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Chitosan And Gelatin Patches Loaded With Salicylic Acid And Tea Tree Oil For Anti-Acne

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Abstract: The paper displays the formulation and evaluation of anti-acne patches made with chitosan, gelatin, tea tree oil, and salicylic acid as active ingredients. Chitosan is dissolved in 1% acetic acid. Glutaraldehyde acts as a crosslinking agent. Both tea tree oil and salicylic acid have antibacterial and anti-acne properties. Evaluation tests such as moisture content, uniformity weight, pH, skin irritancy, etc. are tested. The antibacterial assay was measured using the spread plate method. A zone of inhibition of 26mm was observed, which shows great inhibition activity. PH was found to be 5.3, which is safe to use in the skin. The *trials* F1, F2, F3 has performed. From this, F2 is found to be more specific.

Index Terms **–** acne vulgaris, anti-acne patches, topical application,

I. INTRODUCTION

Acne, also known as acne vulgaris, is a long-term condition when dead skin cells and oil from the skin clog hair follicles. Typical features of the condition include blackheads or whiteheads, pimples, oily skin, and possible scarring. It primarily affects skin with many oil glands, including the face, upper part of the chest, and back. The resulting appearance can lead to a lack of confidence, anxiety, reduced self-esteem, and, in extreme cases, depression or thoughts of suicide.

Anti-acne patches are commonly made of hydrocolloid or hydrogel, a substance renowned for its use in medical dressings.

Hydrocolloid dressings consist of two layers:

1. An inner colloidal layer
2. An outer water-impermeable layer.

The impermeable layer provides a protective covering and helps prevent the spread of pathogenic microorganisms. Here, instead of a hydrocolloid dressing, chitosan and gelatin were used as the major components in this study. Because of its special characteristics, including antibacterial properties, biocompatibility and biodegradability, chitosan is widely used in biomedical and skin tissue engineering applications. Gelatin has excellent biocompatibility, plasticity, adhesiveness, cellular adhesion, and growth promotion. The cationic nature and high charge density of chitosan allow it to form stable complexes with gelatin that contain many amino groups. Thus, gelatin was amalgamated with chitosan to fabricate anti-acne patches.

ACTIVE INGREDIENT: Tea Tree Oil and Salicylic acid

1. Tea Tree Oil

Perennial. The tea tree is native to northern Australia, southern New Guinea, and the Moluccas.It is a hardy, medium-sized tree with papery bark in several layers and linear pointed leaves.

Botanical name: Melaleuca alternifolia

SCIENTIFIC CLASSIFICATION

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Myrtales
Family	Myrtaceae
Genus	Melaleuca L
Species	Melaleuca alternifolia(Maiden&Betche)cheel

Table no 1; Botanical classification of tea tree oil

Medicinal uses:

i. Antiseptic, antifungal, antibacterial
ii. Gargle for sore throats
iii. Douche for thrush and itchy vaginal infections
iv. Acne
v. Hair rinse

2. Salicylic acid

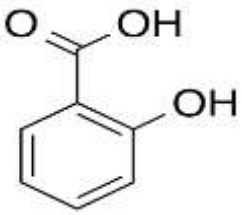

Fig no 1: Structure of Salicylic acid

Medicinal use: When applied to the skin, salicylic acid may work by helping the skin to shed dead cells from the top layer and decrease redness and swelling (inflammation). This decreases the number of pimples that form and speeds healing.

