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Formulation and Evaluation of Hydrogel With Salicylic Acid Using Aloevera Powder As Drug Carrier

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ABSTRACT: The objective of this research paper is to formulate a sustained release hydrogel and assess how well it deliver the drugs. Contrary to natural carriers like starch and aloe vera, synthetic polymeric drug carriers won't assist your health even though they will be safely metabolised. They won't offer any health advantages, in contrast to organic carriers like starch and aloe vera. As a result, the in vitro release properties of ascorbic acid-based hydrogels were examined in the current study. These hydrogels were created using aloe vera gel powder as a drug carrier and nutrient-enhancing excipients. Methods: Hydrogel is a relatively new strategy for long-term drug administration that is advantageous because of its distinct drug releasepatterns including swelling and diffusion. Aloe Veraincreases the bioavailability of vitamin C while safeguarding its other vital characteristics from degradation. Vitamin C is a well-known antioxidant that scavenges free radicals. Results: A number of evaluation criteria, including swelling and in vitro release investigations, were carried out. These assessment study findings indicate that the designed hydro gel can survive even in acidic medium because the largest swelling percentage was seen at pH 1.4 and least in pure water. Significant edoema was noticed at pH 5.4 and 7.4. Additionally, it was observed that the hydro gel broke down when placed in distilled water. The medication can be utilised for sustained drug delivery because in-vitro release experiments demonstrated that it was released at a set rate over a specified period of time. The study's materials were bioavailable and biocompatible, so they won't have any negative impacts or toxicity. .
KEYWORDS: Hydro gel, salicylic acid, Aloe Vera, gelatin, polyvinyl pyrrolidone, starch.

I. INTRODUCTION

In homeostasis, metabolic balance is preserved, although this imbalance might result in oxidative stress. There are currently many medications in the form of antioxidants, but due to their rapid systemic drug release pattern, they arenot bioavailable. Drugs that are widely available have a number of drawbacks, including the possibility of side effects and the heterogeneous systemic release pattern that results from medication use that is neither controlled nor targeted.Thousands of times its dry weight in water can be absorbed and retained by a hydrogel, which is a three-dimensional network of cross-linked hydrophilic polymers. Hydrogels have great promisefor uses like medication administration and tissue engineering due to their high biocompatibility characteristics. Under typical circumstances, the hydrogel does not release the water it has absorbed.[1,2]

The powerful antioxidant vitamin C serves as a "scavenger" and prevents our body's cells from oxidising as a result of free radicals. The utilisation of a natural carrier is currently the subject of extensive investigation, like powdered aloe vera gel. Notably, aloe vera gel powder can improve intestinal absorption, effectively deliver poorly absorbed medications, sustainably release pharmaceutical dose forms, guard against vitamin deterioration, and enhance vitamin C's bioavailability. In addition to serving as an antioxidant when taken internally with medication, it can help immunological, musculoskeletal, and digestive disorders.[3,4]

Composed of poly vinyl pyrrolidone, aloe vera gel powder, gelatin, and starch. The crosslinker uses poly vinyl pyrrolidone, which facilitates the process by giving the hydrogel a framework. A network of hydrophilic cross-linked polymer chains known as a hydrogel can occasionally be found as a form of crosslinking. adhesive in a dispersing medium A beta-hydroxy acid known as salicylic acid (SA) is frequently used to treat acne. It has been demonstrated that SA has anti-inflammatory qualities and lowers skin lipid levels. But few researches have clarified the mechanisms and routesused to treat this type of acne. [5]

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II. MATERIALS AND METHODS

Materials: Chemicals like starch, gelatin, polyvinyl pyrrolidone, and salicylic acid. Analytical grade materials were used for all compounds and reagents in this study. The hydrogel was made and purified using powder of aloe vera gel, Millipore water and distilled water.

