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Systematic review : Natural Acne Patch Base On Nanomaterial Gelatin/Chitosan Bilayer from Mulberry Extract

Antan Saldaw[1], Lintang Tri Ananda[2], Muhammad Rafi Hafis[3], Shahibatul Wafa[4], Aden Dhana Rizkita[5]

[1]Department of Pharmacy, Sekolah Tinggi Ilmu Kesehatan Bogor Husada,
Jl. Sholeh Iskandar No.4 RT 02/ RW 03, Kedung Badak, Kec. Tanah Sereal, Kota Bogor, Jawa Barat 16164

Corresponding author
[5]adendhanarizkita@gmail.com

Abstract: This article discusses the development of an acne patch based on local mulberry ingredients which are extracted and then mixed into chitosan gelatin. The patch is made from the synthesis of galatin/chitosan nanomaterials with a mulberry extract capping agent. The characterization was carried out by looking at the morphology of the nanoparticles using SEM. The results obtained were that the particle shape was amorphous and was tested for anti-bacterial using the disc diffusion method on Staphylococcus aureus (S. aureus), Pseudonym aeruginosa (P. aeruginosa), and Escherichia coli (E. coli) bacteria. The results of the antibacterial test showed the ability of the galatin/chitosan nanoparticles of mulberry extract to have antibacterial activity by forming an inhibition zone with a diameter of 55 ± 2.25 mm. The patch was prepared by mixing a solution of gelatin and chitosan filled with mulberry extract, poured into a cup and dried at room temperature for 2 days. Then given 10% glutaraldehyde for 1 hour at 40oC. The results of the irritation test by applying the patch to the back for 4 hours showed no redness and swelling of the skin.

Keywords: Acne pacth, mulberry ,chitosan, gelatin.

Introduction

Acne is a condition where the pores are clogged and cause pus pockets to become inflamed. Acne treatments are available in various forms, such as medications, blackhead extractors and Kenacort Intralesional. After researching we found a way to eliminate acne problems, in another way, namely using acne patches. It can hide and treat acne at the same time. Acne patch is a product made for the treatment of acne and can cover acne at the same time so that it does not interfere with appearance. Acne patch is popular among consumers consisting of synthetic material hydrocolloid. As technology develops, acne patches can be combined with herbal extracts, one of which is mulberry extract (Arabshahi & A. Urooj, 2007).

Mulberry extract can be used as an anti-acne treatment because it contains vitamin B, selenium, zinc, and antioxidants that can regenerate the skin. Therefore, the purpose of this research is to make acne patches from gelatin/chitosan and mulberry extract made into nanomaterial preparations. Nanomaterial as a material device, where at least one dimension is smaller than approximately 100 nm (Arabshahi & A. Urooj, 2007).

In this study, gelatin and chitosan were used as the main components in making acne patches. Chitosan is obtained through deacetylation of the natural biopolymer, chitin (Wibowo et al., 2018). It is known that chitosan nanoparticles loaded with nutraceutical nicotinamide and caffeic acid can be a clinical option for acne treatment. Gelatin is derived from collagen, It obtains excellent biocompatibility, plasticity, stickiness, and promotion of growth (Chi-wen et al, 2021).

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Materials and Methods

Mulberry Extract Preparation

Mulberry leaves were first cleaned before being extracted with water at 45ºC for 3 hours. The extract was spun by centrifuge, using the supernatant liquid, collected and filtered using filter paper. Then, evaporation under reduced pressure at 45ºC. For sublimation, it was done until there was no water (Arabshahi & A. Urooj, 2007).

Cytoxicity test of mulberry extract

Mulberry extracts were tested for cytotoxicity by MTT reduction assay, which found that all extractions and substrate preparations were non-toxic to cells. The mulberry extracts were verified by Fourier transforms infrared spectroscopy (FTIR), which confirmed the standard properties of common mulberry extracts. Human skin fibroblasts (CCD-SH68) were used to determine the cytotoxicity of the herbal extract (Rizkita et al., 2022). Cells were cultured at a density of 1 × 104 cells/well in flat-bottomed tissue culture plates, with different concentrations ranging from 9.5-300 μg/mL PA and 75-2400 μg/mL mulberry extract at 37oC for 2 days. Repetition was considered for each extract concentration. Cell viability was determined through WST-1 cell proliferation colorimetric assay. 100 μL/well WST-1 reagent was added and incubated at 37oC for 30 minutes, and absorbance at 440nm (Sionkowska & Planekca, 2013).

Gelatin/chitosan extract nanomaterials

1 mg of bilayer GC patch (-80 oC/RT) containing mulberry extract at a concentration of 1 mg/mL, was immersed in 1 mL of distilled water for 0.5, 1, 2, 4, 6, 8, 10, and 12 h. The samples were then analyzed via UV-Vis spectroscopy at 325 nm. The drug release concentration was calculated using the absorbance to concentration formula. The drug release rate was calculated as follows: drug release rate (%) = amount of drug released (mM)/amount of drug in GC patch (mM). Chitosan powder was dissolved into 0.5% acetic acid to prepare 1% solution. A 12.5% gelatin solution was prepared by dissolving gelatin powder in water and ionizing at 40°C. Next, 5 mL of 1% chitosan solution, 1 mL of 12.5% gelatin solution, 2 mL of mulberry extract concentrations of 0.5 and 1 mg/ml were all added into the solution (Chi-wen et al, 2021).

