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Narrative Review: Herbal Nanocosmetics for Anti Aging

Prilyano Garcella, Triyadi Hendra Wijaya and Dhadhang Wahyu Kurniawan*

Department of Pharmacy, Faculty of Health Sciences, Universitas Jenderal Soedirman, Jl. Dr. Soeparno, Purwokerto, Indonesia, 53122.

*correspondence email: dhadhang.kurniawan@unsoed.ac.id

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Abstract: Skin aging is a complex biological process caused by intrinsic and extrinsic factors. There are various approaches to preventing skin aging, one of which is using herbal nanocosmetics. This narrative review aims to determine the natural ingredients, type of nanoformulations, and its effects of herbal nanocosmetics to prevent skin aging. The method used in this study was searching for articles related to herbal nanocosmetics to avoid aging skin through Google Scholar, PubMed, and Science Direct with the keywords herbal plants, anti-aging, herbal cosmetics, cosmetics, nanocosmetics, nanoformulations, nanoparticles, nanomaterials, and topical delivery. The inclusion criteria were research articles or review articles about herbal plants made into herbal nanocosmetics to prevent skin aging with the topical route of administration published between 2010-2021 in full text. The articles that have been obtained are then selected, reviewed, and analyzed. Herbal plants made into herbal nanocosmetics contain phenolic compounds for nanoformulations used, namely silver nanoparticles, solid lipid nanoparticles (SLN), nanostructured lipid carriers (NLC), nanoemulsions, liposomes, niosomes, ethosomes, and transfersomes. These nanocosmetics herbs affect skin aging, including UV protection, preventing wrinkles and dark spots, moisturizing and brightening the skin. The herbal nanocosmetics prevent the effects of skin aging through some mechanisms such as anti-oxidant, photoprotective agents, modulators of collagen or elastin synthesis, and inhibitors of melanin synthesis.

Keywords: Anti aging; cosmetics; herbal nanocosmetics; herbal plants; nanotechnology

1. Introduction

Reaching old age or having the opportunity to live a long life is a hope for all human beings. According to the Indonesian Health Profile, in 2010, the percentage of the elderly population had reached 7.6%, and it is predicted that this figure will double to 15.77% in 2035. This increase occurs in line with the increasing age of life from 69.8 years in 2010 and is estimated to be 72.4 years in 2035 (Kemenkes RI, 2019). Thus, the increase will also improve the quality of human life, prolonging their life span.

In addition, increasing age also has implications for skin aging, which is a biological process that involves a decrease in skin function. Among all the parts of the body, the skin is the most visible part, and aging of the skin directly impacts the well-being of the individual. The reality on the ground also shows that people think that skin beauty is an indicator of well-being. 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 (Shanbhag *et al.,* 2019).

Therefore, efforts are needed to prevent and inhibit the occurrence of skin aging, one of which is cosmetic products. Using cosmetic products is an option to avoid aging skin because it can improve skin texture and function (Souto *et al.,* 2020). The addition of herbal plants in cosmetic products has become a popular trend among the public because it is believed that herbal plants can provide nutritional value to the skin with minimal risk of side effects (Ahmed *et al.,* 2020).

The trend of using cosmetics is currently quite lively in various countries, including Indonesia. This oncourages experts to continue developing cosmetic products to be used according to consumer needs. The technology used to formulate cosmetic products is also growing, one of which is nanotechnology. The nanotechnology approach in the cosmetic field can overcome limitations in conventional products, such as being easily absorbed by the skin, increasing the efficacy of better products, and providing long-lasting effects (Aziz *et al.,* 2019). One example of a cosmetic product that is already on the market is Viterol A from DS Laboratories brand, which contains *Gingko biloba extract*, almond, lavender oil, and other natural ingredients formulated in nanosomes to reduce wrinkles and fine lines on the skin (Souto *et al.*, 2020).