Preparation of Aloe vera gel:

Aloe vera leaves have been plucked off the plant. To extract the gel from fresh aloe vera leaves, the leaves are first cut into small pieces and then thoroughly washed with micropore water. After that, the gel was rinsed with Millipore water and air- drying is done for two days at room temperature before being heated to 50°C to produce a solid, dry mass, it was placed in a hot-air oven for 4 days. Following that, the material is mechanically ground and sieved to create a fine powder. Following that, the aloe vera gel powder is kept chilled. Salicylic acid, gelatin, aloe vera gel powder, and starch are chemically cross-linked to create the medicinal hydrogel. It was documented what temperatures gelatin and starch melted at. Separately in hot water,both are dissolved. Both are separately dissolved in hot water and maintained there until they form a clear solution. After being continuously stirred, the two solutions were combined and brought to room temperature. Aloe vera gel powder is added to the ascorbic acid solution and continually stirred. The setting is then shaken vigorously on a rotary shaker. Polyvinylpyrrolidone solution is added to this emulsion and thus a hydrogel is formed. [6]

III. EVALUATION OF HYDROGEL

Physical characteristic: Analyzing hydrogel;
Visual pH, colour, homogeneity, grittiness, roughness, phase-separation and consistency checks are performed on prepared hydrogel compositions.

FORMULATION TABLE

Ingredient	F1	F2	F3	F4
Salicylic acid	500mg	500mg	500mg	500mg
Gelatin	0.375mg	0.5mg	0.25mg	0.375mg
Starch	0.05mg	0.5mg	0.75mg	0.375mg
PVP	1ml	1ml	1ml	1ml
Aloe Vera powder	100mg	200mg	300mg	400mg

In the current investigation, the evaluation parameters listed below were examined;

1. Research on drug release from cellophanemembranes in-vitro;

Assessment of the hydrogel formulation's in vitro drug release. Franz diffusion cells were used in in vitro diffusion experiments with cellophane membranes. cellophane film placed on a diffusion cell by Franz. The dialysis membrane's donor cavity is used to apply the formulation. 25 ml of phosphate buffer with a pH of 7.4 are placed within the chamber. The trial was conducted for 8 hours at 100 rpm and 37 ± 1°C. Over the course of an hour, samples were obtained from the chamber, and the absorbance at 275.0 nm was determined spectrophotometrically. The same amount of phosphate buffer pH 7.4 was consistently added to the chamber. [7]

2. Swelling behaviour of hydrogel;

In order to measure swelling, hydrogels (0.5 g) were placed directly into freshly prepared 0.1 M Phosphate buffer at pH 1.4, 5.4, and 7.4 and distilled water for 48 hr at room temperature. The product is then weighed once more to determine its final weight after swelling. This is how thepercentage swelling was determined. [7]

$\%Swelling = (W_e - W_d) / W_d$

. Where,
We = is the product's weight after 48 hours of hydration

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Wd = is the weight of the product on drying.

3. Spreadability;

We chose two slides that were 62 in size. On one of the slides, the hydrogel formulation with the specified spreadability was put. The second slide is positioned on the first slide with a distance of 6 cm between them, creating a sandwich. 1 kilogram of Weight is applied to the top slide in order to equally draw the sample hydrogel mixture like sandwich between the two slides to create a thin layer. Excess hydrogel formulation sticking to the slides has been eliminated, along with weight. A simple pulley can be used to apply a load of 20 grammes to the upper slider, which is tied to a rope at one end and fixed tothe device's board and other end of the upper slider is attached to a rope on which a weight(load) of 20 grams can be applied by a simple pulley. Under the influence of weight, the time it took for the upper slider to move 6 cm and separate from the lower slider was noted. The experiment was repeated, and for each hydrogel formulation, the mean of six such measurements was calculated. [7]

$S = M \times L / T$

Where,

S = Spreadability (gcm/sec)

M = A weight fastened to the top slide (20grams)L = Length of the glass slide (6cms)

T = Time in seconds

IV. RESULT'S AND DISCUSSION

4. Washability;

The ease and extent of rinsing with water are physically checked after applying formulations to theskin.

5. Study of extrudability;

Collapsible tubes made up of metal or tubes are filled with hydrogel compositions. The material is extruded through the tubes, and the formulation's capacity for extrusion has been evaluated.

6. Study of pH;

A digital pH metre is used to calculate the pH of hydrogel formulations. The electrode was submerged in one gramme of gel that had been dissolved in 25ml of distilled water. 30 minutes of formulation should be given in order to achieve and record acontinuous reading.

Hydrogel preparations have a uniformly smooth texture, an amber colour, and a thick, creamy consistency. The table contains a discussion of the results. The table provides washability, extrusion, and spreadability findings for all formulations. According to the findings, formulations F1–F4 have good washability, while F2 and F3 have good extrusion and spreadability, respectively.

