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Research Article

Formulation and Evaluation of Aspirin Nanosuspension Using Probe Sonication Method

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Abstract:

Aspirin inhibit the activity of the enzyme now called cyclooxygenase (COX) which leads to the formation of prostaglandins (PGs) that cause inflammation, swelling, pain and fever. Aspirin having various function like anti-inflammatory, analgesic, antipyretic etc. Aspirin loaded nanosuspension was prepared to enhance the bioavailability of the drug. Nanosuspension is defined as a finely dispersed solid particle dissolved in aqueous and organic medium for oral, tropical, parenteral or pulmonary administration. The size ranges about 200nm to 600nm.Aspirin loaded nanosuspension was prepared by probe sonication method. The probe sonication method is used to reduce the particle size and to increase the solubility of the drug. Total 5 Nano formulations were prepared in which NS1 shows 100% of drug content. Invitro Drug release was performed using Franz diffusion cell in which NS5 formulation shows 94.7% drug release in a time period of two hours and 30 minutes. Entrapment efficiency was performed using Ultracentrifugation method kept for 40 minutes at 17,000 rpm speed. Among all NS5 shows 71.9% of entrapment efficiency.

Key words: aspirin; nanosuspension; polaxamer; drug content; entrapment efficiency

Introduction

Nanosuspension is define as a finely dispersed solid particle dissolved in aqueous and organic medium for oral, tropical, parenteral or pulmonary administration. The size ranges about 200nm to 600nm.Nanosuspension is having several advantages like it will improve the solubility issues of the drug and also improve bioavailability. Aspirin having anti-inflammatory action by inhibiting cyclooxygenase which will prevent the synthesis of prostaglandins. Aspirin is rapidly deacetylated by esterase in the body there by producing salicylate which has anti-inflammatory, antipyretic and analgesic effect. Aspirin loaded nanosuspension is prepare by using probe sonication method to improve solubility of the drug and reduce dosage regimen. [1-3]

Advantages:

- Oral administration will provide rapid and improved bioavailability.
- Rapid dissolution can be achieved by IV.
- It will give long term physical stability due to presence of surfactant.
- Can be applied for the poorly water-soluble drug
- It will increase biological performance of the drug due to high dissolution rate & saturation solubility. [2-4]

Disadvantages:

- Sedimentation and compaction can cause problems
- It is bulky so care must be taken while handling and transport
- Uniform and accurate dose cannot be achieved for the nanosuspensions [2-6]

Ingredients	Quantity
Aspirin	10mg
Poloxamer	20,40,60,80,100mg
Buffer 7.4 PH	q. s
Distilled water	q. s

Table 1:

Preparation

Method: Probe Sonication method

Aspirin loaded nanosuspension was prepared by probe sonication method. Drug [10mg] was dissolved in an aqueous solution consisting of surfactant [20,40,60,80,100mg]. Then subjected to stirring until drug completely dissolves. The prepared suspension was subjected to probe sonication.

Characterization of Nanosuspension

1. **Particle size:** The particle size is determined by photon correlation spectroscopy, laser diffraction and coulter counter multi sizer. It will measure the particle ranging from 3nm to 3 µm.
2. **Zeta Potential:** It is an indication of the stability of the suspension. The ranges for the stability of the nanosuspension is about 30mv[minimum]. More the zeta potential more will be stability
3. **Dissolution:** It will increase the dissolution velocity as well as the saturation solubility. This saturation of solubility and dissolution will help in determining the in vitro behaviour of the formulation.
4. **Surface energy:** surface energy of nanosized particles induces agglomeration of the drug crystals. Stabilizer main function is to prevent the drug from agglomeration and give physical stability to the formulation
5. **Transmission electron microscopy:** It will give morphology of the particle. [6-12]

ISSUES	REASON	SOLUTION
1]Agglomeration	Large surface area leads tp agglomeration	Poloxamer 188, PEG, PVP
2]Sedimentation	Agglomeration	Reduction in particle size
3]Change in crystalline	High energy [top to down process	Stabilizer
4]Stability during solidification [spray /freeze drying]	Agglomeration during drying process	Matrix former agent like sucrose, mannitol