2. METHODOLOGY

2.1 MATERIALS AND METHODS

2.11. Chemicals and Reagents

MATERIALS	USE	PERCENTAGE
Chitosan	Polymer	1%
Gelatin	Humectant	6.5%
Tea tree oil	Active ingredient	1%
Salicylic acid	Active ingredient	1%
Glutaraldehyde	Cross linking agent	25%
Polyvinyl alcohol	Plasticizer	0.5%
Hydroxypropyl methylcellulose	Polymer	1%

Table no 2: Chemicals and reagents

2.12. Instruments

SI NO	INSTRUMENTS
1.	Electronic balance
2	PH meter
3	Agitate mixer
4.	Incubator
5	Hot air oven

Table no 3: Instruments

2.2 FORMULATION OF GC PATCHES

2.21 Composition of anti- acne patches

INGREDIENTS	F1	F2	F3
Chitosan	1g	2g	2g
Gelatin	4g	6.5g	6.5g
Tea tree oil	1ml	1ml	1ml
Salicylic acid	0.5%	1%	3%
Glutaraldehyde	-	1ml	1ml
Polyvinyl alcohol	-	0.5g	0.5g
HPMC	1g	1g	1g

Table no 4: Composition of anti - acne patches

2.22 Procedure

- The chitosan was dissolved in acetic acid in distilled water in concentration of 1%w/v and gelatin solution (2%w/w) was prepared by dissolving gelatin powder in distilled water
- The HPMC was dissolved distilled water to obtain 1% w/v
- From this 2ml of CS , 2ml gelatin, 5ml HPMC and homogenously mixed with 0.5 % PVA as plasticizer
- To this mixture 1% Salicylic acid and TTO was added and mixed
- Poured inti petridish and kept aside for 12hrs at room temperature
- After that 25% aq solution of glutaraldehyde was added and kept for 1hr at 40 ^{0} c

2.3 EVALUATION OF GC PATCHES

1.Physical appearance

Checking the physical appearance such as colour ,odour ,flexibility and smoothness

2.Uniformity of Weight

Three matrix systems were taken and they were weighed individually .The readings obtained were recorded and average
weight were determined.

3.Measurment of PH

The PH test was performed for the patch using PH meter

4.Percentage elongation Break test

The percentage elongation break is to be determined by nothing the length just before the break point , the percentage elongation
can be determined from the below mentioned formula.

Elongation percentage = (L1-L2/L2)*100

Where,

L1 = Final length of each strip

L2 = Initial length of each strip

5.Thickness of the patch

The thickness of the drug loaded patch is measured in different points by using a screw gauge and determines the average
thickness and standard deviation for the same to ensure the thickness of prepared patch

6.Percentage moisture content

This test was also carried to check the integrity of films under dry conditions . The individual patches were kept in a desiccator
containing fused anhydrous calcium chloride at room temperature . During this period , the films were weighed at regular time
intervals of 24 , 48, 72 hrs. The percentage moisture content was determined by using the following formulae

$$\% \text{ Moisture content} = \frac{(\text{initial weight} - \text{final weight})}{\text{Initial weight}} * 100$$

7.Antibacterial Activity Assay of GC Patches

The antibacterial activity of the bilayer GC patch and commercial anti acne patches was also determined by spread plate technique . The patches were placed on the LB agar seeded plate with p. aeruginosa and incubated at 37 degree Celsius for 16 hr. then the inhibition zone diameter was measured .

8.Folding endurance

A strip of specific area is to be cut evenly and repeatedly folded at the same place till it broke. The number of times the film
could be fold at the same place without breaking gave the value of folding endurance

9.Skin irritancy test

The skin irritation test is an in vitro,non-animal test designed to identify those chemicals and mixtures capable of inducing
moderate skin irritation.

3.2RESULT AND DISCUSSION

3.1 RESULT

EVALUATION	F1	F2	F3
Colour	yellow	Pale yellow	Pale yellow
Odour	Pungent	Camphoraceous	Camphoraceous
PH	4.8	5.3	5.9
Uniformity of weight	0.12	0.15	0.15
Thickness	0.390	0.483	0.500
Skin irritancy test	nil	nil	Nil
Moisture content	0.10	0.19	0.25
Folding endurance	250	250	250
Elongation Break test	1	1.15	1.2

Table no 5: Result of evaluation

Antibacterial assay of GC patches

The figure shows that the GC patch had a 26mm inhibition zone diameter, thus they demonstrated the most effective inhibition of p.acnes

