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RESEARCH ARTICLE

MICROENCAPSULATION BY SOLVENT EVAPORATION METHOD OF BCS CLASS 4 DRUGS FOR BIOAVAILABILITY ENHANCEMENT

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ABSTRACT:

The microencapsulation process is used for size reduction with enclosing polymer coat on active pharmaceutical ingredient. The microencapsulation process used in present study is solvent evaporation process which formulated prior as o/o emulsification process. The polymer for encapsulation was selected based on drug entrapment efficiency and concentration of polymer mix was selected in ratio 1:2, further ratio was adjusted in central composite design for application of DOE in which independent variables was drug release after 2 hours and permeability across bio membrane after 4 hours. Results are shown revealed significant rise in bioavailability of drug than pure API. Scanning electron microscopy referred the size of microcapsule were in range of 10 - 5000 μm. They were spherical in shape with a rough surface and good solubility. Microcapsule were seen in SEM images are sphere with rough surfaces in all batches irrelevant of drug used. Drug encapsulation efficiencies of all the polymes were higher than 90%, which suggested that this method has potential to prepare microcapsules with efficient drug loading and increased bioavailability.

Keywords: Bioavailability Enhancement, Microencapsulation, Solvent Evaporation Technique, Design of Experiment (DOE), Quality by Design (QbD), Central Composite Design.

INTRODUCTION

In past few decades, biodegradable polymeric microcapsules are more focused as their potential in a wide range of biomedical applications. Microencapsulation is a process by which continuous film of polymeric material coated solid, liquid or even gaseous particles. These particles are in the size range of 1-1000 µm and are widely used as a drug carrier for controlled release. Poly Vinyl Pyrolidon are common and cheap biopolymers used in industry vastly as film forming agent to carry water-insoluble model drugs. Pyrolidones-based microcapsules of PVPK-30 [1, 2, 3], soluplus[4,5] have been used as biodegradable layer for fast release drugs. Solvent evaporation techniques have become more useful method as compared to other methods. The particle size can be controlled in the nano to micrometer range can be possible by this method, but importance of careful selection of encapsulation materials and various conditions in order to achieve high encapsulation efficiency and a low residual solvent content should not be neglected. Solvent evaporation method[6] is investigated for preparing the Pyrolidones-based microcapsules as drug entrapment efficiency is high in this method. Microspheres are formulated so as to maintain the concentration of drug in blood constantly and increase patient compliance, decrease dose and toxicity and the taste and odour of many drugs can be masked, liquid drugs can be converted into a free flowing powder, incompatibility among the drugs can be prevented [7].

The statistical approach leads to prepare microcapsule with higher efficiency with higher throughput. The design Expert 9.0 used for development of microcapsule and desirability of final optimised batch can be evaluated with the help of contour and surface response plot suggested by design expert. Microsphere preparation by solvent extraction/ evaporation basically consists of four major steps:(i) dissolution or dispersion of the bioactive compound often in an organic solvent containing the matrix forming material; (ii) emulsification of this organic phase in a second continuous phase immiscible with the first one; (iii) extraction of the solvent from the dispersed phase by the continuous phase, which is optionally accompanied by solvent evaporation, either one transforming the droplets into solid microspheres; (iv) harvesting and drying of the microspheres[8].

MATERIALS

Polyvinyl pyrolidones K30, Soluplus, Cefuroxime Axetil were purchased from Swapnroop Drugs, Aurangabad by Store department of Anuradha College of Pharmacy Chikhli.

METHODOLOGY

Preformulation studies

Standard Calibration Curve

Standerd Calibration Curve of Cefuroxime Axetil prepared in 7.0 pH phosphate buffer at λ_{max}280 nm. Standard Calibration Curve of Cefpodoxime Proxetil was prepared in 3.0 pH phosphate buffer at λ_{max} 233 nm. Standard Calibration Curve of Furosemide was prepared in 5.8 pH phosphate buffer at λ_{max} 274 nm using Shimadzu 1601 UV-Visible spectrophotometer.

For this stock solution of 1000µg/ml was prepared. Serial dilutions of 10, 20, 30, 40 µg/ml were prepared and absorbance was taken. Average of three sets of values were taken for standard calibration curve and solutions were scanned in the range of 200-400 nm against blank. The calibration curve was plotted. The preformulation studies carried out with the help of IR spectrophotometer and DSC study is carried out to study the thermal stability of the drug with presence of the different excipients[9].

FTIR Study

The FTIR study was performed for evaluation of drug and API interaction which was further studied with the Help of FTIR spectra arise with the any unusual graph pattern which was compared with standard spectra.

DSC Study

The DSC study was performed to get the idea of the interaction of drug and polymer in higher temperature and its affect at inert environment. The effect of the drug and polymer after microencapsulation process studied with DSC study.

