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Preparation and characterization of naproxen sodium loaded nanoparticle

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Abstract
The aim of the study was to investigate naproxen sodium Eudragit S100 Loaded Nanoparticle. Naproxen sodium is anti-inflammatory Analgesic, Antipyretic drug. There are about seven million patients of rheumatoid arthritis in India. The relevance if RA in India is higher than that reported from China. Indonesia, Philippines and south Africa. Nanotechnology is emerging as promising drug delivery system for twenty first century. Recent studies in field of nanotechnology reveals that vast potential in drug delivery system. The objective of therapy now aims to achieve the low possible levels of disease activity, and reducing of joint damage, enhancing physical function life. Strategies are all aimed at reducing pain and discomfort, preventing deformities and loss of joint function, and maintaining a productive and active life. A sustained release nanoparticle preparation of Naproxen sodium based Eudragit S 100 could retard release of drug which ultimately results in extending pharmacological response of naproxen sodium by reducing frequency of administration, which turns reduces drug related adverse effects. In this study naproxen sodium nanoparticle are prepared to resolve problem of poorly water-soluble drugs.

Keywords: naproxen, nanoparticle, rheumatoid arthritis, Eudragit S 100

Introduction
In current research area inquires about nanotechnology and its functions in medicinal drug conveyance have rising tool. Nanotechnology is emerges as promising drug delivery device for the twenty first century. Pharmaceutical nanotechnology is the utility of nanoscience to pharmacy [1]. The ammonium ion is existing as salts, and they are accountable for permeability, which is unbiased of pH in the physiological region. Eudragit S 100 was prove to be a promising polymer for managed and extended localized delivery of favored remedy to some physiological fluids [1, 2]. Despite the excessive research efforts spanning numerous decades, focused and managed delivery of poorly water soluble tablets stays one of the extra elusive goals in the pharmaceutical sciences. Rheumatoid arthritis is persistent disease, more often than not characterize with the aid of irritation of the lining or synovial of the joints and additionally through irritation and loss of function. It can lead to lengthy time period joint damage, ensuing in persistent pain, loss of feature and disability [1, 2]. Therapy is consequently directed closer to limiting the inflammatory technique and its consequences [3]. Unlike common drugs, nanoparticle structures are deliberate to supply therapeutic agents specifically to infected synovium, so warding off systemic and disagreeable effects. Out of each and every 100,000 people, 41 are identified with RA each year. About 1.3 million Americans have RA. Women are about two to three instances extra possible to get RA than men. Hormones in each gender may also play a position in both stopping and triggering it. RA typically begins between the ages of 30 and 60 in ladies and incredibly later in lifestyles in men. The lifetime threat of creating RA is3.6 % for ladies and 1.7 % for men. The existing investigation tested that attainable of test layout in appreciation improvement of nanoparticle and characterization of it [1, 3]. Naproxen use constrained with the aid of short length of action when it administer orally up to eight hrs. Considering point of quick period of action of naproxen sodium repeated administration are required for preserving particular pharmacological response [4]. Patient with persistent inflammatory disorder require lengthy time period remedy of naproxen sodium, however persistent utilization of naproxen can also leads to Gastritis, gastrointestinal disorder, ulcer and bleeding [5, 6]. A sustained release nanoparticle method of naproxen sodium primarily based on Eudragit S 100could retard release of drug which eventually consequences in extending pharmacological response of naproxen with the aid of decreasing frequency of administration, which in turns reduce drug related unfavorable effects [7].

Materials and Methods
Materials
Naproxen and Eudragit S 100 was once bought from Lobe Chemie, Pvt. Ltd. (Mumbai). Tween 80 was received from Lobe Chemie, Mumbai. All Remaining chemical substances have been of analytical grade and were used as procured.

Preparation Method
Nanoparticle was prepared via solvent evaporation method. Drug and polymer have been co-dissolved at room temperature in 10 ml of methanol. Methanol solution produced by means of co dissolving the drug and polymer solution used to be perfectly clear. The solution was slowly injected (0.5ml/min) with syringe in 100ml of water containing tween 80 (0.02%, w/v) as hydraulic emulsifier in cylindrical vessel [8]. During injection, the combination was once stirred at particular RPM with the aid of magnetic stirrer (RemiEquipments Ltd). Stirring was stored at 30 min. The solution without delay turns into an emulsion of polymer methanol solution in exterior aqueous phase. The diffusion of methanol and water out of and into emulsion micro droplets and gradual evaporation of organic solvent. Methanol residue evaporated off throughout a in addition gradual stirring at 300 rpm for 3 hrs at room temperature.