Meanwhile, research by Mahdi *et al.,* (2011) showed that 30% ethanol extract of Phyllanthus urinaria in nanoemulsion could produce good penetration when applied to the skin as anti-aging. Another study from Baitariza *et al* (2014) also showed that Oryza sativa extract with anti-oxidant content had greater anti-aging effectiveness when formulated in microemulsion than in ordinary emulsion. Based on the results of existing research shows that herbal plants modified using a nanotechnology approach produce better anti-aging activity than those only in the form of extracts. Therefore, in this study, researchers conducted a study on the anti-aging effect of herbal plants made into herbal nanocosmetics to prevent skin aging in the form of a narrative review.

2. Material and Methods

The method used in this study was searching for articles related to herbal nanocosmetics to prevent skin aging through *Google Scholar*, *PubMed,* and *Science Direct*. The keywords are herbal plants, anti aging, herbal cosmetics, cosmetics, nanocosmetics, nanoformulations, nanoparticles, nanomaterials, and topical delivery. The inclusion criteria were research articles or review articles about herbal plants made into herbal nanocosmetics to prevent skin aging with the topical route of administration published between 2010-2021 in full text. The articles that have been obtained are then selected, reviewed, and analyzed.

3. Results and Discussion

3.1. Skin aging

Skin aging is a complex biological process caused by intrinsic (chronological) and extrinsic factors (smoking, pollution, lifestyle, and UV exposure). These factors can cause changes in the structure and function of the skin, one of which is wrinkles. Wrinkles are one of the most visible signss of skin aging due to reduced collagen levels and the breakdown of collagen. During aging, collagen fibers are broken down by matrix metalloproteinase (MMPs), which can be induced by UV exposure. Skin aging results from the formation of reactive oxygen species (ROS) and the induction of MMPs leading to the accumulation of collagen fibers, thereby preventing normal collagen formation (Amer *et al.,* 2021; Campa & Baron, 2018).

In addition to a decrease in collagen fibers, aging skin can also lose its function as a strong and flexible barrier. As much as 80% of skin aging is thought to be caused by UV exposure, and overexposure significantly affects the appearance of aging skin (Baumann, 2018). Exposure to UV radiation can increase ROS and cause oxidative stress in skin tissue, which then causes the degradation of extracellular matrix (ECM) (Khare *et al.,* 2019). ECM degradation is directly related to skin aging and is responsible for the increased activity of collagenase, elastase, and tyrosinase (Hwang *et al.,* 2012).

Activation of these three enzymes causes a decrease in elastin and collagen levels, resulting in the skin losing elasticity, and strength, and causing wrinkles (Hwang *et al.,* 2012). In addition, exposure to UV radiation can also cause dark spots on the skin. Both intrinsic and extrinsic aging are affected by ROS-induced oxidative stress. Oxidative stress occurs when the body's supply of anti-oxidants is unmet. If left unchecked, ROS can increase skin pigmentation (Campa & Baron, 2018).

3.2. Natural ingredients that have anti aging content

Most natural ingredients for anti-aging contain phenolic compounds. These phenolic compounds are used for skin care products and cosmetics mainly based on their anti-oxidant activity (de Lima Cherubim *et al.,* 2020). Natural ingredients that have anti aging content are shown in Table 1.

Table 1. Study outcome of herbal plants to prevent skin aging with the topical route of administration that published between 2010-2021.

