Research Article

PREPARATION AND EVALUATIN OF ELASTIC LIPOSOMES OF ANTI-ARTHRITIC DRUG DEXAMETHASONE

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ABSTRACT:

The major objective of the current work was to formulate and evaluate elastic Liposomes, which are utilized to deliver drugs topically to treat arthritis and inflammation. The therapeutic index of the drug is greatly increased by liposomal encapsulation. Since carriers are well established for their potential for topical drug delivery, the formulation of liposomes has been chosen to transport the drug Dexamethasone to the skin layers thought to be most effective at fighting arthritic infections. Dexamethasone containing liposomes were created via the thin film hydration method in various ratios. The ingredients of Formulas F1, F2, F3, F4, and F5 include Dexamethasone, Phosphatidyl choline, and cholesterol. The vesicle size, shape, percentage of drug content, FTIR, DSC, and in-vitro drug release research were used to describe the liposomal formulations. According to studies, the amount of dexamethasone released from elastic liposomes at different times was calculated using a UV spectrophotometer. Discovering Dexamethasone may be targeted as a corticosteroid. When compared to formulations F3 and F5, formulation F2 releases 88.21% more medication in 8 hours, making phosphatidyl choline and cholesterol a better combination.

Key Words: *Dexamethasone , Soyalecithin, Cholesterol, Methanol, Liposomes , Thin Film Hydration Method, Anti-Arthritis.*

INTRODUCTION:

For many years, drugs for acute or chronic illnesses have been administered to patients using a variety of pharmaceutical dosage forms, such as tablets, capsules, creams, ointments, liquids, and injectables. Even now, the main items frequently found in the prescription and over-the-counter drug markets are this Convential drug delivery technique. The traditional drug administration method is recognised to offer quick drug release. The results indicated that medication levels fluctuated and that therapeutic effective range was required to obtain and sustain concentration during treatment[1].

Recently, technically sophisticated drug delivery systems became available, allowing for the regulation of drug delivery rate, maintenance of therapeutic activity for an extended period of time, and/or targeting of drug delivery to particular tissues. These methods have sparked the creation of cutting-edge drug delivery systems that offer a range of therapeutic advantages.

The process of creating a new drug molecule is time and money consuming. Attempts have been made to increase the safety effectiveness ratio of "old" drugs using a variety of techniques, including dose titration, therapeutic drug monitoring and individualizing drug therapy. Targeted delivery, gradual delivery, and controlled distribution of drugs are some more techniques that have been actively sought after. An current medication's performance in terms of efficacy, safety, and increased patient compliance can be greatly enhanced by putting it into a novel drug delivery system. Pharmaceutical companies are working to create novel drug delivery systems in order to give medications to patients effectively and with fewer side effects. In order to meet patient needs and compete in today's competative business environment, focused systems like controlled rate, slow delivery, and targeted delivery are several that are being purchased extremely aggressively[8].

The goal of novel drug delivery systems is to route the active ingredient to the site of action at a rate determined by the body's need during the course of treatment. For varied administration methods, a number of innovative drug delivery systems have been developed.

The optimal medication delivery system conducts the active substance gently to the site of action and disperses the drug at rate determined by the body's requirements over the course of treatment. The targeted drug delivery system succeeds in delivering the medicine to the right place, but it is unable to regulate how quickly the drug is released. In order to increase treatment efficacy and lessen side effects, scientists have recently focused their research efforts on creating innovative drug delivery methods that target the medicine to a specific spot. A therapeutics research control strategy has been to target medications using carrier systems. Using a carrier, such as albumin conjugates, antibodies, lecithin, glycoprotein DNA, Dextran, Polysaccharides, Nanoparticles, and Liposomes makes it possible to target the medicine. The areas of the modern pharmaceutical research that are of the greatest interest are target directed medication delivery systems. The therapeutic effectiveness of the medicine is increased when it is delivered specifically to the target tissues, and its adverse effects on non-target tissues are decreased.[5] A site-specific drug delivery system's major objective is not only to improve the drug's therapeutic and selectivity index, but also to lessen its toxicity. Although spontaneous remission can occur, rheumatoid arthritis frequently evolves to chronic states associated with severe functional loss.[2] It is a chronic inflammatory disorder of unclear etiology that affects around 1% of the general population (geleka and clair , 2003) .An ideal therapy for RA should alleviate disease, avoid the development of extra Articular consequences such vacuities, serositis, and lung fibrosis, and prevent premature death. A number of medications have been utilized in the treatment of RA over the past 10 to 20 years.[6]

MATERIAL AND METHOD

Preparation of first stock solution: Dexamethasone is carefully weighed at 100 mg, added to a100 ml volumetric flask, and the volume is brought up to 100 ml with methanol to yield a 1 mg/ml concentration.