After evaporation of solvent, NPs have been recovered through centrifugation were resuspended in distilled water and lyophilized overnight. Variation of tactics parameters such as particle size, zeta potential and drug encapsulation efficiency used to be studied [9].

Nanoparticle Characterization

Particle size

Prepared Nanoparticle were checked for Particle size by using Horiba analyzer. Analyzing test were carried at 90^0 angle and 25^0 c temp including sample. For each and every sample, standard results was reported are mean diameter and SD of sample.

Zeta Potential

The Zeta-potential of naproxen sodium nanoparticles were deliberate by Zeta size (Horiba analyzer). To find out the zeta potential, nanoparticles were concentrated with 0.1 M solution of potassium chloride and positioned in electrophoretic cell where an electrical field of 15.2 V/cm was applied. Each sample were analyzed [10].

Entrapment efficiency

Aliquots of 2ml of the freshly organized nanosuspension had been centrifuged at 11,000 rpm for 15 min, and the quantity of unincorporated drug used to be measured through UV examination of the supernatant. few samples have been submitted to a 2d centrifugation cycle. The pellets acquired after centrifugation used to be then re-suspended and similarly dialysis method was once used to measure any un-entrapped Naproxen would possibly be precipitated in the system [9, 10].

$$Entrapment\ efficiency\% = \frac{Amount\ of\ NPX\ actually\ present\ in\ nanoparticles}{Amount\ of\ NPX\ actually\ used} \times 100$$

Drug content

Prepared nanoparticle was tested for drug content. Nanoparticle were added to equal amount of methanol and set aside for magnetic stirring at 600 RPM for 3 hrs correspondingly The resultant test sample were observed under UV Spectrophotometer for concentration [11].

In vitro drug release

In vitro test thinks about were completed for every one of the samples by utilizing the Dissolution device LABINDIA cellophane tube in phosphate buffer (900ml, pH 6.8). Prior, one side of the layer was tied with a string and nanosuspension (2ml) was then put inside the cylinder and further set in 900ml pH 6.8 phosphate cushions in a measuring with mixing for 12h. 5ml of the aliquot was pulled back at foreordained intervals up to 12 h. The required quantity were made with pH 6.8 phosphate buffer and the arrangement was broke down for the medication content spectrophotometrically at 330nm [12]. Measure up to volume of the medium was supplanted after every withdrawal to keep up sink condition.

Result and discussion

In this study naproxen sodium nanoparticle were prepared successfully by solvent evaporation method; these nanoparticle are within Nano range. The mean particle diameter of naproxen sodium nanoparticle is 154.5nm to165nm, which were ideal range for rheumatoid arthritis targeted treatment. The Zeta Potential of naproxen nanoparticle was -22.1mV and 89% of drug entrapment efficiency was found.

Table 1: Shows Zeta potential, Particle size and Entrapment efficiency of all formulation

Formulation Code	Entrapment Efficiency (%)	Zeta potential (mV)	Particle size (nm)
F1	81	-21	185.2
F2	78	-20.3	176
F3	89	-22.1	154.5
F4	85	-20.2	168.2
F5	79	-19	215.9
F6	81	-21.3	193
F7	76	-18.7	165.2
F8	86	-23	163.2
F9	83	-19.5	185

Particle size distribution

The particle size distribution was analysis using Horiba Analyzer. The average particle size of all the formulations was of nano size, ranging from 154.5 to 215.9nm. All formulations having nano particle size distribution as given in Table 2.

Table 2: shows particle size determination of al formulations

Formulation code	Mean particle size
F1	185.2 nm
F2	176 nm
F3	154.5 nm
F4	168.2 nm
F5	215.9 nm
F6	193 nm
F7	165.2 nm
F8	163.2 nm
F9	185 nm

From all these nine Formulations are within normal nano range but formulation code FN1 shows good nanoparticle size within range of 154.5 to 165 nm.

