International Journal of Pharmaceutical Research and Applications
Volume 9, Issue 2 Mar-Apr 2024, pp: 21-26 www.ijprajournal.com ISSN: 2249-7781

Aloevera gel powder actasdrug carrier and enhance the bioavialabilty of low solubility drugs.

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Submitted: 03-03-2024 Accepted: 13-03-2024

ABSTRACT

This work aims to create a controlled release hydrogel and assess how well it delivers medication. Unlike natural carriers like starch and aloe vera, the synthetic polymer drug carriers will not offer any health benefits even if they will be safely digested. Thus, aloe vera gel powder was utilized as a drug carrier and nutrient-fortifying excipient in the formulation of the salicylic acid-based hydrogel used in the current study to examine the in vitro release properties. Methods: Due to its distinct drug release patterns, such as swelling and diffusion, hydrogel is a relatively new method of sustained drug delivery that offers several benefits. Vitamin C is a well known antioxidant which scavenges free radicals and Aloe vera enhances the bioavailability of vitamin C which is also protecting it from degradation along with its other essential properties. A range of assessment metrics, including in vitro release tests and swelling experiments, have been conducted. The findings of these evaluation trials indicate that the manufactured hydro gel can outlast even in acidic media, with the highest swelling percentage observed at pH 1.4 and the lowest in distilled water. Significant edema was observed at pH 7.4 and 5.4. Moreover, it was observed that the hydro gel disintegrated in distilled water. In conclusion, the medication can be employed in sustained drug delivery because the in vitro release tests demonstrated that it was released at a predetermined rate over a regulated length of time. The study's materials are bioavailable and biocompatible, meaning they won't have any harmful or adverse impacts.

Keywords: Hydrogel, salicylicacid, Aloe, gelatin, polyvinylpyrrolidone, starch.

I. INTRODUCTION

Homeostasis maintains metabolic equilibrium, but an imbalance in it might result in oxidative stress. Many medicaments in the form of antioxidants are presently available but they are not effective in bioavailability because of their rapid systemic drug release patterns. The conventional drugs available in the market possess many drawbacks such as their systemic release patterns are not uniform as the drug delivery is not of controlled form, neither are they targeted in their action, further there are chances of inducing side effects. A hydrogel is a three-dimensionally cross-linked hydrophilic polymer network that may absorb and retains large amount of water up to thousands of timesitsdry weight. The excellentbio compatibility property ofhydrogel smakes them most promising for applications such as tissue engineering and drug delivery. Water absorbed by hydrogel is not released under ordinary conditions. (1,2)

Vitamin C is a powerful antioxidant it acts as “scavengers' ' and prevents the free radicals from oxidizing the cells in our body. Present investigation involves the use of a natural carrier such as Aloe vera gel powder having inherent tremendous medicinal values. It is noted that Aloe vera gel powder may enhance the intestinal absorption, effective delivery of poorly absorbable drugs, sustained release of pharmaceutical dosage forms, protection against degradation of vitamins and the enhancement of bioavailability of vitamin C. When taken internally along with the drug it may improve the digestive musculo-skeletal and immune-related conditions apart from acting as an antioxidant. The gelatin starch mediated hydrogel is a very novel approach as till date research has not been performed using gelatin and starch combined with Aloevera gel powder and polyvinyl pyrrolidone. The Cross-linker used poly vinyl pyrrolidone helps in cross-linking by providing a framework to the hydrogel. (17)

A hydrogelisa network of cross linked polymer chains that are hydrophilic, sometimes found as a colloidal gel in which water is the dispersion medium. (7)

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One common beta-hydroxy acid used to treat acne is salicylic acid (SA). It has been discovered that SA has anti-inflammatory and skin lipid-lowering qualities. However, few studies have elucidated the mechanisms and pathways involved in such treatment of acne. (5)

II. MATERIALS AND METHODS

Materials The chemicals such as salicylic acid, polyvinylpyrrolidone, gelatin, starch. All the chemicals and reagents used for the present study were in analytical grade. Aloe vera gel powder, distilled water, and Millipore water were used for the preparation and purification of hydrogels.