Natural ingredients	Plant part used	Active compound	Test subject	Study outcome	References
Marigolds (*Tagetes erecta*)	Flower	Syringic acid, β-amyrin	In vitro	*T. erecta* showed an effective inhibitory activity against hyaluronidase, elastase, and MMP-1 enzymes that play a role in the process of wrinkling so that *T. erecta* have a potential as anti wrinkle.	(Maity *et al.*, 2011)
Sage (*Salvia ofiicinalis*)	Leaf	Glycosides, alkaloids, flavonoids, triterpenoids, saponins, dan phenolic compounds	In vitro In vivo: swiss albino rat	*S. ofiicinalis* can reduce the thickness of the epidermis and increase skin elasticity through the inhibitory activity of the enzymes collagenase, elastae, and hyaluronidase so as to slow down the formation of wrinkles. In addition, this plant also provides a protective effect on the skin against UV exposure.	(Khare *et al.*, 2019)
Basil (*Ocinum sanctum*)	Flower, stem, leaf	Rosmarinic acid	In vitro	*O. sanctum* acts as an inhibitor of hyaluronidase and collagenase enzymes.	(Chaiyana *et al.*, 2019)
Rosmary (*Rosmarinus officinalis*)	Flower, stem, leaf	Phenolic acids, flavonoids (glycosides quercetin, luteolin), diterpenoid (carnosic acid, carnosol)	In vitro	The active ingredients of *R. officinalis* are able to inhibit the activity of elastae, collagenase, and tyrosinase enzymes in the skin aging process.	(Salem *et al.*, 2020)
Patchouli (*Pogostemon cablin*)	Leaf	β-gurjunene, β-guaiene, β-patchoulene, α-patchoulene, Δ-patchoulene (terpenoids)	In vivo: female kunming rat	Hydrodestillation of dried *P. cablin* leaves produces an essential oil known as patchouli oil. Patchouli oil is able to inhibit the formation of wrinkles, reduce the decrease in skin elasticity, increase collagen content, and maintain the integrity of the skin structure exposed to UV radiation so that it is useful for preventing photoaging	(Lin *et al.*, 2014)
Temu giring (*Curcuma heyneana*)	Rhizome	Curcumin, demethoxycurcumin, bis-demethoxycurcumin (curcuminoids)	In vivo: male rat	Temu giring provides a repair effect on damaged skin structures exposed to sunlight so as to prevent skin aging.	(Kusumawati *et al.*, 2018)
Tumeric (*Curcuma longa*)	Rhizome	Curcuminoids	volunteers (usia 25-30 tahun)	The curcuminoid compounds present in the tumeric improve skin properties such as hydration and sebum content.	(Kaur & Saraf, 2011)

Natural ingredients	**Plant part used**	**Active compound**	**Test subject**	**Study outcome**	**References**
Malacca (*Phyllanthus emblica*), sapodilla (*Manilkara zapota*)	Fruit	Galic acid	In vitro	Both plants showed anti-oxidant activity and inhibition of collagenase and elastase enzymes. *M. zapota* showed better collagenase and elastase enzymes inhibitory activity than *P. emblica.*	(Pientaweeratch *et al.*, 2016)
Pegagan (*Centella asiatica*), *Meum athamanticum, Aegopodium podagraria*	Herbs	Flavonoids, phenolic compounds	In vitro	Of the three plants, *A. podagraria* had the best anti-oxidant activity and inhibition of collagenase and elastase enzymes. Good anti-oxidant activity can prevent oxidative damage, thereby delaying skin aging.	(Zofia *et al.*, 2020)
Rice plant (*Oryza sativa*)	Seed	Anthocyanin, γ-oryzanol	volunteers (age 24-56 years)	The active ingredients contained in the purple seed rice plant can increase hydration of the skin so that the skin becomes more moist, reduces skin roughness, and increases skin elasticity.	(Manosroi *et al.*, 2020)
Oats (*Avena sativa*)	Seed	Flavonoids, phenol	volunteers (age 20-25 years)	*A. sativa* also has the potential to increase skin hydration and collagen synthesis so that it can be usefull for anti aging skin.	(Muhammad *et al.*, 2019)
Tengguli (*Cassia fistula*)	Flower	Phenolic compounds (protocatecheuic acid, vanilic acid, chlorogenic acid, ferulic acid), flavonoids	In vitro: skin fibroblast	The tengguli flower significantly induces collagen synthesis, inhibits the collagenase enzyme, increases skin moisture through increasing hyaluronic acid synthesis, and reduces dark spots on the skin.	(Limtrakul *et al.*, 2016)
Avocado (*Persea americana*)	Avocado peel	Alkaloids, flavonoids, phenols, tannins, glycosides	In vivo: male rat	Avocado peel extract can increase hydration, collagen, and skin elasticity compared to the control group.	(Lister *et al.*, 2021)

Table 2. Study outcome of herbal nanocosmetics to prevent skin aging that published between 2010-2021.

