corresponding author,
e-mail: patihul.husni@unpad.ac.id P. Husni)

https://doi.org/10.24198/idjp. v6i1.56857

1. Introduction

Skin aging, a biological process that involves a decline in skin function, is affected by aging as a person becomes older. Because skin is the most noticeable component of the body, a person's wellbeing is directly impacted by skin aging (1). The aging process of the skin is associated with signs of aging, including wrinkles, sagging, age spots and, dryness, loss of elasticity in the skin, and the skin tends to become thinner (2-4). Regarding prevention and inhibition of skin aging, use of cosmetic products is an option to avoid skin aging because it can improve texture and function of skin (5, 6).

Due to the public's perception that herbal plants may nourish the skin with a low risk of adverse effects, the use of them in cosmetic products has grown increasingly popular (7). Therefore, many studies were performed and developed on topical formulation of herbal cosmetics to prevent skin aging (8-12).

Recently, the use of nanotechnology in the cosmetic industry can overcome the drawbacks of conventional products, such as their propensity to be readily absorbed by the skin, to boost the performance of superior products, and to produce long-lasting benefits (13). In addition, according to the findings of recent studies, nanotechnology-modified herbal plants have greater anti-aging action than those that are merely used as extracts (9). Development of a topical formulation of herbal nanocosmetics for anti-aging involves combining botanical extracts with nanotechnology to enhance their efficacy.

This review is aimed to summarize and describe topical formulation of herbal nanocosmetics for anti-aging application. In addition, this review also shows several studies performed by researchers in development of topical formulation of herbal nanocosmetics for anti-aging.

2. Methodology

By using specific keywords “herbal nanocosmetics anti-aging formulation”, this review was prepared. Inclusions criteria (related to specific keywords) and exclusions criteria (opinions and unrelated topics) were also determined. Finally, journals published in 2011-2023 were collected.

2.1. Skin aging and anti-aging strategies

Figure 2 depicts the intricate process of skin aging, which is influenced by both internal and external influences. Hereditary, hormonal, and nutritional variables are among the internal causes that might lead to skin aging. The main extrinsic element that causes skin aging is sun exposure. Smoking, pollution, way of life, and UV exposure are additional environmental influences (1, 14). Wrinkles are one of the changes in the skin's structure and function that can result from these variables.