Formulation	Colour	Homogeneity	Consistency	Phase separation
F1	Amber colour	Excellent	Excellent	None
F2	Amber colour	Excellent	Excellent	None
F3	Amber colour	Excellent	Excellent	None
F4	Amber colour	Excellent	Excellent	None

TABLE NO:2

Formulation	Washability	Extrudability	Spreadability
F1	+++	++	12
F2	+++	++	12.63
F3	+++	++	10.5

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F4	+++	+++	14.56

TABLE NO:3

FORMULATION OF HYDROGEL :

Viscous, translucent, amber colored hydrogel formed from starch and gelatin. As a medicine carrier, it is enhanced by ascorbic acid and aloe vera gel powder. Gels were precisely crosslinked by adding 1 ml of the framework-providing aqueous PVP solution. [8]

characteristic is swelling. Polymers swell in aqueous biological environments without dissolving, making this conceivable. Only 10–30% liquid polymer and 60– 90% liquid at equilibrium make up the gel. Water causes the hydrogel to inflate, increasing the space between the polymeric chains grow in size as shownin the figure.

PERCENTAGE OF SWELLING:

The hydrogel's most significant

pH	% Swelling
Distilled water	5.4
1.4	110.4
5.4	64
7.4	80

Table 4: Percentage swelling of hydrogel at different Ph.

The presence of the polymeric network, which is mostly dependent on the solubility of the oral medicine, should thus not obstruct the release of low-molecular-weight pharmaceuticals from the hydrogel. Salicylic acid and other medications with high water solubility will be made available rather rapidly.

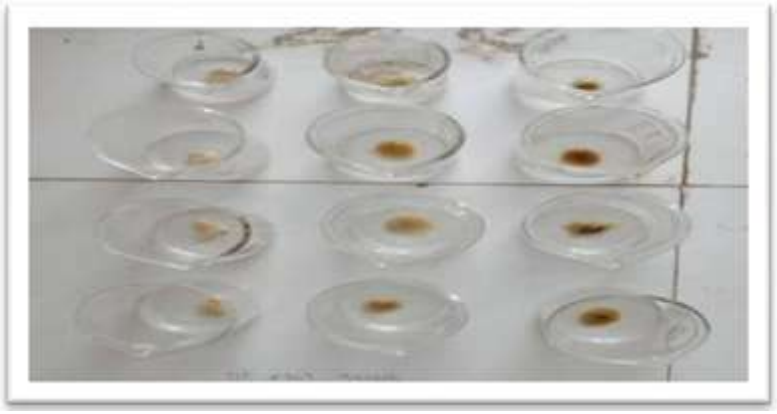

Figure 1: Hydrogel swelling suggests that the release of drug through diffusion.

Figure 1 suggested that the medicine would diffuse into the system as the swelling percentage grew because it was significantly constant at different pH. It is evident from the chart that the highest percentage swelling is observed at pH 1.4 and the with distilled water, the lowest. At pH 5.4 and 7.4, significant edoema was seen. In addition, it was discovered that the hydrogel broke down in distilled water. It is therefore indicated that the hydrogel formulation can successfully release its medication content under normal pH circumstances, even at lowpH states. [8]

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IN VITRO RELEASE STUDIES OF SALICYLIC ACID:

Since the hydrogel is a medication with a controlled release, an in vitro release study is required to determine the dosage released. The UV-Vis spectrophotometer used to measure the amount of salicylic acid emitted over a 1-hour period is shown in the Table.

Figure 2: in-vitro drug release testing

Time (Min)	Amount of salicylic acid released(gm/L)
30min	1.50
60min	2.30
90min	3.12

Table 5: Studies on the release of a hydrogel laden with salicylic acid in vitro.

The relevance of the table is With increasing time, the amount of medicine released in an in vitro release trial of a hydrogel containing salicylic acid likewise increased. This is primarily brought on by the hydrogel's capacity to get swell in the presence of water and the expanding space between the polymer chains, so every 30 minutes, a medication with a significant amount of water solubility, like salicylic acid at 244 nm, is observed. [9]

V. CONCLUSION:

Salicylic acid hydrogel preparations represent a viable and effective method for controlled anti-inflammatory delivery. To achieve the appropriate drug dissolution and patterns for drug release in the current investigation, a polymer with desirable hydrophilic and hydrophobic properties might be chosen. Additionally, the components utilised to make hydrogels are non-toxic, bioavailable, and biocompatible. Using the based on the findings, The diffusion of salicylic acid from the hydrogel steadily increased over time, indicating that the drug was released at a predetermined pace over a regulated period of time.

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