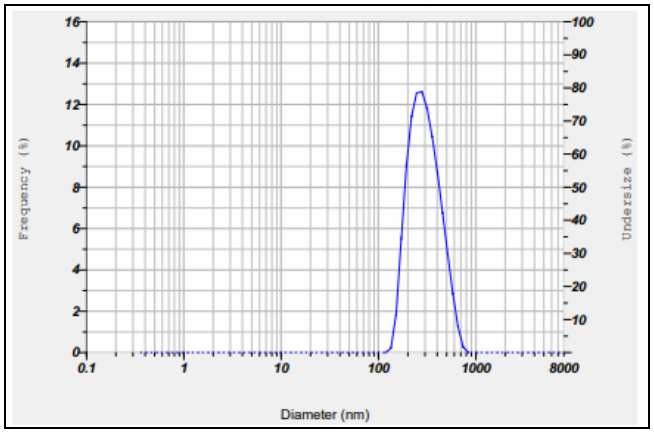

Fig 1: Shows optimized Formulation particle size result

Zeta potential

Zeta Potential evaluation is a method for identifying the surface charge of Nanoparticles in solution (colloids). Nanoparticles have a surface charge that attracts a thin layer of ions of contrary charge to the Nanoparticles surface. This double layer of ions travels with the Nanoparticles as it

diffuses for the duration of the solution. The electric powered practicable at the boundary of the double layer is recognised as the Zeta potential of the particles. Zeta achievable is taken as a measure for steadiness of nanosuspension. The zeta possible of all the 9 formulations used to be observed to be ranging from -19.5 to23 mV. The linear mannequin used to be advised for Zeta potential [12, 13]. Suspensions with zeta workable greater than +25mV and much less than -25mV have been discovered to be stable.

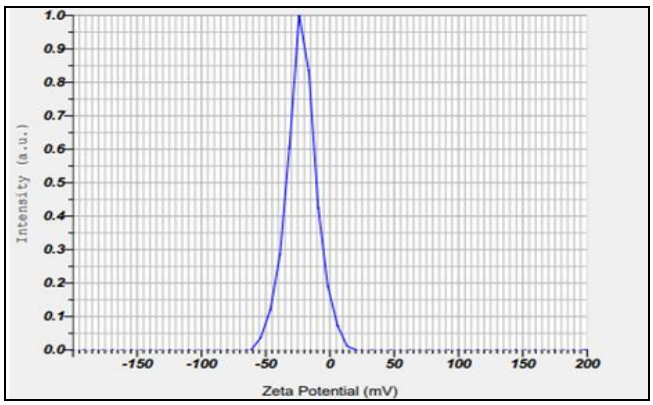

Fig 2: shows zeta potential results of F3 formulation

Entrapment Efficiency

The entrapment efficiency of all the readied tests of nanoparticle extended from 76.5% to 93.1%. Table 1 demonstrates an Entrapment effectiveness of every one of the nine-test sample of naproxen nanoparticle. Formulation code F3 demonstrates that 89% drug content.

In vitro Drug release

In vitro release of nanoparticle carried out in a phosphate buffer pH 6.8 was performed utilizing cellophane layer. As indicated by medication discharge F1 code demonstrates improved medication release of naproxen indicates in fig 3. The measure of drug release and drug content efficiency directly affects the medication discharge profile from the preparation [15].

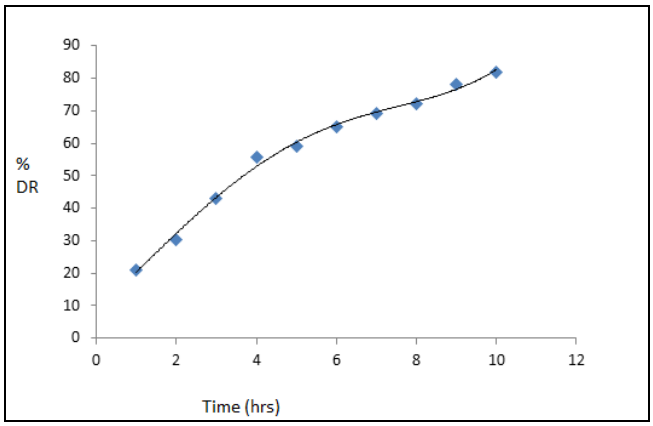

Fig 3: Dissolution profile of optimized F3 formulation

Conclusion

The nanoparticle of the poorly water-soluble drug like naproxen sodium is proved to be better and a cost-effective alternative. Naproxen loaded Eudragit S 100 nanoparticle can be administrated as intramuscular or an eye drop for inflammatory ocular diseases. The nanoparticle was studied for particle size, zeta potential, and entrapment efficiency, formulation FN1 was selected as an optimum formulation with desired properties. Drug: polymer ratio had a significant influence on particle size, Zeta potential and entrapment efficiency. Unlike conventional drugs, the nanocarrier system may increase the solubility of certain drugs and protect them against degradation in the circulation, further increasing their local bioavailability and reducing unwanted off-target side effects. Therefore this study was undertaken to develop nanotechnology-based strategies for the treatment of Rheumatoid arthritis.

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Conflict of Interest: No.

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