Preparation of second stock solution: Take 10 ml of the initial stock solution and dilute it with 100 ml of methanol in a volumetric flask until the solution has a 100 µg/ml concentration[9].

Preparation of third stock solution: Use methanol to bring the volume of the volumetric flask up to 50 ml by pipetting out 5 ml of the second stock solution. It yields a 5 µg/ml solution. Pipette sequentially 1 ml, 2 ml, 3 ml, 4 ml, and 5 ml; methanol is then diluted to the desired Concentration in a volumetric flask, yielding 5µ g/ml, 10µ g/ml, 15 µg/ml, 20 µg/ml, and 25 µg/ml, respectively. This entire solution is examined using ultraviolet spectroscopy at its longest wavelength (nm)[4].

Preparation of liposomes:

Multilamellar liposomes containing dexamethasone were created utilising the thin layer film hydration approach. In a 9:1 mixture of chloroform and methanol, dexamethasone, soya-lecithin or phosphotidyl choline, and cholesterol were dissolved. The rotary flash evaporator's spherical bottom flask is filled with the aforementioned Solution. The organic solvents in the rotary flash evaporator evaporate at 60 degrees for 15 minutes at 90 RPM. After the organic solvent has evaporated, a thin coating has formed on the inner surface of the RBF.Using a vacuum oven, this thin coating dried overnight. Hydrate for an additional hour at 70°C. After that, centrifuge the liposomal suspension at 3000 rpm for 30 minutes using an ultra-centrifuge. Then this suspension of liposome sonicate for 15 min at 65°C to get small Unilamellar Vesicles. After that, the vesicles are put on a slide and examined under a microscope; because liposomes are nanoscale, the necked eye cannot see them. As a result, we must use transmission electron microscopy to examine (TEM) [3].

Sl.No	Batch code	Amount of drug (mg)	Soya-lecithin	Cholesterol	Solvent (Ratio) Chloroform :Methanol
1	F1	100	80	5	9:1
2	F2	100	95	10	9:1
3	F3	100	90	15	9:1
4	F4	100	75	20	9:1
5	F5	100	85	25	9:1

Table No -1: Formulation of liposomes

Characterization of Microsphere:

1) FTIR
2) DSC (Differential Scanning Calorimetric)
3) Particle Size
4) Zeta potential
5) TEM (TRANSMISSION ELECTRON MICROSCOPY)
6) Measurement of PH
7) Drug content
8) IN-VITRO drug release (using franz diffussion cell Apparatus)

RESULT:

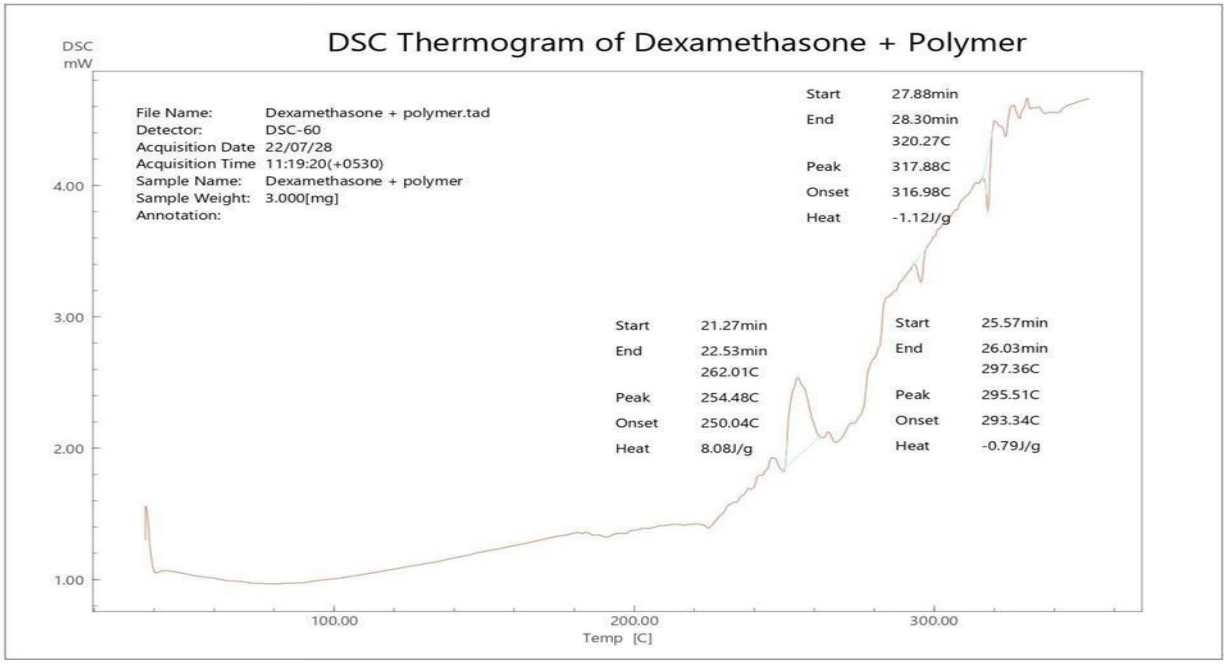

Fig no-1DSC (Differential Scanning Colorimeter)

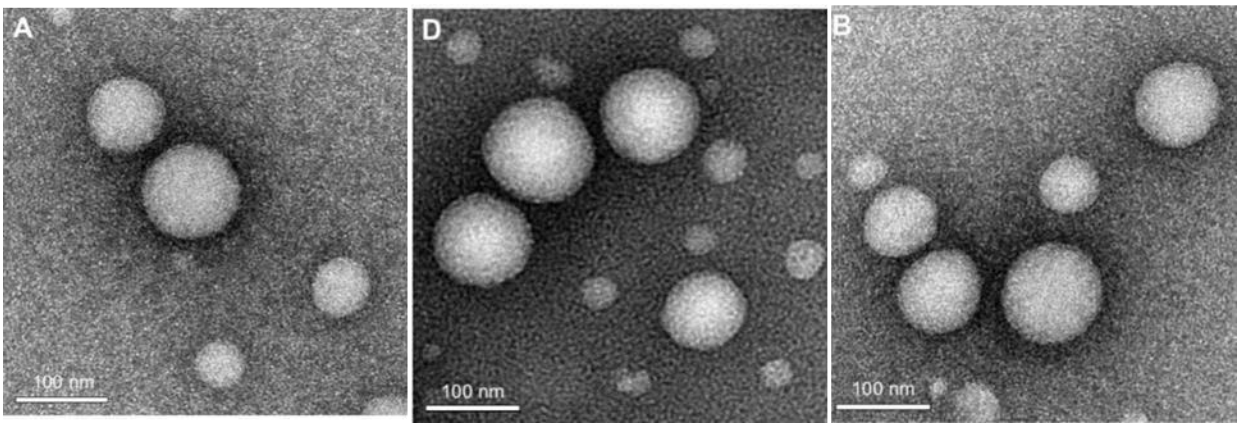

Fig no -2 TEM

Sl.No	Formulations	%Drug content (%)
1	F1	12.54%
2	F2	37.2%
3	F3	17.4%
4	F4	25.8%

Table no-2 Percentage of Drug content

Sr.No	Time	F1	F2	F3	F4	F5
0	**0**	0	0	0	0	0
1	**1**	5.5092050	12.551046	8.408786	9.51338	3.99037
2	**2**	13.655648	21.802092	20.283263	25.668200	12.827196
3	**3**	22.492468	29.8104602	30.224686	35.747698	28.429707
4	**4**	32.848117	37.956903	37.680753	54.387866	32.571966
5	**5**	41.961087	49.693305	53.283263	61.982008	39.889958
6	**6**	49.555230	66.814643	61.982008	74.684937	52.86903
7	**7**	74.823012	77.308368	73.304184	77.998744	72.06150
8	**8**	82.831380	88.216317	85.73096	86.421338	83.216317

Table no- 3 Cumulative percent drug released vs time plots of formulation F1, F2, F3, F4, and F6

