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Formulation optimization and characterization of Nanosuspension of Acyclovir

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INTRODUCTION

- Nano suspension is a sub micron colloidal dispersion of Nano sized drug particle stabilized by surfactant.
- They can also be defined as a biphasic system consisting of pure drug particle dispersed in a aqueous in which diameter of the suspended particle is les then 1 µm.
- This approach is useful for the molecule which is having poor solubility, poor permeability or both.
- Acyclovir is used orally for the treatment and prophylaxis of initial and recurrent episodes of genital and labile herpes.
- It is a class III drug which is poor bioavailability as well as poor permeability.

Approaches to improve the permeability of BCS class III drugs

- Novel drug delivery systems
- Prodrugs
- Permeation / penetration Enhancers
- Efflux Pump inhibitors
- Enzyme inhibitors
- Complexation

Method of preparation - Nanosuspension

Precipitation method	Supercritical fluid methods
Milling techniques	Sonocrystallization metho
High Pressure Homogenization	Emulsification solvent evaporation

Method: Emulsification solvent evaporation

200mg of Acyclovir was taken along with different quantity of Eudragit EPO (0.075gm, 1gm, 1.125gm) and dissolved them in 95% Ethanol and they were allowed to sonicate for 10 mins

Different quantity of Surfactant solution of Tween 80 (1%, 2%, 3%) were prepared and The Drug + Polymer mixture was added dropwise into the surfactant solution on the magnetic stirrer for 2 hours.

Evaporation of the solvent took place and nanoparticle were produced by hardening of the droplets.

EVALUATION PARAMETERS

1. PARTICLE SIZE, MORPHOLOGY AND ZETA POTENTIAL ANALYSIS
2. % ENTRAPMENT EFFICIENCY
3. IN-VITRO DIFFUSION STUDY
4. DIFFERENCIAL SCANNING CALORIMETRY
5. X-RAY DIFFRACTION STUDY
6. TRANSMISSION ELECTON MICROSCOPY
7. EX VIVO DIFFUSION STUDY

EXPERIMENTAL WORK

Optimization of the Nano suspension is done by using 3^2 full factorial design

Concentration of polymeric stabilizer (X1) and concentration of surfactant stabilizer (X2) were selected as independent variables, while Particle size, % Entrapment efficiency and % Drug release were selected as dependent variables.

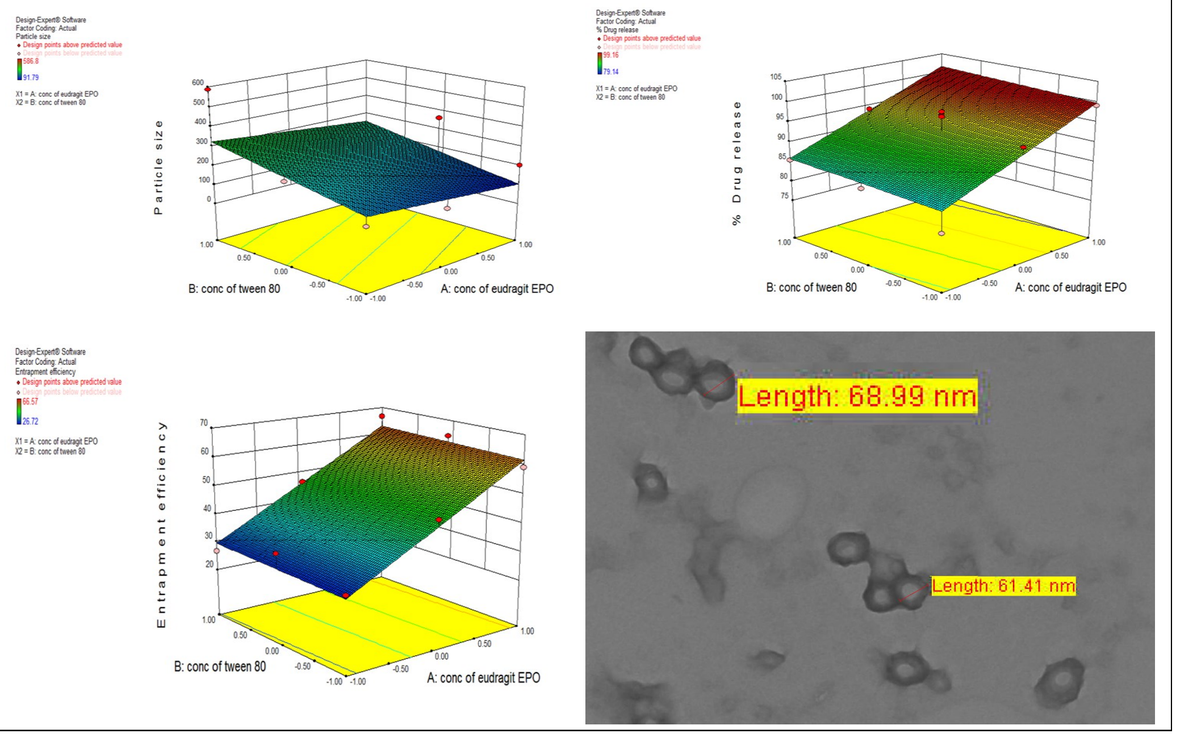
Independent variables	Design level	
	Coded level	Uncoded level
1. Concentration of Eudragit EPO (gm)	-1	0.075
	0	0.1
	+1	0.125
2. Concentration of Tween 80 (%)	-1	1
	0	2
	+1	3

Batch No	Coded value		Actual value	
	X_1	X_2	X_1	X_2
B1	-1	-1	0.075	1
B2	-1	0	0.075	2
B3	-1	+1	0.075	3
B4	0	-1	0.1	1
B5	0	0	0.1	2
B6	0	+1	0.1	3
B7	+1	-1	0.125	1
B8	+1	0	0.125	2
B9	+1	+1	0.125	3
B10*	0	-0.5	0.1	1.5
B11*	+0.5	0	0.112	2

***=check point batch**

RESULTS

EVALUATION	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10*	B11*
PARTICLE SIZE / ZETAPOTENTIAL (nm/mv)	124.8/-8	225.7/2.29	586.8/1.52	91.79/-3.07	145.6/-2.75	135.9/2.52	**206.8/7.23**	362.1/3.04	161.4/0.103	141/2.22	150/-1.43
%ENTRUPMENT EFFICIENCY(%)	29.34	34.14	26.72	47.12	41.12	46.34	**59**	64.32	66.57	43.89	42.58
IN VITRO DIFFUSION STUDY(%)	71.14	83.69	85.56	93.65	96.94	94.04	**99.16**	98.27	97.68	97.55	96.22



CONCLUSION

- The preparation of Nano suspension was carried out in order to increase the permeability and bioavailability of Acyclovir.
- From the study B7batch was found to be optimum batch in terms of particle size, % entrapment efficiency and % drug release.
- Also other studies like, TEM, DSC and XRD were carried out along with Ex vivo study.
- The dosage form shows immediate permeation across the GIT mucosa, therefor, the permeation enhancement has been achieved.
- Hence it can be calculated that Nano suspension containing acyclovir provides higher bioavailability as compare to the marketed product.

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