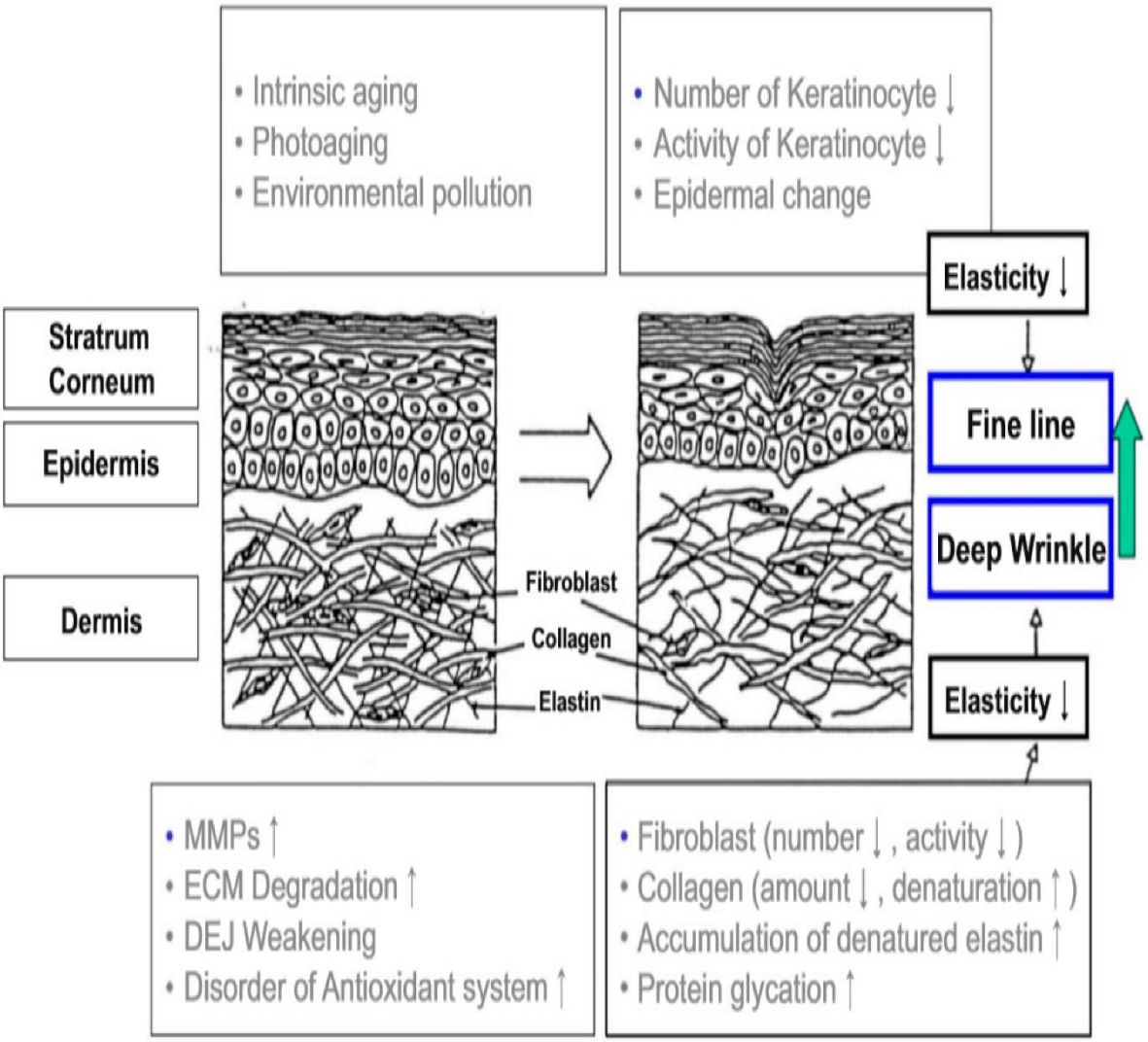

Figure 2. Mechanism of skin aging (15)

Due to decreased collagen levels and collagen breakdown, wrinkles are one of the most obvious indicators of aging skin (Figure 3) (8, 16). Aging skin can lose its ability to act as a robust and flexible barrier in addition to having fewer collagen fibers (17). Extracellular matrix (ECM) can degrade as a result of oxidative stress and increased ROS brought on by UV radiation exposure (18). Increased activity of tyrosinase, elastase, and collagenase is caused by ECM degradation, which is directly linked to aging skin (19). The activation of these three enzymes results in a drop in collagen and elastin levels, which weakens the skin and gives it wrinkles (19).