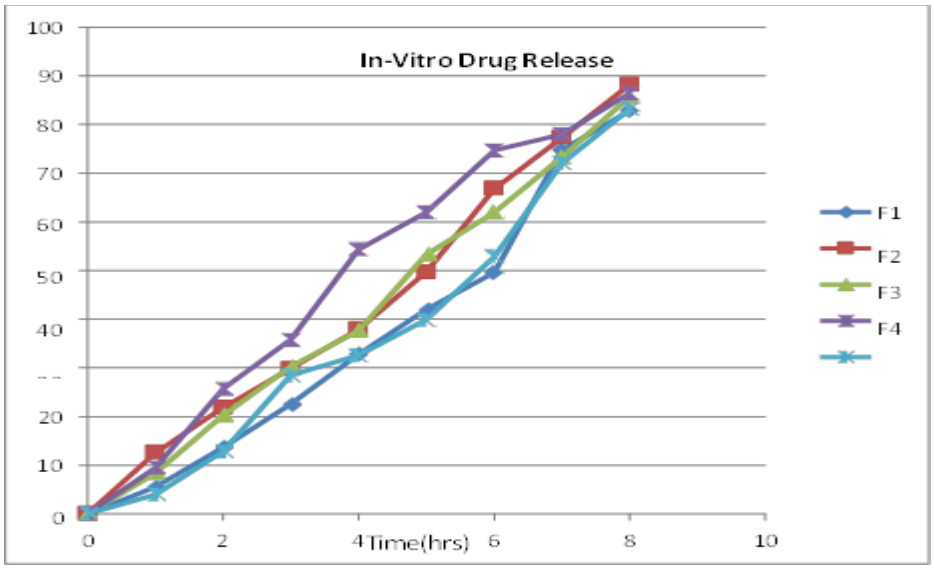

Fig no-3 Cumulative percent drug released vs time plots of formulation F1, F2, F3, F4, and F6

DISCUSSION

This research's major objective was to create elastic liposome's that contained Dexamethasone in order to improve its bioavailability. Researchers have a number of options to investigate undiscovered advances in pharmaceutical technology related to liposomes. Researchers have created new liposomes, such as immunological liposomes, magnetic liposomes, long-circulating liposomes, etc. To enhance their therapeutic targeting effectiveness.[10]The present dissertation used polymers including phosphatidyl choline, cholesterol, methanol, and chloroform to create elastic liposomes of dexamethasone using the thin film hydration/hand shaking method. Phosphatidyl choline and cholesterol were employed to make Dexamethasone elastic liposomes in the preparation of F1, F2, F3, F4, and F5. Studies for the pre-formulation were completed. The goal of the FTIR analysis was to discover any potential interactions between the polymers and the chosen drug, dexamethasone. Dexamethasone's FTIR was shown in the figure (Fig.no.14). The peaks are shown in the figure (Fig.no.15) of the Differential Scanning Colorimeter (DSC) experiments on pure drug and drug with polymer (Fig.no.16). The Franz diffusion cell apparatus was used to conduct the in-vitro drug release investigation, and a suitable ratio of Chloroform: Methanol was used (2:1). The figure provides the dissolution profile (Fig.no. 18). And the Information Displayed in the Tables. According to the dissolution data, designed formulations released drugs at an average rate of 88.21% after 8 hours. F2, which contains phosphatidyl choline, cholesterol, methanol, and chloroform, had the highest CDR of all the formulations at 88.21%.

CONCLUSION:

A Glucocorticoid with a significant clinical usage, dexamethasone possesses anti-inflammatory and immunosuppressive properties. Dexamethasone cannot be used for prolonged therapy due to a large variety of side effects, including hypertension, hydro electrolytic disorders, hyperglycemia, peptic ulcers, and glycosuria. Clinically dexamethasone topical administration is used to treat a variety of ocular conditions, including allergic conjunctivitis. Over the past few years, numerous efforts have been made to increase the effectiveness and bioavailability of medications as well as to lessen their side effects by way of the creation of innovative drug carrier systems.[11] Dexamethasone liposomal 5 formulations were therefore created with various phospholipid (Phosphatidyl choline), cholesterol, and cholesterol compositions to minimize all of these side effects. Formulations F1, F2, F3, F4, & F5 contained the drugs dexamethasone phosphotidyl choline, and cholesterol. Methanol and chloroform in a ratio of (2:1). Multilamellar vesicles (MLV'S) can be created by thin film hydration approach employing rotary evaporator coupled with liposomes of the drug Dexamethasone, Phosphatidyl Choline, cholesterol, chloroform, and methanol in a varied ratio. Pre-formulation testing for drug and polymer compatibility using FTIR and DSC confirmed the drug's purity and revealed no drug–polymer interactions. The ratio of phosphatidyl choline to cholesterol has a significant impact on variables such as vesicle size, Zeta potential, percentage drug content, and invitro drug release (88.21% drug release).[12]

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