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Review: The Utilization of Pegagan (*Centella Asiatica*) in Food Industry and Wound Healing Materials in Pharmaceutical

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Abstract: ***Centella Asiatica L is a plant that is commonly found in Indonesia, which is found in humid places and gets enough sunlight, for example in rice fields, the edges of ditches, meadows, and other humid places. The Pegagan plant has active compounds such as alkaloids, tannins, flavonoids, alkaloids, steroids, triterpenoids and there are bioactive groups namely steroids, triterpenoids, and saponins, these plants do not cause harmful side effects, low toxicity and can be digested in the body. Pegagan has long been used for food, skin diseases, improving digestive disorders, cleansing the blood, and increasing body resistance.The pharmacological effects of Pegagan itself are as anti-syphilis, anti-toxic, anti-infective, fever-reducing, urine laxative, anti-leprosy, overcoming stress, and can be used for female fertility. The content of triterpenoids in the Pegagan plant is the most important substance because it has the benefit of increasing mental function provides a calming effect and is also useful for blood vessels, therefore it can launch blood circulation to the brain. Asiaticoside is part of the triterpenoid that can strengthen skin cells and can improve skin repair, as a natural antibiotic, stimulates blood cells and the immune system***

Keywords: Food; Pegagan; Pharmaceutical; Wound

1. Introduction

In Indonesia, there are millions of plant species that have properties for healing from various diseases and are also useful for human health[1]. One of the plants that grow wild without human influence is Pegagan/ Gotu Kola. Pegagan has the scientific name *Centella asiatica*. Pegagan is a wild plant that grows anywhere and can be used for herbal medicine because it is known for its efficacy and healing of disease[2]. Pegagan has long been used and utilized in the form of dry, fresh, and in the form of ingredients[3].

Centella Asiatica L is a plant that is commonly found in Indonesia, which is found in humid places and gets enough sunlight, for example in rice fields, the edges of ditches, meadows, and other humid places[4]. Pegagan has long been used for skin diseases, improving digestive disorders, cleansing the blood, and increasing body resistance. The pharmacological effects of Pegagan itself are as anti-syphilis, anti-senile, anti-toxic, anti-infective, fever-reducing, urine laxative, anti-leprosy, overcoming stress, and can be used for female fertility. The taste of Pegagan is sweet and has a cool nature[5].

Centella Asiatica L can be used from the whole plant as medicine. The leaves of this plant are well known as a very powerful wound healer. In China, Pegagan has long been used for the treatment of skin diseases, which is used topically. Ayurvedic medicine in India, the Pegagan plant is used as an ingredient of antiepileptic syrup, Pegagan is also used in India and Thailand as a tonic and treats dysentery. It is also used to add breast milk and in Pegagan leaf extract it is used as an ingredient against senility in Vietnam[6]. The content in Pegagan in the form of Asiaticoside and Madecassoside acid functions to increase proliferation, angiogenesis, collagen synthesis, and epithelialization in the injured part[7].

The Pegagan plant has active compounds such as alkaloids, tannins, flavonoids, alkaloids, steroids, triterpenoids and there are bioactive groups namely steroids, triterpenoids, and saponins, these plants do not cause harmful side effects, low toxicity and can be digested in the body. The content of triterpenoids in the Pegagan plant is the most important substance because it has the benefit of increasing mental function provides a calming effect and is also useful for blood vessels, therefore it can launch blood circulation to the brain. Asiaticoside is part of the triterpenoid that can strengthen skin cells and can improve skin repair, as a natural antibiotic, stimulates blood cells and the immune system[8].

Wounds are the destruction of several body tissues, and one of the ways to heal wounds is using medicinal plants, one of which is Pegagan (*Centella Asiatica L*), there are several causes of injuries such as sharp or blunt cuts, temperature changes, chemicals, explosions, electric shocks, or animal bites, and most people use it to help heal wounds, namely the use of antiseptics [9]. The process in wound healing is a process that will occur in living things that are injured, the body's mechanism will immediately return the components of damaged body tissues and will form new components which are the same as before in accordance with the wound healing phase[10]. By looking at these things, the purpose of this is to provide information about various dosage forms of Pegagan as a wound healer.