Herbal plants	Active compound	Test subject	Nanoformulation	Dosage form	Study outcome	References
Achyrocline satureioides	Quercetin, luteolin, 3-O-methylquercetin (flavonoids)	In vitro	Nanoemulsion	Gel	*A. satureioides* gel provides a protective effect on the skin against UVA/UVB radiation so as to prevent oxidative damage.	(Balestrin *et al.*, 2016)
Meniran (*Phyllanthus urinaria*)	Gallic acid, corilagin, geraniin, ellagic acid	In vitro	Nanoemulsion	Cream	*P. urinaria* cream can neutralize ROS so as to prevent oxidative damage caused by UV radiation.	(Mahdi *et al.*, 2011)
Marigolds (*Tagetes erecta*)	Quercetagetin (flavonoids)	volunteers (usia 30-55 tahun)	Nanoemulsion	Gel	Gel containing marigold flower extract can increase hydration and reduce wrinkles on the skin.	(Leelapornpisid *et al.*, 2014)
Orange (*Citrus sinensis*)	Hesperidin	In vitro, In vivo: female albino swiss rat	NLC	Cream	The hesperidin compound in the cream can increase collagen and decrease elastin in UV-exposed skin, thereby preventing the formation of wrinkles.	(Amer *et al.*, 2021)
Galangal male (*Alpinia zerumbet*)	Phenolic compounds	In vitro	NLC	-	*A. zerumbet* acts as an inhibitor of the hyaluronidase enzyme so as to prevent the appearance of wrinkles on the skin.	(Noor *et al.*, 2020)
Peaches (*Prunus persica*)	Flavonoids	In vitro, In vivo: male rat	SLN	Cream	*P. persica* cream can reduce the formation of wrinkles, increase collagen, prevent inhibition of elastin through inhibition of the activity of the enzymes collagenase, elastase, and tyrosinase.	(Mostafa *et al.*, 2021)
Rice plant (*Oryza sativa*)	Ferulic acid, gamma-oryzanol, phytic acid	volunteers (age 25-40 years)	Niosome	Gel and cream	Both creams and gels can improve the appearance of aging skin such as increasing hydration and thickness, brightening, and reducing skin hardness.	(Manosroi *et al.*, 2012)
Centaurea pumilio	Flavonoids, phenolic acid	In vitro	Silver nanoparticle	-	*C. pumilio* has the ability to slow down the aging process and prevent the formation of dark spots through inhibition of the enzymes collagenase, elastase, and tyrosinase.	(Mostafa *et al.*, 2019)
Eucalyptus (*Eucalyptus camaldulensis*)	Rutin	In vitro	Silver nanoparticle	-	*E. camaldulensis* showed an inhibitory activity against elastase and collagenase enzymes that play a role in the process of forming wrinkles. Thus, *E. Camaldulensis* has the potential as an anti wrinkle agent.	(Radwan *et al.*, 2020)
Tumeric (*Curcuma longa*)	Curcuminoid	volunteers (age 25-30 years)	Liposome, ethosome, transfersome	Cream	*C. longa* cream is useful for increasing skin hydration. *C. longa* loaded in transfersomes showed better activity than in ethosomes and liposomes.	(Kaur & Saraf, 2011)

Table 3. Study outcome of herbal plants to prevention of skin aging with nanotechnology approach that published between 2010-2021.