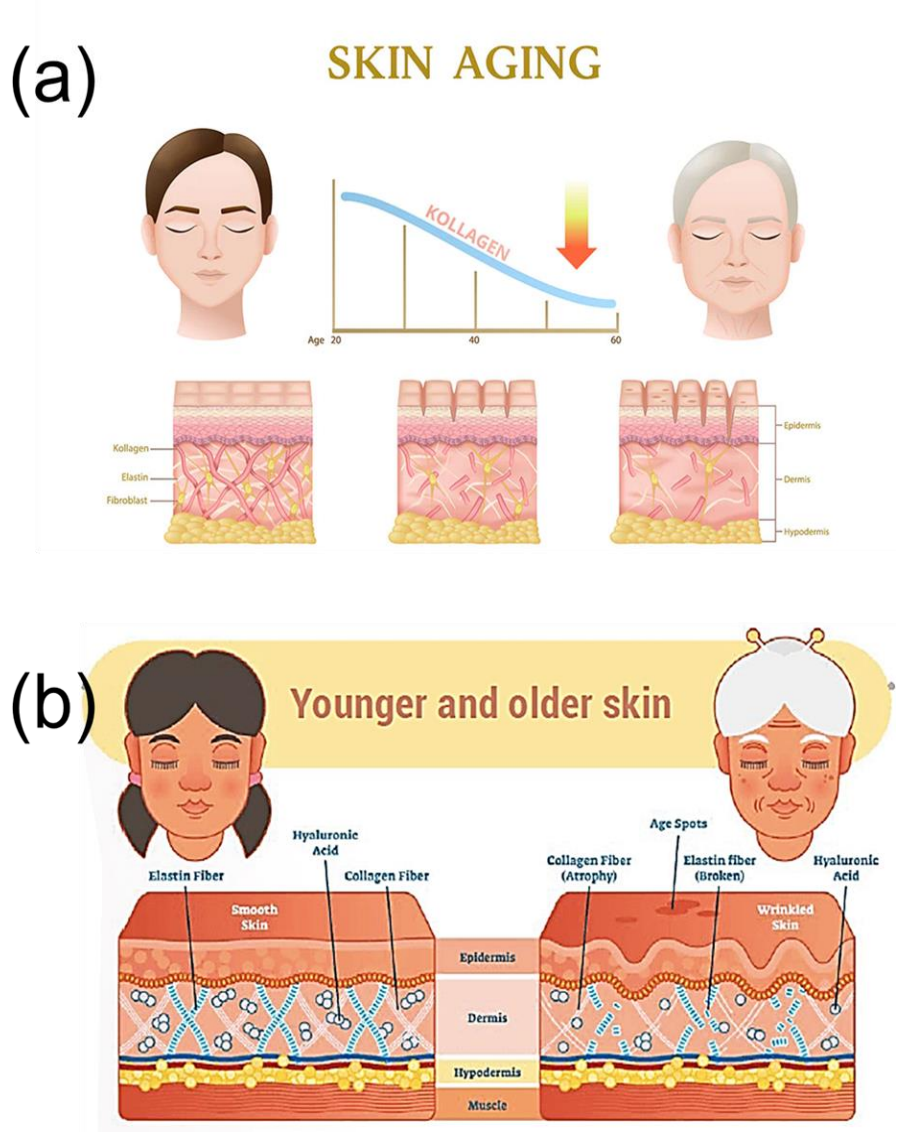

Figure 3. Illustration of skin aging process (a) and comparison of younger and older skin (b) (14, 20)

Skin aging can be stopped or slowed down in a variety of ways. These consist of using sunscreen, abstaining from tobacco, maintaining a nutritious diet, and obtaining adequate sleep (14). Nutrition is a popular preventive strategy for reducing or postponing the appearance of wrinkles in order to combat the effects of reactive oxygen species (ROS) (21). In addition to being beneficial for general health, eating a balanced diet can help prevent premature skin aging. Antioxidant-rich foods like tomatoes, dark leafy greens, and berries can help shield skin cells from harm brought on by free radicals. Nuts, seeds, and seafood are good sources of omega-3 fatty acids, which can also help keep skin plump and moisturized. Lastly, maintaining proper hydration throughout the day by consuming lots of water will assist keep skin cells hydrated and looking youthful (14). A few actions can be taken to lessen the appearance of premature skin aging. One is to shield yourself from the sun as much as you can. This entails staying away from tanning beds, using sunscreen with an SPF of 30 or higher, and dressing protectively when

going outside. Giving up smoking is another. Smoking raises the risk of skin cancer in addition to hastening the aging process. Ultimately, maintaining a healthy and youthful-looking complexion can also be aided by obtaining adequate sleep and controlling stress (14). Furthermore, using skin care products can help prevent premature aging of the skin. For products that assist increase the formation of collagen, brighten the skin, and enhance suppleness, look for substances like retinol, hyaluronic acid, niacinamide, or vitamin C (14).

2.2. Herbal nanocosmetics

Herbal nanocosmetics are a cutting-edge approach to skincare that combine cutting-edge nanotechnology with traditional herbal medicines to create cosmetics that are both more potent and maybe safer. For their numerous skincare benefits, herbal extracts made from plants, flowers, roots, and fruits are utilized (22). These herbal extracts are encapsulated using nanotechnology. To improve the stability and skin penetration of these herbal components, a variety of nanoparticle forms are employed, including liposomes, nanoemulsions, and solid lipid nanoparticles (23, 24). The depiction of herbal-loaded nanoparticles is shown in Figure 4.