Saturated Solubility Study

Saturated solubility study performed to evaluate the drug entrapment capacity of the polymer of drug. The microcapsule prepared with various concentration i.e 1:0.3, 1:0.5, 1:1, 1:2 by drug: polymer ratio respectively. The saturated solubility of each individual microcapsule studied by taking specified amount in glass vial containing water which rotated on lab shaker for 24 hours. The sample were prepared and diluted further for analysing drug contained in it [7,8,9,11].

Polymer Selection with Response Surface Methodology (RSM)

The polymer blend selected for preparation of microcapsule regarding the desired quality to be achieved after formulation of microcapsule such as drug solubility which leads to enhance drug dissolution and drug permeability which was evaluated with the help of in vitro methods. The polymer blend selected with the help of RSM statistical method with central composite design using Design Expert 9.0 (Trial Version). The polymer blend i.e fixed variables are X1 is PVPK 30 and X2 is Soluplus. While the responses are Drug release (Q 2 i.e. after 2 hours) and Permeability after 4 hours.

Table 1: Coded Value of Polymer (Fixed Variables)

Sr. No.	Fixed Variables	Coded Value
1	PVPK 30	X1
2	Soluplus	X2

Preparation of Microcapsules

The microcapsules prepared with help of solvent evaporation method in this the pre-weighed and pre-mixed polymer blend mixed in acetone to form a clear solution. In another beaker containing 250 ml liquid paraffin with 0.1% Tween 80. The Drug suspended in liquid paraffin with help of magnetic stirrer. While continuing stirring clear solution of polymer blend in acetone added drop wise into liquid paraffin containing drug. The solution continued to stir on magnetic stirrer to evaporate acetone from the system at room temperature for 2-3 hours.

After stirring microcapsules are decanted and filtered. The microcapsules are washed severally with n-hexane to remove residual liquid paraffin. The final microcapsules are stored in tightly closed container for further development of dosage form [11,2].

Characterization of Microcapsules

SEM Analysis

Surface Morphology of the microcapsule was investigated by scanning electron microscopy (SEM) using a JEOL JSM-6510 SEM. The microspheres were coated with gold before scanning to enhance their conductivity. The surface morphology can reveals by SEM image also the coated core material enclosed with coating polymer can be inferred.

Drug Entrapment Efficiency

Drug content which entrapped by polymers of the microcapsules were determined by UV-vis spectrophotometry. The microcapsule equivalent to 50 mg drug were dissolved in acetone 2ml and diluted with buffer solution. A clear solution was obtained for drug content measurement. Drug content values were the average from three experiments.

In vitro drug release study

The drug release profile was carried out with the help of drug dissolution apparatus Type 1 (Basket type). The microcapsule of single dose quantity filled in basket and rotated in dissolution flask containing buffer with temperature maintained at 37 ± 0.5°C for 2 hours. After specific time period the 2ml aliquote withdrawn from dissolution flask and exactly same quantity of same temperature buffer added in the flask to maintain sink condition. The aliquots were further diluted and

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analysed. The release profile of the drug carried out in triplicate [5].

In Vitro Drug Permeability study

The drug permeability study includes the study of the drug formulation and its effect on the drug permeability through intestinal membrane. The vitro model selected for studying in vitro permeability of the drug was modified Wilson and crane apparatus for drug permeability measurement. In this study the everted gut sac of chicken illieum tied with glass tube which made pouch like structure open at one end with tied knot at other. Filled with buffer then dipped in bottle containing drug solution and aerated the whole system as well as maintained at 37 ±0.5° C [13].

The samples are withdrawn after specific time period from the attached tube of the gut section and filled with exactly same amount of fresh buffer added in it to maintain sink condition. The samples were further diluted and analysed. The samples were analysed triplicate by UV spectrophotometric analysis [4].

RESULT AND DISCUSSION

The microcapsules prepared by this method were discrete and individual system with free flowing nature having nearly uniform size.

Preformulation Study

Standard Calibration Curve

The drug evaluated for formulation before their formulation. The absorbance maxima of the individual drug determined with their respective buffer solutions. Standard Calibration Curve of Cefuroxime Axetil was prepared in 7.0 pH phosphate buffer at λ_{max} 280 nm. Standard Calibration Curve of Cefpodoxime Proxetil was prepared in 3.0 pH phosphate buffer at λ_{max} 233nm.Standerd Calibration Curve of Furosemide was prepared in 5.8 pH phosphate buffer λ_{max} 274nm. Using UV-Visible spectrophotometer. For this stock solution of 1000 µg/ml was prepared. Serial dilutions of 5, 10, 15, 20, 25 µg/ml were prepared and absorbance was taken. Averages of 3 sets of values were taken for standard calibration curve, and solutions were scanned in the range 200-400 nm against blank. The calibration curve was plotted.