Nanoformulation	Study outcome	References
Nanoemulsion	Nanoemulsion containing the active ingredient *A. satureioides* can improve skin permeation.	(Balestrin *et al.*, 2016)
	The size of the molecule and the high permeability of the active ingredients of *P. urinaria* make it difficult for the active ingredients to penetrate the skin. Nanoemulsion containing *P. urinaria* extract can increase the solubility.	(Mahdi *et al.*, 2011)
	T. erecta extract loaded in nanoemulsion can increase the permeation of the active ingredients in the skin layer, which was shown through in vitro studies using rat skin.	(Leelapornpisid *et al.*, 2014)
Nanostructured lipid carriers (NLC)	*C. sinensis* extract loaded in NLC showed film formation on the test medium. This film is related to the occlusive properties that cause the active ingredients to penetrate deeper into the skin skin layer.	(Amer *et al.*, 2021)
Solid lipid nanoparticles (SLN)	SLN containing the active ingredient *P. persica* showed good stability without causing irritation, thereby increasing the performance of the active ingredient.	(Mostafa *et al.*, 2021)
Niosome	When the active ingredient of *O. sativa* was trapped in the niosomes, its chemical stability was increased more than the active ingredient which was not trapped in the niosomes. This causes the shelf life of the active ingredients to increase.	(Manosroi *et al.*, 2012)
Silver nanoparticle	Silver nanoparticle carrying *C. pumilio* and *E. camaldulensis* extracts did not cause any toxicity so they were safe to use.	(Mostafa *et al.*, 2019; Radwan *et al.*, 2020)
Liposome, ethosome, transfersome	Transfersomes showed better activity than ethosomes and liposomes.	(Kaur & Saraf, 2011)

Exposure to UV rays can cause skin disorders such as sunburn, damage to collagen and elastin, which causes wrinkles and damages skin elasticity, and causes thickening of the epidermis and hyperpigmentation. In addition to functioning as anti-oxidants, secondary metabolites can also function as photoprotective agents. Secondary metabolites can also inhibit the activity of elastase and collagenase enzymes and increase collagen production in fibroblast, thereby reducing damage due to UV exposure (Warsito & Kusumawati, 2019). This has also been shown by the natural ingredients listed in Table 1.

Apart from wrinkles, hyperpigmentation is another sign of skin aging, caused by melanin's overexpression, which can also cause skin disorders. Melanin is a tyrosine derivate that is formed during oxidative stress reactions through the activity of the tyrosinase enzyme. Thus, melanin inhibitation can work through the inhibitation of the tyrosinase enzyme (Warsito & Kusumawati, 2019). This has also been shown by several natural ingredients listed in Table 1.

These natural ingredients have the potential to reduce the effects of aging on the skin with anti aging mechanisms including anti-oxidants through free radical scavenging, providing skin protection against UV rays through anti-oxidant activity, inhibiting melanin production through tyrosinase, and various effects that lead to increased collagen synthesis or decreased collagen breakdown. Thus, these natural ingredients also have the potential to be used as active ingredients in cosmetic products to prevent skin aging.

3.3. Prevention of skin aging with nanotechnology approach

Some of the nanotechnology approaches obtained to prevent skin aging including nanoemulsion, nanostructured lipid carriers (NLC), solid lipid nanoparticles (SLN), niosome, silver nanoparticles, liposome, ethosome, and transfersome. The nanotechnology approach is shown in Table 3.

3.3.1. Nanoemulsion

Nanoemulsions are thermodynamically stable carrier systems with transparent appearance, formed from oil droplets stabilized by the combination of surfactants and co-surfactants in aqueous dispersion. Balestrin *et a.,l* (2016), Leelapornpisid *et al*., (2014), dan Mahdi *et a.,l* (2011) showed that nanoemulsions could improve skin permeation. This increase in permeation is due to the small nanoemulsion size (<200 nm), which makes it easy to interact with the skin so that more active ingredients are delivered to the site of action (Otlatici *et al.*, 2019; Souto *et al.*, 2020).