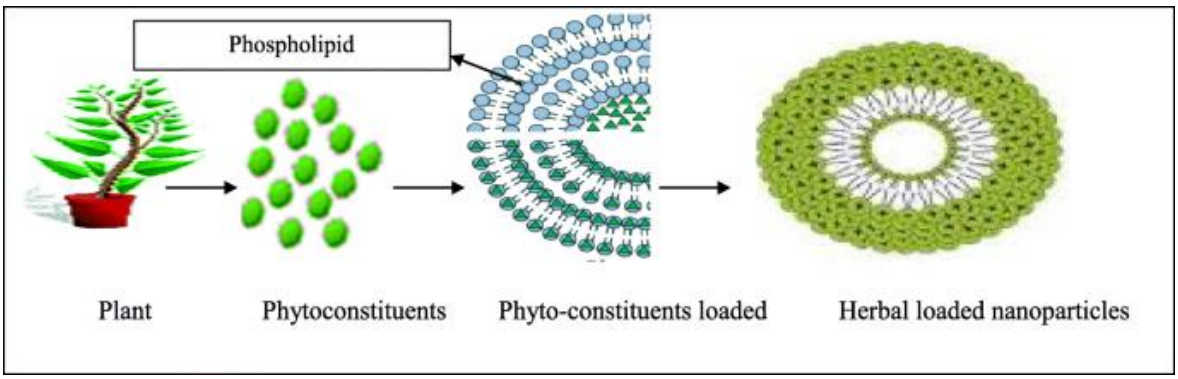

Figure 4. Illustration of herbal loaded nanoparticles (25)

Herbal nanocosmetics' advantages a) Improved penetration: By allowing herbal extracts to enter the skin's layers more deeply, nanoparticles increase the extracts' bioavailability and effectiveness. b) Stability and shelf life: Encapsulation prolongs the shelf life and ensures stability of the herbal ingredients by shielding them from deterioration. c) Targeted delivery: To ensure targeted and sustained administration, nanoparticles can be engineered to release the herbal actives at particular skin layers or gradually (26).

Herbal plants are commonly used in skincare and cosmetic goods, including anti-aging products. Because the constituent molecules of herbs contain pharmacological activity, they can be employed as ingredients in skin care and preventative products (1). Several plants have been used to cure wrinkles. Wild Carrot (*Daucus carota*), Aloe (*Aloe vera*), Japanese red pine (*Pinus densiflors*), Cucumber (*Curcumis sativum*), Wheat (*Triticum sativum*), Rosemary (*Rosmarinus officinalis*), Coriander (*Coriandrum sativum*), and Sweet orange (*Citrus sinensis*) are examples of plants that are commonly used in cooking. Because of their metabolites, these plants have promise anti-wrinkle qualities.

Among these characteristics are their ability to scavenge free radicals, boost the dermal synthesis of collagen fibers, and reduce the expression of matrix metalloproteinase and/or collagenase (8).

In addition to beneficial herbs, new technologies—including nanotechnology—are needed for delivery systems that allow active ingredients to quickly and easily pass through the skin. The field of nanotechnology is a valuable endeavor that involves the production and application of innovative, controlled non-metric particles to address issues related to health and appearance. As a result of its extremely advantageous qualities, it finds extensive use in numerous industries, such as the pharmaceutical and cosmetics sectors (8).

Active compounds can be supplied to the epidermis and dermis using a nanotechnology strategy (27). These herbs' usage of nanotechnology can improve stability, decrease toxicity and pain, and increase permeation altogether. Herbal nanocosmetics significantly minimize the symptoms of aging on the skin, making them a viable alternative to synthetic cosmetics in the treatment of skin aging. To properly ascertain the toxicity and safety of these herbal nanocosmetics, more investigation is necessary (1).

2.3. Studies on topical herbal nanocosmetics for anti-aging

In order to create safer and more effective formulations, ongoing research attempts to optimize nanocarriers, investigate innovative herbal extracts, and enhance knowledge of the interactions between nanoparticles and skin. Some of the nanotechnology techniques used to slow down skin aging include niosomes, liposomes, ethosomes, transfersomes, solid lipid nanoparticles (SLN), nanoemulsion, and nanostructured lipid carriers (NLC). Topical formulations of herbal nanocosmetics are typically administered in the form of creams or gels. Table 1 includes a collection of studies on the topical formulation of herbal nanocosmetics for anti-aging.

Table 1. Studies on topical formulation of herbal nanocosmetics for anti-aging.