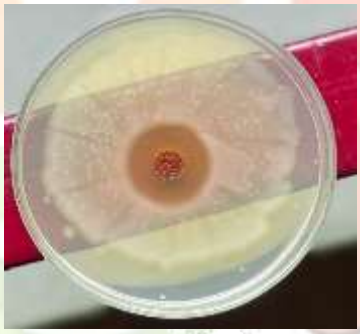

Fig no: 1

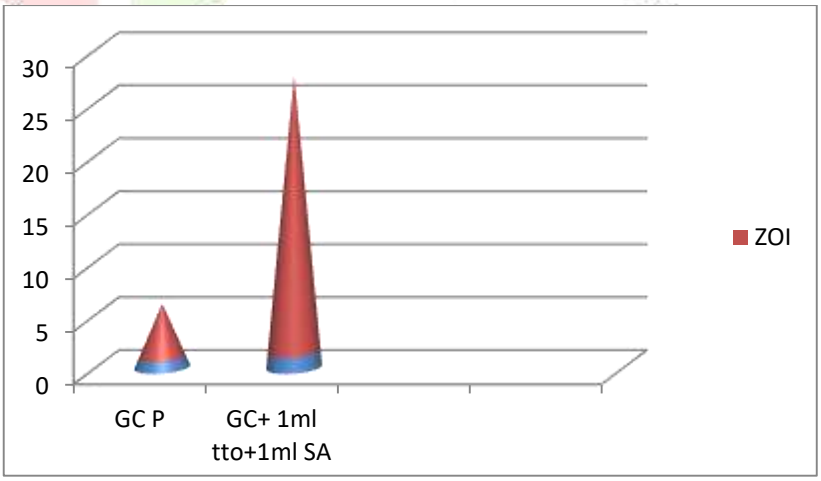

Fig 2: . Graphical representation of antibacterial assay GC patches and GC patch with tea tree oil and salicylic acid as active ingredient. The patch with tea tree oil and salicylic acid showa an zone of inhibition (ZOI) Of 26mm.

3.2 DISCUSSION

Most anti-acne patches are hydrocolloid or hydrogel stickers with a waterproof surface to protect pimples from secondary infection. Commercial circular hydrocolloid patches can absorb fluid from the pimple and make the pimples flatten out. Some patches contain triclosan or chlorhexidine diacetate as anti-acne ingredients, which might cause hypersensitivity, including general allergic reactions. Thus, this research aims to develop an anti-acne patch based on natural materials and obtain the anti-acne effect without irritation properties.

Here, we use Tea tree oil and Salicylic acid as active ingredients. Both tea tree oil and salicylic acid have antibacterial and anti-acne properties. Chitosan is used as polymer and Glutaraldehyde act as a crosslinking agent.In this study, anti-acne patch made of gelatin and chitosan was crosslinked with glutaraldehyde to form a stable complex. F1 , F2 and F3 trials had performed by changing the concentration of certain ingredients.

From the evaluation test, the PH of trial F2 was found to be 5.3, which is suitable for the skin PH, and no redness, oedma, or inflammation was observed. From the result of the antibacterial assay, the zone of inhibition of the GC patch was found to be 3mm, and the GC patch loaded with tea tree oil and salicylic acid was found to be 26mm in diameter. Thus, the GC patch demonstrated the most effective inhibition of *p. acne*.

In this study the GC patches loaded with salicylic acid and TTO shows more effective antibacterial activity,optimum PH and non irritance to the skin, thus it is more potent for anti acne application .

4. CONCLUSION

The GC patch loaded with TTO and Salicylic acid in 1ml and 1% respectively demonstrated effective antibacterial activity. The impermeable layer provide a protective covering and helps to prevent the spreading of pathogenic microorganisms. From this the F2 is found to be more specific with a PH of 5.3 and a zone of inhibition of 26mm which is more potent for anti acne application. These properties makes the GC patch loaded with TTO and Salicylic acid an excellent candidae for anti acne treatments.

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