3.3.2. Solid lipid nanoparticles and nanostructured lipid carriers

Solid lipid nanoparticles (SLN) have particle sizes ranging from 50 to 1000 nm, where the core consists of a single solid lipid (Rahman *et al.*, 2020). Most of the anti-oxidant molecules are inherently unstable and can be easily oxidized to form inactive compounds before reaching the workplace which makes them difficult to formulate in stable and appropriate cosmetic products (Mostafa *et al.*, 2021). Based on Mostafa *et al* (2021) research, flavonoid compounds incorporated in SLN showed good stability without signs of irritation. This SLN carrier system is able to protect sensitive active ingredients so that the stability of the active ingredients is maintained and penetration is enhanced with a hydrating effect on the skin surface (Khezri *et al.*, 2018; Mostafa *et al.*, 2021).

While nanostructured lipid carriers (NLC) consist of a mixture of solid and liquid lipids. This gives it the advantage of a higher active ingredient delivery capacity than SLN (Souto *et al.*, 2020). Amer *et al* (2021) showed that NLC could increase the penetration of active ingredients. The increase in penetration is due to the occlusive nature formed from NLC so that the active ingredients can reach deeper layers of the skin (Amer *et al.*, 2021).

3.3.3. Silver nanoparticles

Silver nanoparticles are part of nanotechnology used in various fields because they have unique and interesting physicochemical properties. Based on the research of Mostafa *et al* (2019) dan Radwan *et al* (2020), herbal active ingredients contained in silver nanoparticles can reduce the effects of aging on the skin without causing signs of toxicity. Phenolic compounds identified in *C. pumilio* and *E. camaldulensis* play an important role in forming silver nanoparticles. This is because phenolic compouns act as reducing and stabilizing agents. So that during the formation of nanoparticles, bioactive compounds from plants interact with silver ions to produce new compounds to provide good activity (Mostafa *et al.*, 2019; Radwan *et al.*, 2020).

3.3.4. Liposome, niosome, transfersome and ethosome

Liposomes are spherical nanoparticles composed of phospholipids and a cholesterol bilayer. Liposomes are known to have hydrophilic and lipophilic groups. The presence of this structure allows liposomes to incorporate lipophilic compounds into the lipid bilayer and hydrophilic compounds into the aqueous compartment. Because they have lipids similar to those of the epidermis, liposomes can reduce systemic absorption and increase the delivery of active ingredients to the dermal (Rahman *et al.*, 2020).

Niosomes are nonionic nanospheric carrier systems with an aqueous core surrounded by a nonionic amphiphilic lipid layer in the lamellar phase. Manosroi *et al.*, (2012) showed that niosomes could increase the stability of the active ingredients of O. sativa. This stability strength increase is due to a lipid bilayer on the niosomes (Rameshk *et al.*, 2018). Regarding structure, niosomes are almost similar to liposomes but have better penetration ability, better stability, and reduced toxicity, so that they can present more advantages over liposomes (Rahman *et al.*, 2020).

The limitation of liposomes that cannot penetrate the skin layer deeply gives rise to a new carrier system, transfersomes. Based on research by Kaur & Saraf (2011), transfersomes showed better activity in increasing skin hydration than liposomes and ethosomes. This increase in activity is due to the ultra-elastic nature of transfersomes which can deform to a high degree, thereby increasing the delivery of active ingredients to the deeper layers of the skin. In addition, the transfersome structure composed of phospholipids and single chain surfactants provides elasticity, making it suitable for topical use for skin care (Rahman *et al.*, 2020).