Topical Dosage Form	Nanoformulation	Herbal Plants	Active Compound	References
Cream	Nanoemulsion	*Phyllanthus urinaria*	Gallic acid, corilagin, geraniin, ellagic acid	(9)
	Nanoemulsion	*Macadamia integrifolia*	oleic acid, palmitic acid, palmitoleic acid, linoleic acid, sterol compounds and also vitamin E groups (tocopherol and tocotrienol)	(28)
	Liposome, ethosome, transfersome	*Curcuma longa*	Curcuminoid	(29)
	Niosome	*Oryza sativa*	Ferulic acid, gamma-oryzanol, phytic acid	(10)
	NLC	*Citrus sinensis*	Hesperidin	(8)
	SLN	*Prunus persica*	Flavonoids	(30)
Gel	Niosome	*Oryza sativa*	Ferulic acid, gamma-oryzanol, phytic acid	(10)
	Niosome	*Caesalpinia sappan L.*	Gallic acid	(31)
	Nanoemulsion	*Achyrocline satureioides*	Quercetin, luteolin, 3-O-methylquercetin (flavonoids)	(12)
	Nanoemulsion	*Tagetes erecta*	Quercetagetin (flavonoids)	(11)

The development of herbal nanocosmetics faces a number of difficulties, including formulation stability, safety, compatibility, and regulatory compliance. It can be difficult to create stable formulations that preserve the integrity of both herbal extracts and nanoparticles. Furthermore, it's critical to guarantee that nanoparticles are safe and compatible with skin and herbal extracts. In addition, strict adherence to criteria is necessary to achieve regulatory standards for cosmetics utilizing nanotechnology and herbal constituents.

3. Conclusion

The advantages of herbal extracts are combined with nanotechnology in herbal nanocosmetics, which can be utilized to increase the potency of natural compounds for anti-aging effects. Herbal nanocosmetics are often formulated as creams or gels for topical use.

4. References

[1] Garcella P, Wijaya TH, Kurniawan DW. Narrative Review: Herbal Nanocosmetics for Anti Aging. Journal of Pharmaceutical Science and Clinical Research. 2023;01:63-77.

[2] Salminen A, Kaarniranta K, Kauppinen A. Photoaging: UV radiation-induced inflammation and immunosuppression accelerate the aging process in the skin. Inflamm Res. 2022;71(7-8):817-31.

[3] Baldassarri P, Calvani M. The aging process of skin and the increase in size of subcutaneous adipocytes. Int J Tissue React. 1994;16(5-6):229-41.

[4] Letsiou S. Tracing skin aging process: a mini- review of in vitro approaches. Biogerontology. 2021;22(3):261-72.

[5] de Souto Barreto P. Editorial: Lifestyle and Aging. JAR Life. 2020;9:1-2.

[6] Addor FAS. Beyond photoaging: additional factors involved in the process of skin aging. Clin Cosmet Investig Dermatol. 2018;11:437-43.

[7] Zhang J, Onakpoya IJ, Posadzki P, Eddouks M. The safety of herbal medicine: from prejudice to evidence. Evid Based Complement Alternat Med. 2015;2015:316706.

[8] Amer RI, Ezzat SM, Aborehab NM, Ragab MF, Mohamed D, Hashad A, et al. Downregulation of MMP1 expression mediates the anti-aging activity of Citrus sinensis peel extract nanoformulation in UV induced photoaging in mice. Biomed Pharmacother. 2021;138:111537.

[9] Mahdi ES, Noor AM, Sakeena MH, Abdullah GZ, Abdulkarim MF, Sattar MA. Formulation and in vitro release evaluation of newly synthesized palm kernel oil esters-based nanoemulsion delivery system for 30% ethanolic dried extract derived from local Phyllanthus urinaria for skin antiaging. Int J Nanomedicine. 2011;6:2499-512.

[10] Manosroi A, Chutoprapat R, Abe M, Manosroi W, Manosroi J. Anti-aging efficacy of topical formulations containing niosomes entrapped with rice bran bioactive compounds. Pharm Biol. 2012;50(2):208-24.

[12] Balestrin LA, Bidone J, Bortolin RC, Moresco K, Moreira JC, Teixeira HF. Protective effect of a hydrogel containing Achyrocline satureioides extract-loaded nanoemulsion against UV-induced skin damage. J Photochem Photobiol B. 2016;163:269-76.

[13] Aziz ZAA, Mohd-Nasir H, Ahmad A, Mohd Setapar SH, Peng WL, Chuo SC, et al. Role of Nanotechnology for Design and Development of Cosmeceutical: Application in Makeup and Skin Care. Front Chem. 2019;7:739.