From the information above, it is important to explore the potential of several research results on Pegagan (*Centella Asiatica L*) in the food and pharmaceutical industries, especially in wound healing preparations.

Classification of Pegagan (*Centella Asiatica L*) (Integrated Taxonomic Information System)

Kingdom	: Plantae
Subkingdom	:Viridiplantae
Infrakingdom	: Streptophyta
Superdivision	: Embryophyta
Division	: Tracheophyta
Subdivision	: Spermatophytina
Class	: Magnoliopsida
Superorder	: Asteranae
Order	: Apiales
Family	: Apiaceae
Genus	: Centella L.
Species	:*Centella asiatica (L.) Urb*

Figure 1: Pegagan[8]

Pegagan commonly called tread of horses is a herbaceous plant in Indonesia that can be used as a traditional treatment and the content of Pegagan can act as a wound healing process, many researchers say that Pegagan has an effect on good wound healing such as increasing angiogenesis, increasing collagen secretion, stimulates fibroblast proliferation, and other extracellular matrix syntheses[11].

All parts of Pegagan can be used as a treatment, the leaves of Pegagan that can be used topically for open wounds and burns are effective, and the extract from the leaves of Pegagan itself can also be used as a treatment for keloids, leg ulcers, phlebitis, scleroderma, lupus, leprosy, cellulitis, and canker sores[6]. Pegagan is also widely used as pharmaceutical and non-pharmaceutical preparations.

1) Pegagan in the food industry

a) Pegagan chips

Chips are snacks whose sources come from various types such as sweet potatoes, cassava, and bananas, these chips are one of the traditional preparations that can be consumed instantly and are easy to find, the process of making chips is done by selecting in advance and the ingredients to be used are sliced -thinly sliced and finally fried to be consumed [12] .

Pegagan has a lot of benefits, not only as a medicinal plant, but also used for processed vegetables and drinks. Some processed pegagan is developed for drinks, namely tea which can reduce the bitter taste, and in terms of food. Pegagan is processed as chips, ready-to-eat chips that are fit to eat[2].

Figure 2: Pegagan chips [2]

Pegagan chips are made with a savory taste that can be compared to other chips and has a distinctive taste that is slightly bitter and a little bitter on the tongue, and it can be seen from the physical appearance that the pegagan chips have a smaller size, round shape, and a slightly dark green color[2].

b) Mochi ice cream

Pegaganis usually used by the community only as a medicine for several types of human diseases, to increase the economic value, the community makes an easy new innovation, namely mochi ice cream which has a very soft texture, mochi ice cream is usually made with stuffing inside, mochi ice cream as well made from white glutinous rice flour added with sugar and red beans, mochi ice cream is a modern snack and many enthusiasts from small children to adults, usually mochi ice cream is made with several flavors and colors from the mochi ice cream skin. Mochi ice cream is mochi filled with ice cream which has a soft and chewy physical appearance, and the process of making this mochi ice cream is easy to make and has a distinctive sweet taste, and many people like it, especially children because of the variety of flavors and colors. From Pegagan itself, the leaves are used in the manufacture of mochi ice cream as the effect of the use of Pegagan leaf extract on physical properties (color and chemical properties of mochi ice cream[13].

c) Gummy Candy

Gummy candy is a preparation that is physically soft like jelly made with a mixture of ingredients from fruit juices and additional sweeteners and its constituent ingredients, namely gel, gummy candies are influenced by the composition of the base, namely gelatin and pectin which can increase the elasticity of the texture of gummy candies. Usually, Gummy candies are favored by children because of their chewy taste, shape, and texture. Pegagan which has active ingredients that are used as a composition of gummy candies, researchers use ethanol extract of Pegagan which has pharmacological activities, including antioxidants and immunomodulators, therefore researchers have a new innovation to make gummy candies containing Pegagan [14].

Figure 3: Gummy Candy[14]

d) Pegagan in a tea

Pegagan contains active compounds that have health benefits, namely terpenoids, flavonoids (quercetin and kaempferol), triterpenoids (*Asiatic acid, Madecassoside, and Asiaticoside*), glycosides, so antihypertensive health drinks are made.