Ethosomes are lipid carrier systems with a single or multi-layered structure and are composed of water, phospholipids, and ethanol. This composition provides higher sorption efficiency on the ethosomes, thereby increasing the permeation of the active ingredients and will be more efficiently delivered to the site of action. Despite the higher sorption efficiency, the alcohol composition of the ethosomes causes poor stability due to evaporation. Thus, the active ingredients contained in the ethosomes can be released after a while (Otlatici *et al.,* 2019; Rahman *et al.,* 2020).

The nanotechnology approach as a carrier system can increase skin permeation resulting in a number of active ingredients more efficiently delivered to the skin. In addition, its large surface area provides the advantage of carrying more active ingredients and is less irritating and toxic. Thus, the nanotechnology approach is effective and can potentially be used as a carrier system in preventing skin aging.

3.3.5. Herbal nanocosmetics to prevent skin aging

Herbal plants have been widely used in skincare and cosmetic products, one of which is anti aging products. The potential of herbs in skin care and prevention products can be through the pharmacological activity of the compounds in them. In addition to useful herbs, new technologies are also needed for delivery systems so that active ingredients can easily and quickly cross the skin, one of which is nanotechnology. Herbal plants made into herbal nanocosmetics to prevent skin aging are shown in the Table 2.

Herbal compounds have been widely used for cosmetic products such as anti-aging products. There are various forms of cosmetic products used for anti-aging treatments including creams and gels. This semi-solid system is widely used for topical application in cosmetic products because of its ease when applied to the skin and is acceptable for long-term use, making it more preffered by consumers (Garcês *et al.,* 2018). In addition, this semi-solid system remains stable during long storage periods making it suitable for transporting phenolic compounds that tend to be unstable in nature. These cosmetic products usually function as moisturizers, anti-oxidants, anti wrinkle agents, whitening agents, and skin supplements (vitamins) (Jadoon *et al.,* 2015; Mostafa *et al.,* 2021).

In the development of cosmetic products, penetration into the skin layer is the basis of the active ingredient delivery system. Apart from skin penetration properties, the purpose of the active ingredient delivery system is also to increase the duration and stability and prevent unwanted effects (Otlatici *et al.,* 2019). The nanotechnology used in the herbs in Table 2 has shown an increase in penetration so that several active ingredients are more efficiently delivered to the site of action. This increased penetration can help herbal nanocosmetics inhibit the production of elastase and collagenase.

Elastase is an enzyme that degrades elastin, resulting in skin elasticity being maintained (Desmiaty *et al.,* 2020). Meanwhile, collagenase is an enzyme that plays a role in extracellular matrix remodeling, including the breakdown of collagen to maintain skin strength (Pientaweeratch *et al.*, 2016). Elastin and collagen are the main structural components in the dermis. The herbal nanocosmetics in Table 2 also showed melanin's inhibitation through the enzyme tyrosinase. Melanin is a natural pigment located in the epidermis (Warsito & Kusumawati, 2019).

Thus, through a nanotechnology approach, active ingredients can be delivered to the epidermis and dermis (Warsito & Kusumawati, 2019). In addition to increasing penetration, the nanotechnology used in these herbs can also improve stability and minimize unwanted effects such as irritation and toxicity. Herbal nanocosmetics are pretty effective in reducing the impact of aging on the skin and have the potential to be used as an alternative in preventing skin aging. However, the safety and toxicity of these herbal nanocosmetics still have to be further ascertained to their needs. An overview of the potential of herbal nanocosmetics aimed at scientific anti aging can be seen in the Figure 1.