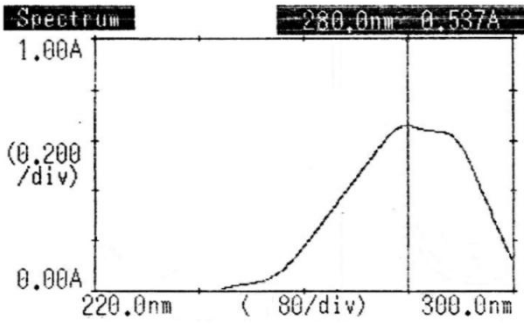

Figure 1: Absorbance Maxima of Cefuroxime Axetil at 280 nm

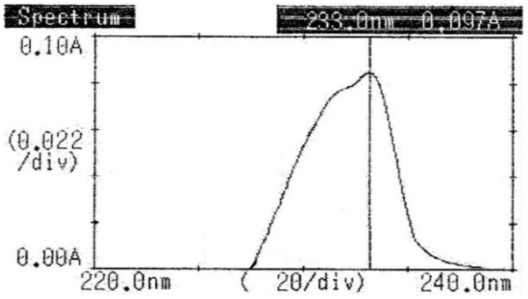

Figure 2: Absorbance maxima of Cefpodoxime Proxetil at 233 nm

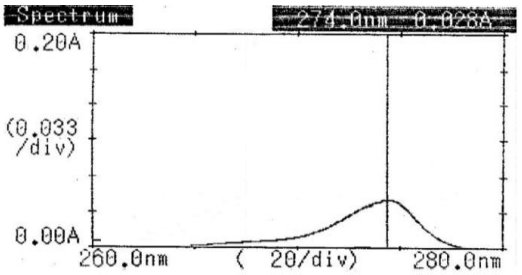

Figure 3: Absorbance maxima of Furosemide at 274 nm

Standard Calibration Curve of Cefuroxime Axetil

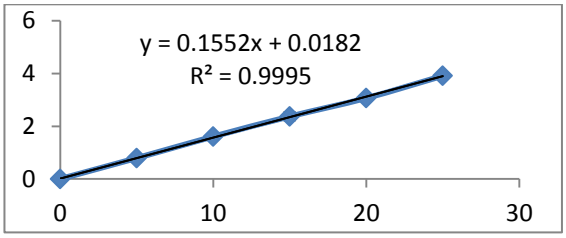

Figure 4: Standard Calibration Curve of Cefuroxime Axetil

Standard Calibration Curve of Cefpodoxime Proxetil

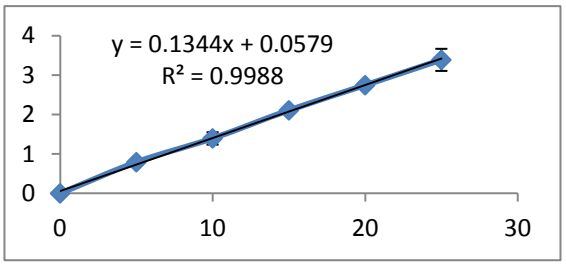

Figure 5: Standard Calibration Curve of Cefpodoxime Proxetil

Standard Calibration Curve of Furosemide

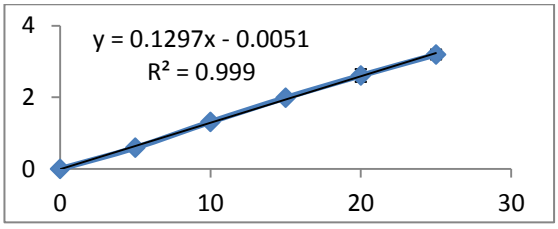

Figure 6: Standard Calibration Curve of Furosemide

Fourier Transformed Infra Red Spectrophotometer

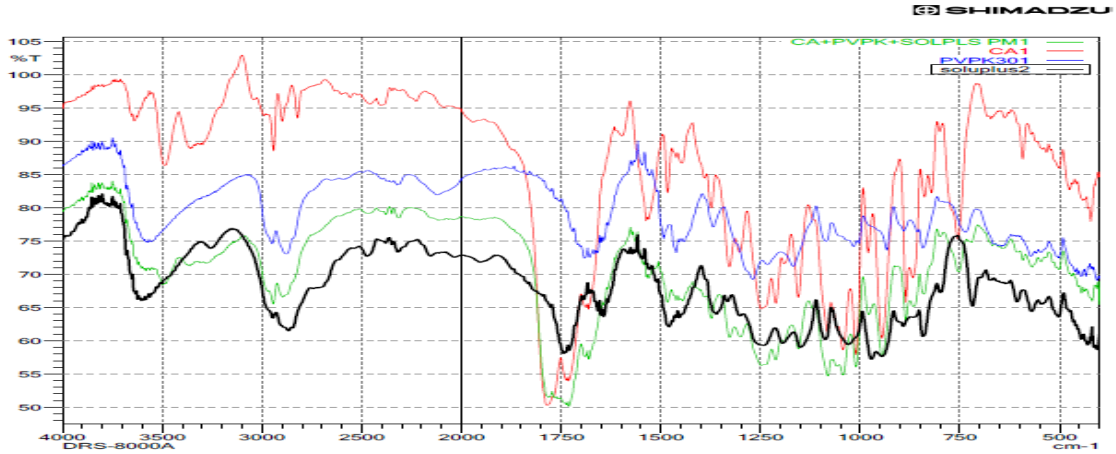

Figure 7: Cefuroxime Axetil Microcapsules overlay Graph