Figure 4: Tea bag [15]

In herbal tea bags containing Pegagan combined with turmeric herbs which have the activity of preventing or treating hypertension and improving the elasticity of blood vessels, herbal tea is made as an antihypertensive health drink[15].

2) Pegagan in the pharmaceutical

a) Pegagan as hand and body lotion

Hand and body are widely used from natural ingredients that contain antioxidants, flavonoids, vitamin C and saponins which are useful for preventing skin damage and free radicals[16]. Need something that can protect, namely antioxidant compounds that can counteract and stabilize free radicals. Pegagan is used to make hand and body preparations that have antioxidant activity, substances that can fight the effects of free radicals. Currently, the use of natural ingredients as a source of antioxidants in cosmetic preparations has been developed. One of the Indonesian plants that can be used is the Pegagan herb, which has antioxidant compounds in it[17]

Figure 5: Hand and Body[16]

b) Pegagan as Hair Tonic

Hair is something that can improve appearance, one of which must be cared for and maintained in health, usually problems that occur in the hair are dandruff, lack of pigmentation, causing graying and hair loss, therefore researchers are trying to make new innovations in synthetic formulations such as finasteride and minoxidil. is a vasodilator drug that acts to stop and slow down hair loss and make thick hair growth[18]. One of the herbaceous plants that have benefits for hair growth is Pegagan (*Centella Asiatica L*) combined with pandan leaves (*pandanus amaryllifolius*), Pegagan is a wild plant and is widely distributed in nature, therefore hair tonic preparations are made which are very easy to apply and prepare. In semisolid form, the advantage is that it will not leave a thin layer that can cause problems in the hair, namely dandruff, and hair tonic preparations are suitable for application to hair because of their topical use[19].

c) Pegagan as a chewable tablet

Chewable tablets are preparations that must be chewed and usually have a taste when they are in the oral cavity, and the chewable tablets are also easy to swallow and have no bitter or unpleasant [20]. Pegagan is a herbaceous plant that contains flavonoid compounds and has antioxidant activity, this chewable tablet containing Gotu kola was made for hepatoprotective activity, where a study will be conducted to evaluate the effect of *Centella Asiatica* chewable tablets on high-fat rats[21].

3) Wound healing pharmaceutical preparations

Pegagan (*Centella Asiatica (L). Urban*) has effectiveness on wound healing, namely stimulating fibroblast proliferation, increasing angiogenesis, increasing collagen secretion and matrix synthesis. Pegagan also has antioxidant and antibacterial activity. Wound healing is a complex process. Medium or small wounds can heal independently if there is no infection in the wound, therefore we need compounds that help wound healing, one of which is the Pegagan plant which contains Asiaticoside which has a role in wound healing[22]. Some of the research examining various types of preparations that can help heal various types of wounds.

Table 1: Preparations of Pegagan as a wound healing

Preparation type	Function	Part of Pegagan	Reference
Gel	Helps the healing process of burns on the diameter of the wound	Pegagan leaf ethanol extract combined with papaya leaf extract	[23]
Gel	Helps the healing process of burns in male white mice on the	Pegagan herbal extract combined with	[24]

	diameter of the wound	aloe vera	
Ointment	Helps the wound healing process in white rats on the length of the wound	Pegagan leaf herb extract	[25]
Ointment	Helps the healing process of burns in male mice on the diameter of the wound	Pegagan herb powder after extraction	[26]
Extract	Helps inhibit the growth of staphylococcus aureus bacteria in diabetic wounds	ethyl acetate fraction of ethanol extract	[27]
Hydrogel	Helps wound healing as a dressing for incisions in mice	Pegagan herb extract	[28]

a) Gel

In other gel preparations, it was found that in gel preparations containing ethanol the combination of Pegagan leaves with papaya leaves was compared with neomycin sulfate which is one of the standard drugs used for the treatment of burns using rat test animals, the comparison of neomycin and extracts of a combination of Pegagan and papaya leaves which differed in concentrations of 1%,3%, and 5%, the results studied which can be seen from the wound diameter from the X-axis from 0-10 mm, on neomycin sulfate on day 12 the wound diameter was reduced to 1.0 mm from 10mm while ethanol extract gel at the highest concentration of 5% reduced by 2.4 mm from 10 mm, therefore the gel extract combination of Pegagan leaves with papaya leaves can help heal burns quickly when the concentration is high[23].