METHODS PREPARATION O FALOEVERA GEL :

The leaves of the Aloe vera plant were collected. Freshly cut Aloe vera leaves were washed with Millipore water and then cut open to collect the gel. The gel is then washed with Millipore distilled water and air dried for two days under ambient condition and then at50ºC in a hot-air oven for four days to get a solid dry mass. This was then converted into fine powder by mechanical grinding and sieving. The Aloevera gel powder is then stored under refrigeration.[3] Preparation of hydrogel with drug by chemical cross-linking method salicylic acid, Aloe vera gel powder, gelatin and starch were weighed. Melting points of gelatin and starch were noted. Both were separately dissolved in hot water and kept in a hot water bath until a clear solution was obtained. The two solutions weremixed with constant stirring and were cooled to room temperature. To this Salicylic acid solution along with Aloe vera gel powder was added with constant stirring. The setup was then kept on a rotary shaker for uniform mixing. To this emulsion poly vinyl pyrrolidone solution was added and thus hydro gel was formed. (3,4,5)

Formulation Table:

Table no.1

Ingredient	F1	F2	F3	F4
Salicylic acid	500 mg	500mg	500mg	500mg
Gelatin	0.37 mg	0.5mg	0.25mg	0.37 mg
Starch	0.05mg	0.5mg	0.75mg	0.375mg
PVP	1ml	1 ml	1ml	1ml
Aloe Vera powder	100mg	200mg	300mg	400mg

EVALUATION OF HYDROGEL:

1.Physical characteristic:

The prepared hydrogel formulations were inspected visually for their pH, color, homogeneity, consistency, grittiness, texture and phase separation The following evaluation parameters were studied in the present work.

2. Spread ability :

Two glass slides of standard dimensions(6×2)were selected. The hydrogel formulation whose spread ability had to be determined was placed over one of the slides. These condslide was placed over the slide in such a way that the formulation was sand wiched between them across a length of 6 cm along the slide. 100 grams of weight was placed upon the upper slide so that the hydrogel formulation between the two slides was traced uniformly to form a thin layer. The weight was removed and the excess of the hydrogel formulation adhering to the slides was scrapped off. The lower slide was fixed on the board of the apparatus and one end of the upper slide was tied to a string to which a 20 gram load could be applied with the help of a simple pulley. The time taken for the upper slide to travel the distance of 6cm and separate away from the lower slide under the direction of the weight was noted.

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The experiment was repeated and the average of 6such determinations was calculated for each hydrogel formulation. (11)
Where,
S=Spread ability (gcm/sec),m=weight tied to the upper slide(20 gm),l= length of glass slide (6cms), t = time taken is seconds.

$$S = M. L / T$$

3.Wash ability :

Formulations were applied on the skin and then ease and the extent of washing with water was checked manually.

4.Extrud ability study :

The hydrogel formulations were filled into collapsible metal tubes or aluminum collapsible tubes. The tubes were pressed to extrude the material and the extrudability of the formulation was checked.

5.Determination of pH :

The pH of hydrogel formulations was determined by a digital pH meter. One gram of gel was dissolved in 25 ml of distilled water and the electrode was then dipped into gel formulation for 30 min until constant reading obtained and constant reading was noted.

6. In-vitrodrug release studies using the Prehydrated cellophane membrane :

The prepared hydrogel was evaluated for invitrodrug release. In vitro diffusion study was carried out in a Franz diffusion cell using cellophane membrane. The cellophane membrane was mounted on the Franz diffusion cell. Formulation was applied through donor compartment on the dialysis membrane. Reservoir compartment was filled with 25 ml phosphate buffer of pH 7.4 The study was carried out at 37 ± 1°C and at a speed of100rpmfor 8 hr. Samples were withdrawn from the reservoir compartment at 1 hr interval and absorbance was measured spectro photometrically at 275.0 nm. Each time the reservoir compartment was replenished with the same quantity of 7.4pHphosphate buffer. (4)

7. Swelling behavior of hydrogel :

The hydrogel (0.5 gm) was immersed directly in freshly prepared 0.1 M Phosphate buffer of pH1.4, 5.4, 7.4 and distilledwaterfor48 hours at room temperature to study the swelling behavior. The swollen product was then weighed again to get the final weight.
Percentage swelling was calculatedas follows:
Where,
We = is the weight of the product after hydration of 48 hours,
Wd = is the weight of the dried product. (11)

$$\% \text{ Swelling} = (W_e - W_d) / W_d \times 100$$

III. RESULTS:

Formulation	colour	Homogeneity	Consistency
F1	Amber colour	Excellent	Excellent
F2	Amber colour	Excellent	Excellent
F3	Amber colour	Excellent	Excellent
F4	Amber colour	Excellent	Excellent