The IR spectra of microcapsule having the same content as that of solid dispersion and showing exactly same graphs a formulation process not make any significant changes in structure of the drug in functional group hence indicating no interaction between drug and ingredients in microcapsules.

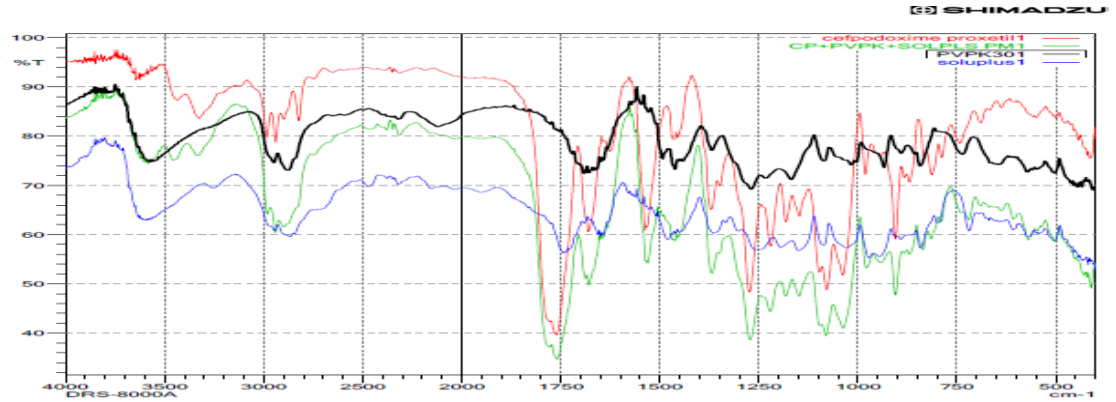

Figure 8: Overlay Spectctra of Cefpodoxime Proxetil and Microcapsules

The IR spectra of microcapsule having the same content as that of solid dispersion and showing exactly same graphs and formulation process not make any significant changes in structure of the drug in functional group hence indicating no interaction between drug and ingredients in microcapsules.

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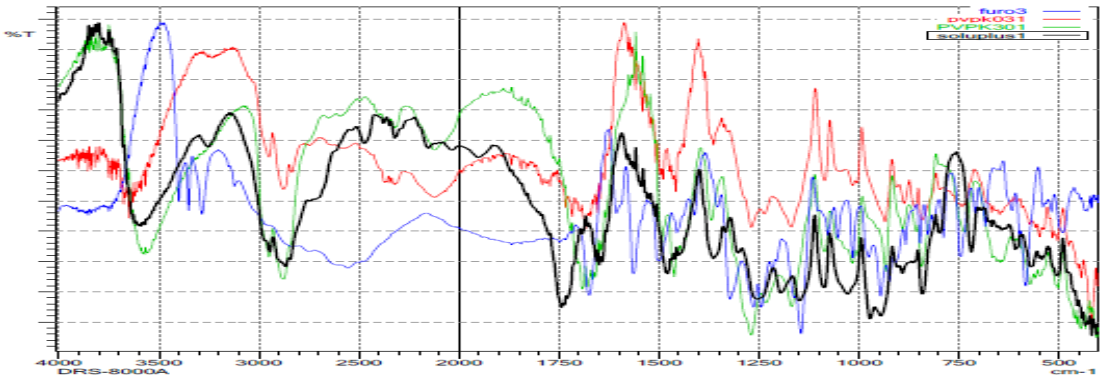

Figure 9: Overlay spectra of Furosemide and Microcapsules

DSC Study

The DSC Graphs shows endothermic curve on 88.80°C. Also exothermic peak shows on 252°C (Fig. 74) for pure cefuroxime axetil. The microcapsule shows transition temperature 217.24°C which shows complete impingement of drug core inside carrier of polymers as shown in SEM image.