Table 2: Stability issues of Nanosuspension

Evaluation test

1) **Drug content:** Take 1ml of suspension dissolved in 10 ml of volumetric flask make up the volume up to 10ml with methanol. Then check for the absorbance under UV spectrometer.
2) **Entrapment efficiency:** 1lml of suspension was taken dissolved in 9 ml of 7.4 phosphate buffer kept for ultracentrifugation for 45 minutes at 17,000 rpm speed. The supernatant was collected and check under UV spectrophotometry.
3) **Dissolution study:** The dissolution study was carried out by Franz diffusion cell. In which it consists of 2 compartment one is donor and another is receptor. The membrane was placed in between donor and receptor compartment. The sample was withdrawn at every regular interval and check under UV.
4) **Determination of nanosuspension particle yield:** The product yield was calculated by gravy metery. [11-13]

Result and Discussion

1] Calibration curve: The calibration curve of Aspirin was performed by taking methanol as solvent.

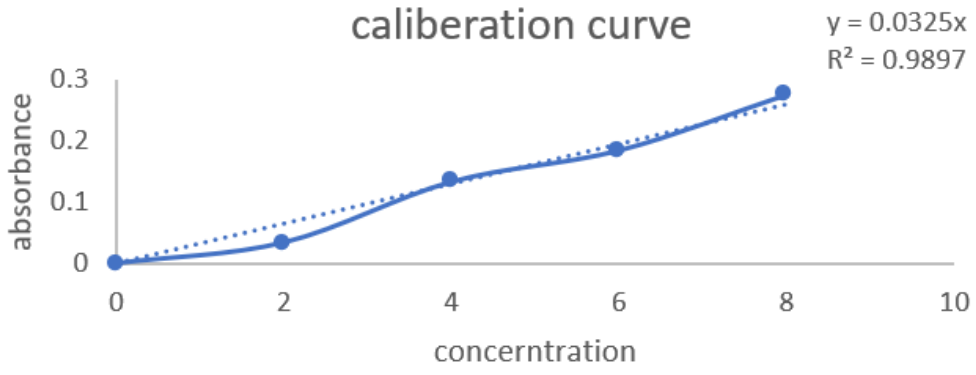

Figure 1: calibration curve of Aspirin

The plot was showing linearity with a regression value of 0.973 as shown in figure no 1

2] Drug content: the Drug content was carried out by taking 5 ml of nanosuspension formulation in which NS1 shows 100% of drug content as shown in figure no 2

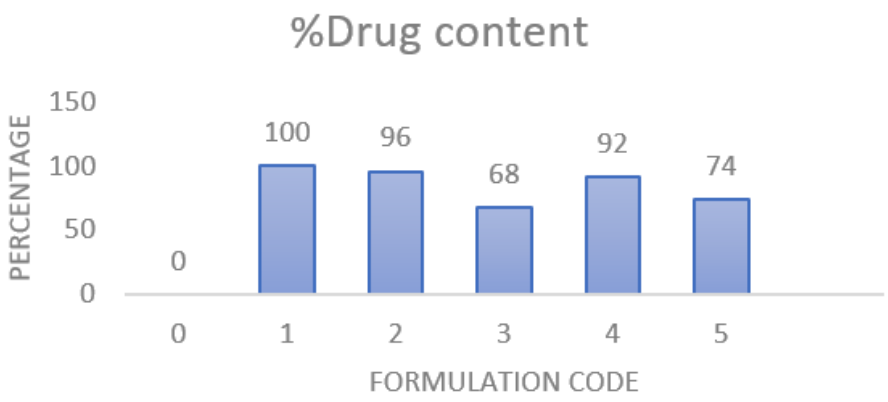

Figure 2: Drug content of nanosuspension formulations

3] Entrapment efficiency: The entrapment efficiency was carried out by ultracentrifugation in which NS5 shows 71.9%