[14] AMIROBeauty. Understanding Skin Aging: How Does Skin Age and What Should I Do for It? : AMIRO; 2023 [cited 2023 January 8th]. Available from: https://amirobeauty.com/blogs/news/how-skin-ages-and-tips-for-healthy-skin.

[15] Shin KO, Park HS. Antiaging Cosmeceuticals in Korea and Open Innovation in the Era of the 4th Industrial Revolution: From Research to Business. Sustainability-Basel. 2019;11(3).

[16] Campa M, Baron E. Anti-aging Effects of Select Botanicals: Scientific Evidence and Current Trends. Cosmetics [Internet]. 2018; 5(3).

[17] Baumann L. How to Use Oral and Topical Cosmeceuticals to Prevent and Treat Skin Aging. Facial Plastic Surgery Clinics of North America. 2018;26(4):407-13.

[18] Khare R, Upmanyu N, Jha M. Exploring the Potential Effect of Methanolic Extract of Salvia officinalis Against UV Exposed Skin Aging: In vivo and In vitro Model. Curr Aging Sci. 2021;14(1):46-55.

[19] Hwang IS, Kim JE, Choi SI, Lee HR, Lee YJ, Jang MJ, et al. UV radiation-induced skin aging in hairless mice is effectively prevented by oral intake of sea buckthorn (Hippophae rhamnoides L.) fruit blend for 6 weeks through MMP suppression and increase of SOD activity. Int J Mol Med. 2012;30(2):392-400.

[20] Friedman R. The Physiology of Anti-Ageing: a2magazine; 2018 [cited 2023, June 26th]. Available from: https://www.a2magazine.co.za/2018/06/the-physiology-of-anti-ageing.html.

[21] Cao C, Xiao Z, Wu Y, Ge C. Diet and Skin Aging—From the Perspective of Food Nutrition. Nutrients [Internet]. 2020; 12(3).

[22] Michalak M. Plant Extracts as Skin Care and Therapeutic Agents. International Journal of Molecular Sciences [Internet]. 2023; 24(20).

[23] Teja PK, Mithiya J, Kate AS, Bairwa K, Chauthe SK. Herbal nanomedicines: Recent advancements, challenges, opportunities and regulatory overview. Phytomedicine. 2022;96:153890.

[24] Husni P, Ramadhania ZM. Plant Extract Loaded Nanoparticles. Indonesian Journal of Pharmaceutics. 2021;3(1):38-49.

[25] Sandhiya V, Ubaidulla U. A review on herbal drug loaded into pharmaceutical carrier techniques and its evaluation process. Future Journal of Pharmaceutical Sciences. 2020;6(1):51.

[26] Mohd-Setapar SH, John CP, Mohd-Nasir H, Azim MM, Ahmad A, Alshammari MB. Application of Nanotechnology Incorporated with Natural Ingredients in Natural Cosmetics. Cosmetics [Internet]. 2022; 9(6).

[27] Warsito MF, Kusumawati I. The Impact of Herbal Products in the Prevention, Regeneration and Delay of Skin Aging. Adv Exp Med Biol. 2019;1178:155-74.

[28] Hanum TI, Laila L, Sumaiyah S, Syahrina E. Macadamia Nuts Oil in Nanocream and Conventional Cream as Skin Anti-Aging: A Comparative Study. Open Access Maced J Med Sci. 2019;7(22):3917-20.

[29] Kaur CD, Saraf S. Topical vesicular formulations of Curcuma longa extract on recuperating the ultraviolet radiation-damaged skin. J Cosmet Dermatol. 2011;10(4):260-5.

[30] Mostafa ES, Maher A, Mostafa DA, Gad SS, Nawwar MAM, Swilam N. A Unique Acylated Flavonol Glycoside from Prunus persica (L.) var. Florida Prince: A New Solid Lipid Nanoparticle Cosmeceutical Formulation for Skincare. Antioxidants (Basel). 2021;10(3).

[31] Fatmawaty A, Subehan, Muliawati. Formulasi Dan Evaluasi Kestabilan Fisik Gel Niosom Ekstrak Etanol Kayu Secang (*Caesalpinia sappan* L.). Journal of Pharmaceutical and Medicinal Sciences. 2016;1(1):38-44.