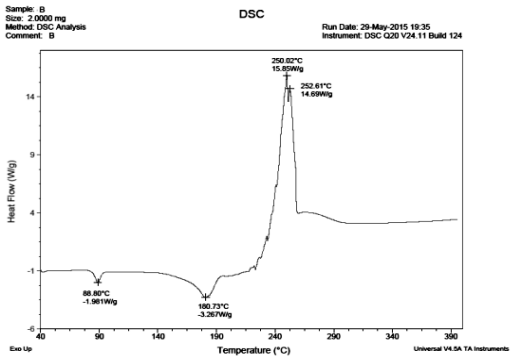

Figure 10: DSC of Cefuroxime Axetil

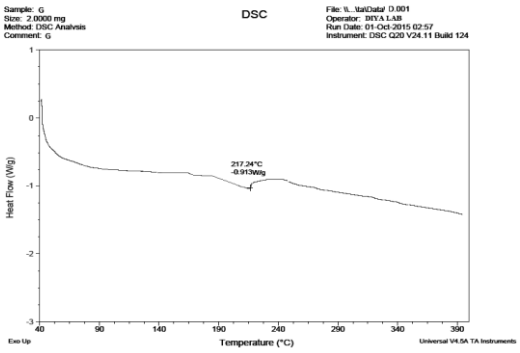

Figure 11: DSC of Microcapsule Cefuroxime Axetil

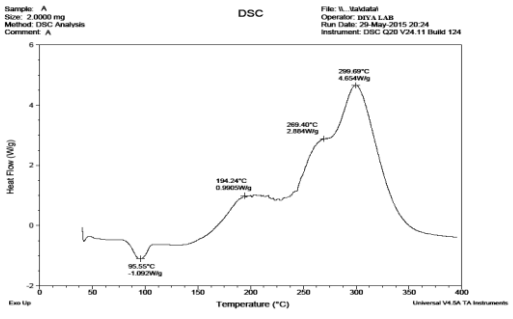

Figure 12: DSC of Cefpodoxime Proxetil

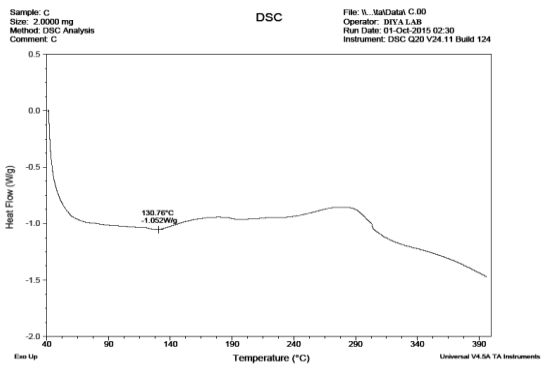

Figure 13: DSC of Microcapsule Cefpodoxime Proxetil

The DSC Graphs shows sharp endothermic curve on 222.95°C and 275.94°C. Exothermic curve on 224.19°C, resulting in showing the crystalline nature of drug. The microencapsulated furosemide shows transition temperature 227.24°C resulting in no change of drug nature and concludes complete impingement of drug in polymer matrix.