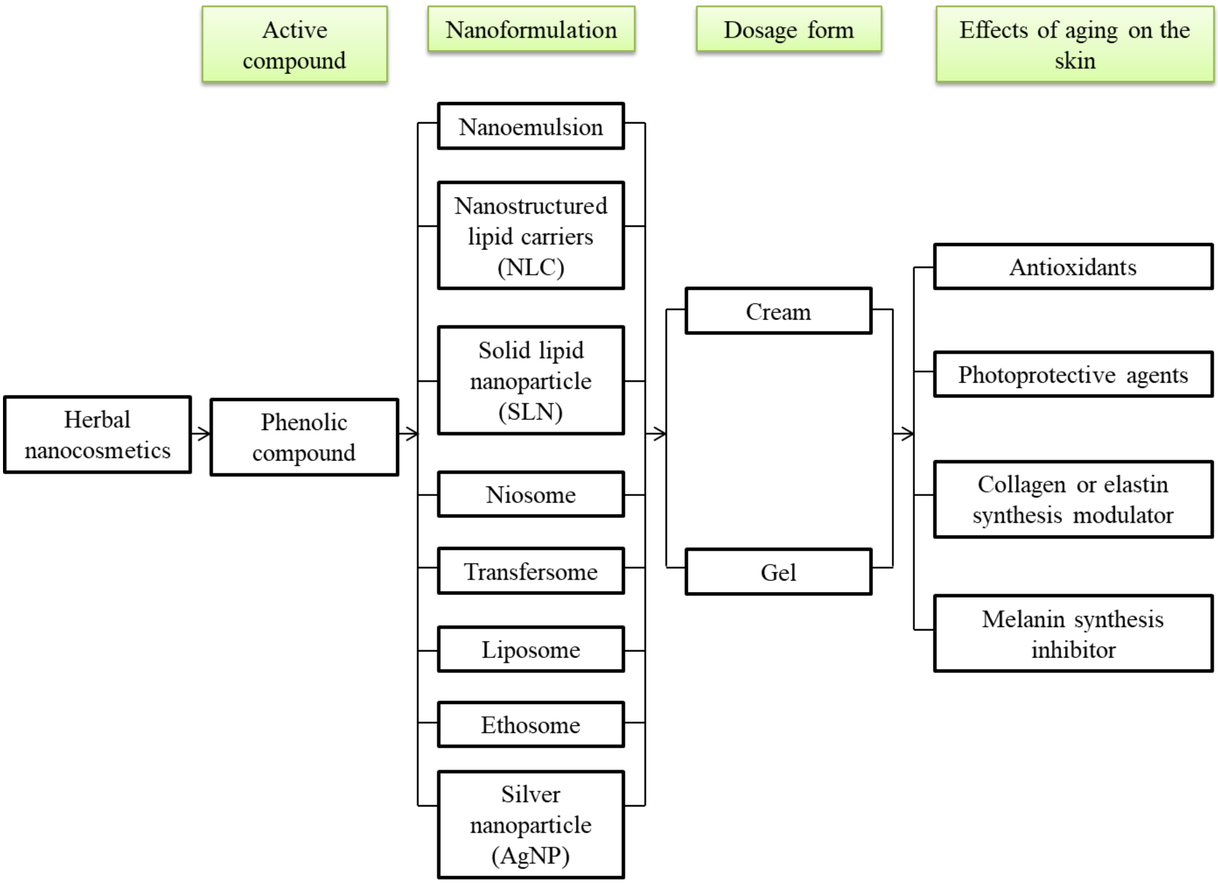

Figure 1. An overview of the potential of herbal nanocosmetics aimed at scientific anti aging.

4. Conclusion

The nanotechnology approach in herbal nanocosmetics to prevent skin aging can reduce the effects of aging on the skin. Types of nanoformulations commonly used to develop herbal nanocosmetics to prevent skin aging are inorganic carriers (silver), lipid and polymer nanocarriers (SLN, NLC, nanoemulsions, liposomes, niosomes, ethosomes, and transfersomes).

The results of this narrative review can be used as a reference for further research that discusses herbal plants made herbal nanocosmetics to prevent skin aging. However, the literatures that thoroughly discuss the action of the nanoparticle carrier system in providing anti aging effects are limited so that the explanation of the effectiveness of this carrier system in delivering active ingredients to the site of action is not yet complete.

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Conflict of Interest

All authors declared that there was no conflict of interest.

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