Characterization of acne patch morphology

Microscopic Morphology Observation The dried patches (monolayer GC patch, bilayer GC patch, -20oC/RT, bilayer GC patch, -80oC/RT) were coated with gold layer and examined through scanning electron microscopy (SEM). Histograms of the diameters of 50 individual pores were generated from the SEM images. Three samples were examined per group. The effective size of the pores was calculated as the average patch diameter. Fourier Transform Infrared Spectroscopy The composition of bilayer GC patches was analyzed using Fourier transform infrared spectroscopy (FTIR) in the range of 4000-400 ml using KBr pellets (Chi-wen et al, 2021).

Preparation of Monolayer and Bilayer Patches

Monolayer Patches Constructed at Room Temperature 10 ml of gelatin and chitosan solution filled with mulberry extract was poured into a dish and dried at room temperature for 2 days. Then 10% glutaraldehyde was applied for 1 hour at 40oC. After forming, the patch was cut into a round shape with a diameter of 8 mm using a mold (Chi-wen et al, 2021).

Bilayer Patches Constructed at -20oC / Room Temperature 5 ml of gelatin and chitosan solution filled with mulberry extract was poured into a cup and frozen at -20oC. and frozen at -20oC for 12 hours. Then, transfer the dish into room temperature for 1 hour. Then, the patches were dried at room temperature for 2 days before being treated with 10% glutaraldehyde for 1 hour at 40oC. The patches were then cut into round shapes with a diameter of 8 mm using a mold (Chi-wen et al, 2021).

Bilayer Patches Constructed at -8 oC/ Room Temperature 5 ml of mulberry extract containing gelatin and chitosan solution was poured into a dish, frozen at -80oC for 12 hours, and lyophilized for 2 days. Then, move the dish to room temperature for 1 hour. The patches were dried at room temperature for 2 days before being treated with 10% glutaraldehyde for 1 hour at 40oC. The

patches were cut into round shapes with a diameter of 8 mm using a mold (Chi-wen et al, 2021).

Skin irritation test of the patch

The skin irritation test was performed on humans. The test patch was applied to an inflamed pimple for 24 hours. After removing the patch, the remaining substance was washed off. Subsequent assessment of the presence or absence of signs of irritation included redness, swelling, turbidity, edema, and bleeding (X Zhang et al, 2017)

Results and Discussion

Characterization of Mulberry Extract

Natural ingredients of mulberry extract were added into gelatin/chitosan patches to perform anti-acne and healing effects. The mulberry extract was tested for cytoxicity, and found that all extractions and substrate preparations were non-toxic.

Characterization of gelatin/chitosan

Most of these anti-acne patches are hydrocolloid or hydrogel patches with a waterproof surface to protect acne from infection. Hydrocolloid patches can absorb fluid from acne and keep the acne covered. Some patches contain triclosan, salicylic acid, or chlorhexidine diacetate as anti-acne ingredients that may cause hypersensitivity, including generalized allergic reactions (Rizkita et al., 2020). This study aims to develop anti-acne patches based on natural ingredients and obtain anti-acne effects without irritating properties. In this study, bilayer anti-acne patches made of gelatin and chitosan were mixed with glutaraldehyde to form a stable complex.

GC bilayer patches prepared at -80OC/room temperature with the addition of mulberry extract showed effective antibacterial activity and accelerated skin fibroblast cell survival. The porous bottom layer provided the GC bilayer patch with a good water retention rate of up to 150% after 3 hours of immersion and may be useful for absorbing exudates from open acne wounds. The dense top layer thins the surface, allowing this layer to function as a protective barrier. These properties make the cytokine-compatible GC bilayer with mulberry extract an excellent candidate for anti-acne point treatment the surface area is shown at Figure 1.

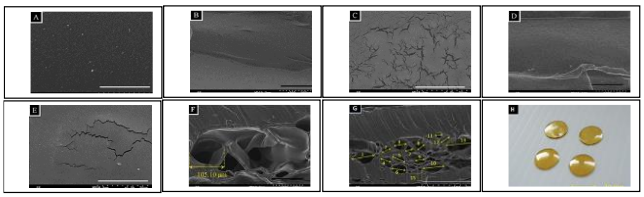

Figure 1. a) Surface image of monolayer GC patch, x 1000, b) Cross-sectional image of monolayer GC patch, x 300, c) Surface image of bilayer GC patch, -20 C/RT, 1000, d) Cross-sectional image of bilayer CC patch, 20 C/RT, x 300, e) Surface image of bilayer GC patch, 80 C/RT, x 1000, f) Cross-sectional image of bilayer GC patch, -80°C /RT, 300, g) Cross-sectional image of bilayer GC patch, -80°C/RT, 100, h) Microscopic photography of GC bilayer patches.

Prototype of natural Acne patch

The prototype made based on local materials and lyophilization is shown in Fig 2

Figure 2. The prototype of Acne Patch

That figure above is a product example of an acne patch made from natural materials as a capping agen combining with. And actually acne patch is made from nanoparticles because make an easy to enter the body until the blood like frans diffusion delivery system.

Conclusions

Mulberry extract, gelatin and chitosan are synthesized and made into natural acne patch

products. These ingredients have been assessed and tested to do no harm to the skin for acne treatment, and have met the safety standards. After turning into technical requirements, it was found that the first important technical requirement was the efficiency of acne treatment, followed by the efficacy of liquid suction and healing from acne. Therefore, these specifications were used to help develop the prototype. Afterwards, this prototype was evaluated for consumer satisfaction. The main criteria of consumer satisfaction were safety as it is a natural product, followed by acne treatment, color, smell, and cost of the product. Recommendations for further improvement Recommendations for further improvement are the strength and stickiness of the product. Gelatin/Chitosan bilayer patch with mulberry extract is good for anti-acne treatment that can cure acne in just 24 hours.

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