Table no.2

Formulation	Wash ability	Extrud ability	Spread ability
F1	+++	++	12
F2	+++	++	12.63

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F3	+++	++	10.5
F4	+++	+++	14.56

Table no.3

Percentage of swelling :

Swelling is the most important property of the hydrogel. This is possible since the polymers swell without dissolving in anaqueous biological environment. At equilibrium, the gels comprise 60-90 % fluid and only fluid 10-30 % polymer. The hydrogelss well in water and the space between polymer chains becomes largeas can be seen in figure.

Tableno.4:Percentages welling of hydrogelat different pH

pH	**% swelling**
Distilled water	5.4
1.4	110.4
5.4	64
7.4	80

Thus, the release of low molecular weight drugs from the hydrogel will not be hindered by the presence of polymer networks, but depends primarily on the solubility of the drugs. Drugs with appreciable water solubility, like salicylic acid will be released quite rapidly.

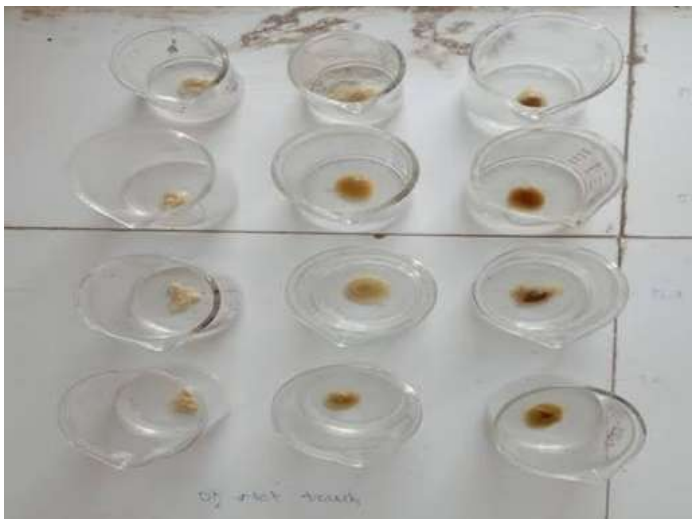

Fig 1:Swelling of hydrogel implies the release of drug through diffusion

Table, reveals that the percentage of swelling is considerably good at various pH which implies that as the swelling percentage increases more, drug is diffused in the system. From the Table it is evident that maximum swelling percentage was observed in pH 1.4 and least in distilled water. Appreciable swelling was seen in pH 5.4 and 7.4. Furthermore, the hydrogel was seen

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to under god is integration in distilled water. Hence it is suggested that along with the normal pH condition seven at low pH state the formulated hydrogel can successfully release its drug contents.

In vitro release studies of salicylic acid:

In-vitro release studies are essential to know the amount of drug released, since hydrogel is a form of controlled drug release. The amount of salicylic acid released at the intervals of 1 hour was determined at 244 nm using the UV-Vis Spectrophotometer which can be seen in Table.

Figure 2:In vitro drug release testing.

Table5:Invitro release studies of salicylic acid loaded hydrogel:

Time	Amount of Salicylic acid released(gm/ml)
30min	1.50
60min	2.30
90min	3.12

The table significance that as the time increases the amount of drug release also increases .this is mainly because of swelling property of hydrogel in water and the space between the polymer chain become large hence drug with appreciable water solubility, like salicylic acid at 244 nm is seen after every 30 min interval.

IV. DISCUSSION :

Salicylic acid hydrogel preparation represents a feasible and productive approach to delivery anti inflammatory in controlled manner. Polymer with desired hydrophilicity and hydrophobicity can be chosen to impart the desirable is solution and drug release patterns in the present study. In addition the materials used in hydrogel preparation are bio availability, biocompatible with nontoxicity. From the results it can be clearly concluded that the diffusion of salicylic acid from the hydrogel has gradually increased with respect to time suggesting that the drug is released at predetermined rate over a controlled period of time.

ACKNOWLEDGEMENTS:

I cannot express enough thank to our guide Mr.H.S.Kandle sir,for their continued support and encouragement. I Thankful for Indian Journal of Pharmaceutical Sciences journal which promote to us for more research work .

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