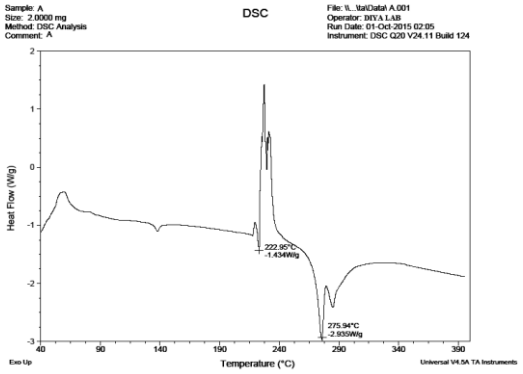

Figure 14: DSC of Furosemide

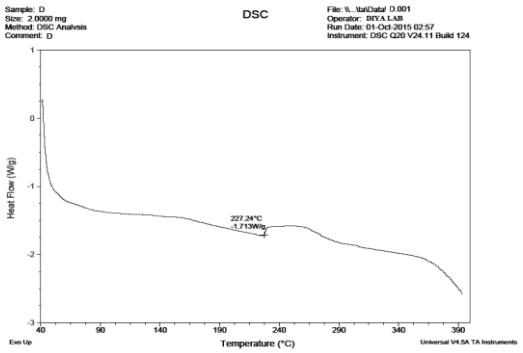

Figure 15: DSC of Microcapsule Furosemide

Saturated Solubility Study

The solution gives the drug content as follows

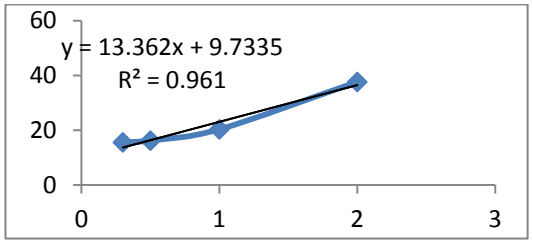

Figure 16: Saturated Solubility Study of PVPK 30 and Cefuroxime Axetil

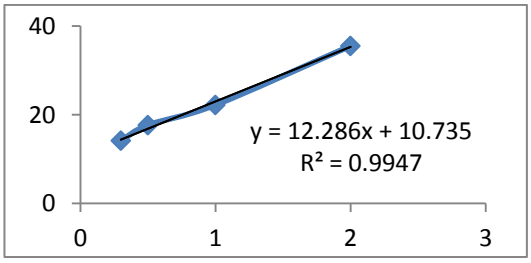

Figure 17: Saturated Solubility Study of Soluplus and Cefuroxime Axetil

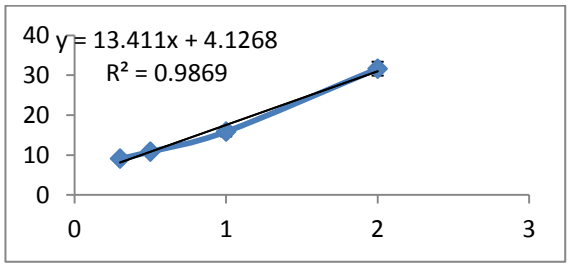

Figure 18: Saturated Solubility Study of PVPK 30

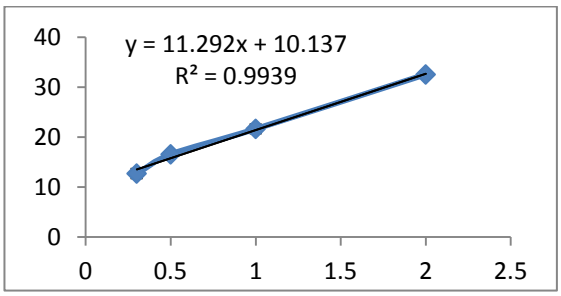

Figure 19: Saturated Solubility Study of Soluplus and Cefpodoxime Proxetil

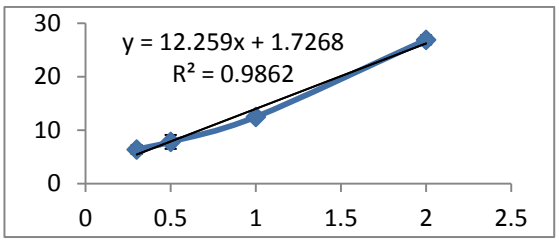

Figure 20: Saturated Solubility Study of PVPK 30 and Furosemide

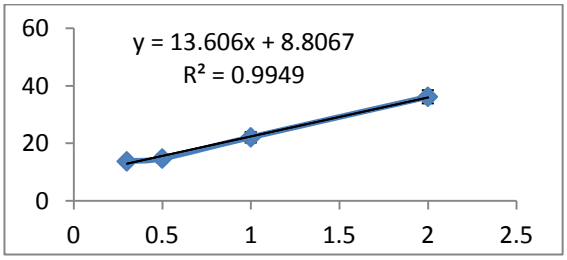

Figure 21: Saturated solubility study of Soluplus and Furosemide

From above graph it can be suggested that amount of PVPK is more favourable for improvement of solubility and microencapsulation formation hence the polymer concentration was decided as 1:2 for Soluplus and PVPK respectively.

Formulation by Central Composite Design

The Design expert software 9.0 were used for determination of polymer concentration to be taken while formulation. Ratio of soluplus and PVPK kept at 1:2 respectively. The formulation decided with the help of results obtained from saturated solubility study of PVPK, Soluplus, and drug in respective Buffer. The formulation trials are as follows;

Table 2: Batch Ingredient Concentration Taken

Variable Code	-1	0	+1	Ingrediant
X1	283.33	333.33	383.33	PVPK 30
X2	141.33	166.66	191.33	Soluplus
	500			Drug

Table 3: Batch Formula Codes

Variable Code	Batches Formulated		
X1	-1	0	+1
X2	-1	0	+1

Table 4: Final Formulation Runs

Run	Factor1: PVPK	Factor2: Soluplus
1	0	-1
2	0	1
3	-1	1
4	1	1
5	1	-1
6	-1	0
7	-1	-1
8	1	0
9	0	0

The Batches are formulated according to the formula shown in table 2 for determination of bioavailability of the formulation. The microcapsules prepared by the above batches evaluated for drug release study and permeability study.

Characterization of Microspheres

Scanning Electron Microscopy (SEM)

The SEM of drug performed and shows the distorted and irregular, rough shaped crystals of the drug having nonspecific size crystals with rough surface. In the SEM photograph of cefuroxime axetil after microencapsulation shows a small bead like structure with layer of coating polymer upon it leads to the conclusion of proper coating of small core of drug with polymer.