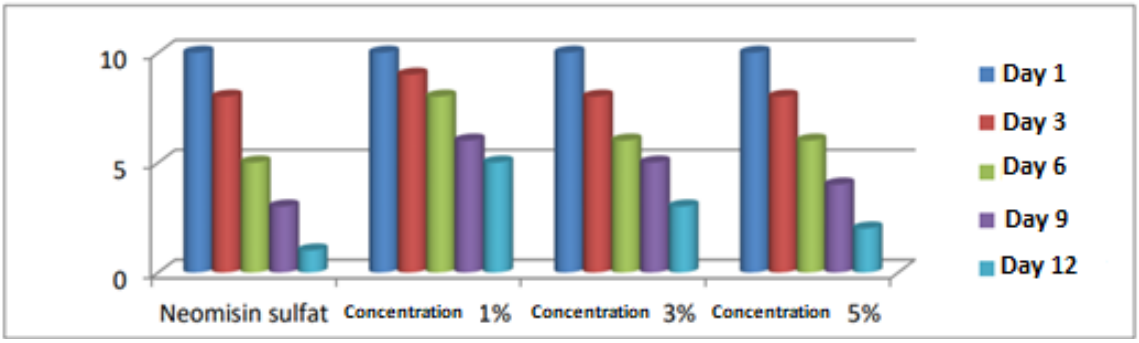
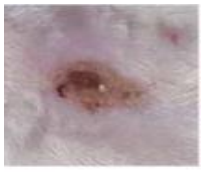


Figure 6: Graph of the diameter of the incision wound compared with neomycin gel and the combination of Pegagan and papaya leaves [23]

b) Ointment

Table II: Diameter of the incision wound development in white rats compared with vaseline album with Pegagan ethanol extract ointment[26]

Day	Ointment base (negative control)	Pegagan leaf extract ointment 24%
1		
7		

In the observation data using Pegagan extract ointment with different concentrations, vaseline album, and povidone-iodine ointment using rat test animals on negative controls, namely the ointment base (vaseline album) the wound was not completely closed because the ointment base used was vaseline albumin ointment (hydrocarbon). The selection of Vaseline in wound healing is less effective because the hydrocarbon base is skin softening or emollient which will leave a layer on the surface of the skin, resulting in increased skin hydration. The effect of the Pegaganextract ointment on the Pegagan extract ointment at a concentration of 8% and 16% because the incision wound was almost completely closed than the 24% concentration because the ointment extract at a concentration of 24% was more concentrated and viscous, an extract that was too thick would cause oxidation and block the hydrosylation of proline and lysine then cause colleagues that will not be produced by fibroblasts, therefore the Pegagan ointment extract concentration of 16% is the best at the best effectiveness[26].

c) Hydrogel

The hydrogel was made by researchers as a wound dressing that can be directly applied to injured skin. Its function is as a moisturizer or rehydration that provides a cooling sensation. The experimental animals used were male rats by observing the effect of Pegagan (*Centella Asiatica L*) hydrogel on the wound healing process as seen from the number of leukocytes in rats until the 14th day of rats. The results obtained were the number of leukocytes in test animals using hydrogel, there was a significant difference in the number of leukocytes in the two test groups, therefore hydrogel Asiatica had an effect on the number of leukocytes[28].

d) Extract

The Pegagan extract was tested on the diabetic wound bacteria studied, namely the inhibition of *Staphylococcus aureus* bacteria with different extract doses of 20%, 40%, 60%, and 100% with the control test (chloramphenicol).

The increase of Pegagan extracts affected the staphylococcus aureus bacteria. The high content will further inhibit the growth of the staphylococcus aureus bacteria. Flavonoids compounds in Pegagan inhibit the growth of Staphylococcus bacteria (bacteriostatic) [27].

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