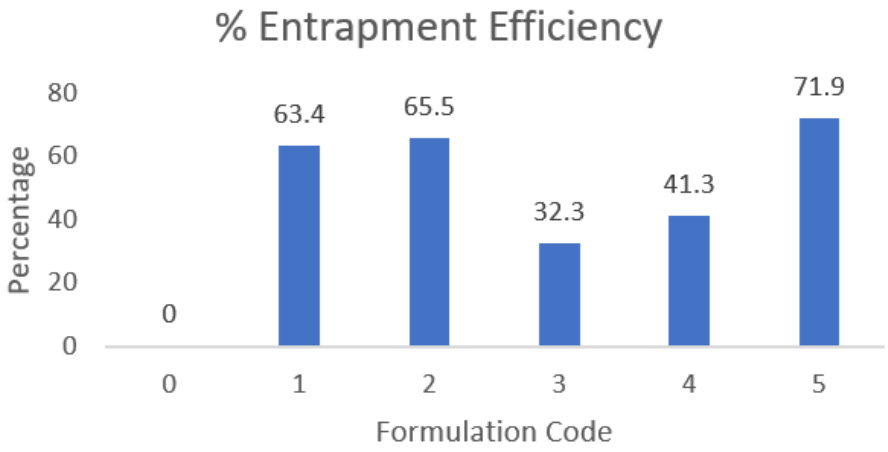

Figure 3: Entrapment efficiencies of nanosuspension formulations

4] Dissolution Study: In vitro drug release was obtained by using Franz diffusion cell in which NS5 formulation showed 94% of drug release in 150 minute of time interval as shown in figure no 4

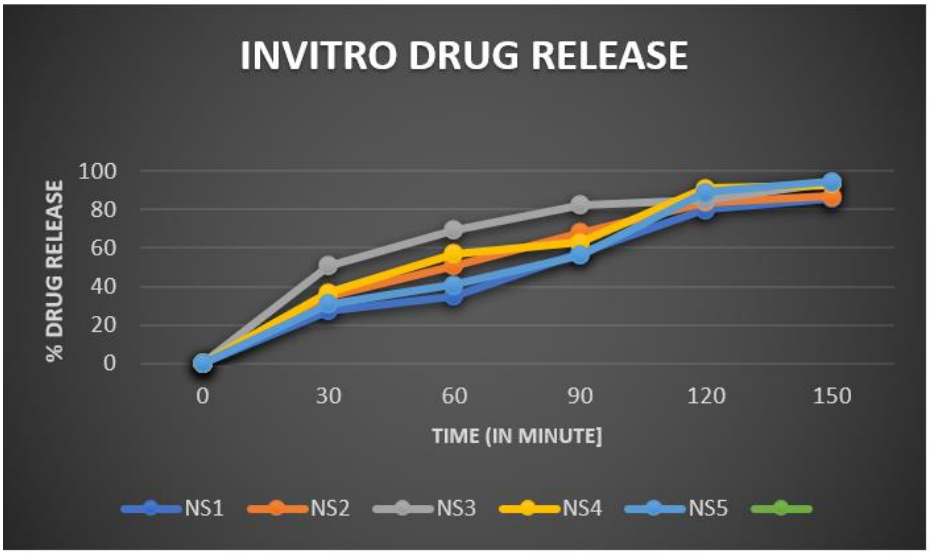

Figure 4: In-vitro dissolution studies of nanosuspension formulations

Conclusion

Aspirin loaded nanosuspension were prepared by probe sonication method. In which 5 Nano formulation were prepared and evaluation test was carried out. The NS1 shows 100% of drug content. The entrapment efficiency was performed by using probe sonication method in which NS5 shows 71.9% of entrapment. In vitro drug release was done by using Franz diffusion cell NS5 formulation showed 94.7% of drug release in 2.30 minutes of time interval. Aspirin loaded nanosuspension will enhance bioavailability of drug and its solubility profile. The probe sonication method is used to reduce the particle size and increase the solubility of the drug.

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