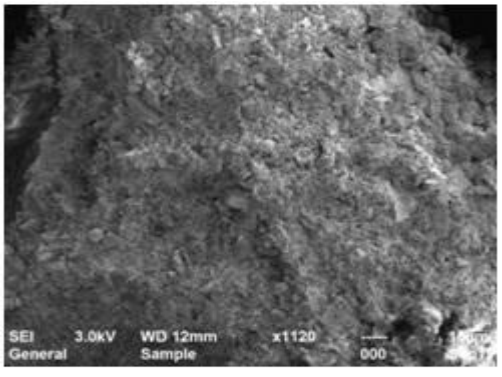

Figure 22: SEM of Cefuroxime Axetil

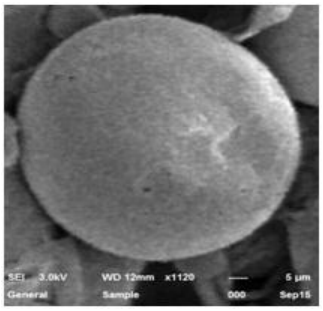

Figure 23: SEM of Microcapsule Cefuroxime Axetil

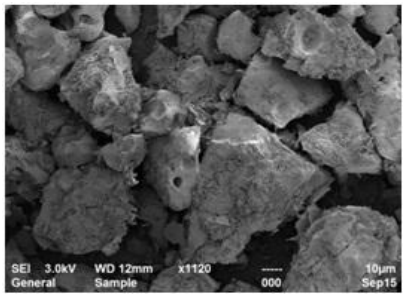

Figure 24: SEM of Cefpodoxime Proxetil

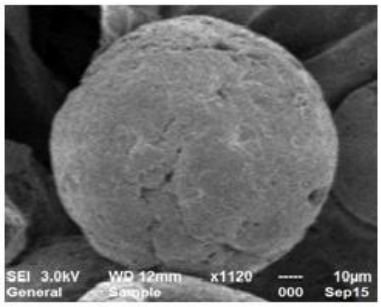

Figure 25: SEM of Microcapsule of Cefpodoxime Proxetil

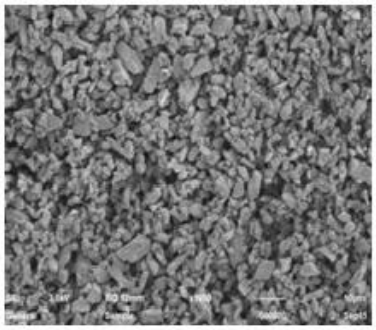

Figure 26: SEM of Furosemide

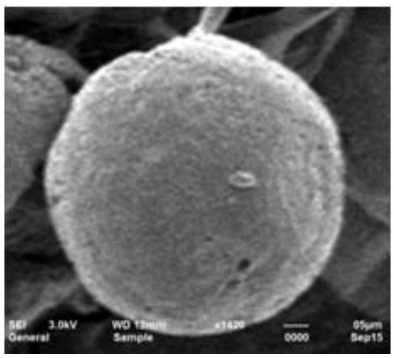

Figure 27: SEM of Microcapsule furosemide

Drug Entrapment Efficiency

The Drug entrapment study performed prior to drug release study for evaluating the drug loaded in the formulation in right proportion as well as the efficiency of process for drug entrapment for study release profile study evaluated for its release pattern with errors.

Table 5: Actual Drug Content

Sr. No.	PVPK	SOLUPLUS	Drug Entrapment Efficiency (%)		
			Cefuroxime Axetil	Cefpodoxime proxetil	Furosemide
1	0	-1	99.86±0.690	96.94±0.744	98.87± 0.656
2	0	1	95.07±0.802	99.33±0.602	99.36±0.603
3	-1	1	100.51±1.120	99.87±0.654	100.30±0.576
4	1	1	98.43±0.704	100.04±0.681	97.57±0.705
5	1	-1	99.22±1.054	99.38±0.528	99.1±0.552
6	-1	0	95.69±1.045	97.48±0.55	100.34±0.412
7	-1	-1	99.36±1.238	99.73±.1.1	100.98±0.659
8	1	0	96.29±1.075	97.42±0.315	97.16±0.431
9	0	0	97.37±1.193	99.41±1.304	98.29±0.690

All values are expressed as mean±SD, (number of terms) *n*=3

The in vitro drug release profile shown by the coded batch as follows

Table 6: Characteristics of Cefuroxime Axetil Microcapsules

Batch Run	X_1	X_2	Dissolution (%) after 2 hrs	Permeability (mg/ml)
1	0	-1	53.63 ± 0.0154	1.859 ±0.0133
2	0	1	55.88 ± 0.0131	2.952 ± 0.0116
3	-1	1	41.14 ± 0.0149	3.224 ± 0.0047
4	1	1	66.48 ± 0.0295	3.882 ± 0.0322
5	1	-1	69.63 ± 0.0406	2.291 ± 0.0249
6	-1	0	45.29 ± 0.2165	2.573 ± 0.01083
7	-1	-1	37.65 ± 0.0482	1.433 ± 0.01049
8	1	0	62.45 ± 0.0384	2.774 ± 0.01214
9	0	0	58.39 ± 0.0543	2.711 ± 0.01655

All values are expressed as mean±SD, (number of terms) *n*=3

Effect on Indpendant Variables:

Table 7: ANOVA of independent variables

Dependent variables	Source of variation				Sum of squares	Degree of freedom	F value	P value
	Source	Std. Deviation	R-Square	Predicted R-Square				
Dissolution (T_2)	Linear	3.54	0.9250	0.8283	925.66	2	37.02	0.0004
Permeability	Linear	0.25	0.9124	0.7995	3.83	2	31.24	0.0007

Final Equation in Terms of Coded Factors:

The model proposes the following polynomial equation for percentage drug entrapment (Cefuroxime Axetil) by Polymer

Dissolution (Y) = $54.504 + 12.41X_1 + 0.431X_2$

Permeability = $2.63+0.29X_1+0.75X_2$

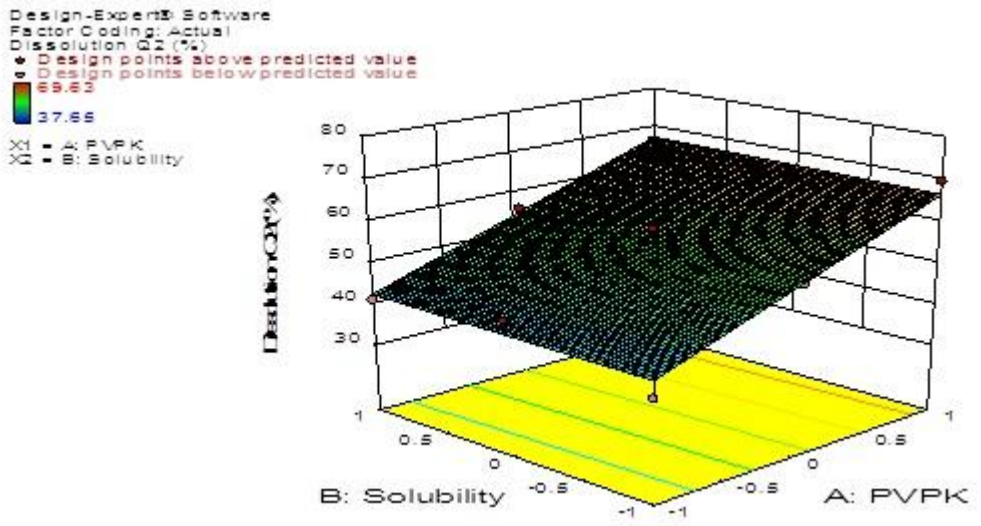

Figure 28: RSM plot for Effect on Dissolution by individual polymer Cefuroxime Axetil

From above RSM plot shows that the solubility of drug depends on the concentration of both polymers as concentration of polymer rises the solubility also increases but if compared individual polymer then it concluded that the PVPK 30 is more responsible to enhance the solubility of the drug.

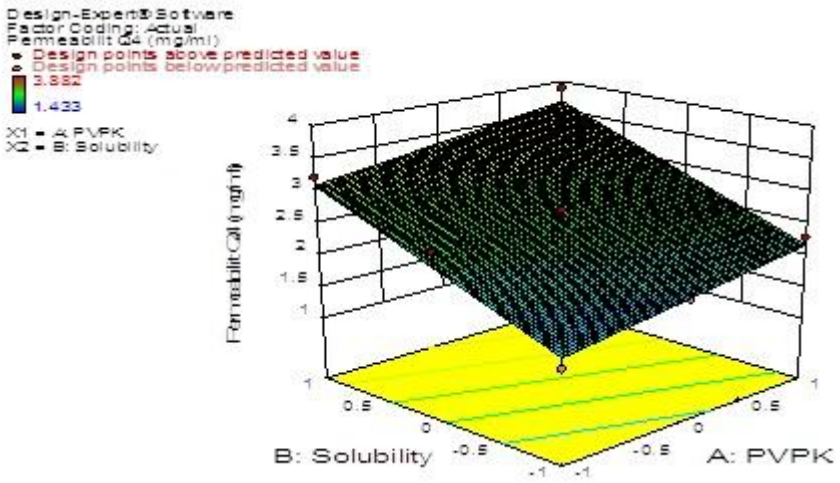

Figure 29: RSM plot for Effect on Permeability by individual polymer Cefuroxime Axetil.

From above RSM plot shows that the permeability of drug depends on the concentration of Soluplus while PVPK 30 doesn't play any significant role in permeability enhancement

Desirability plot for polymer for bioavailability enhancement:

The desirability plot shows the most desirable concentration of the batch runs to achieve most efficient bioavailability with significant economical and efficient method.

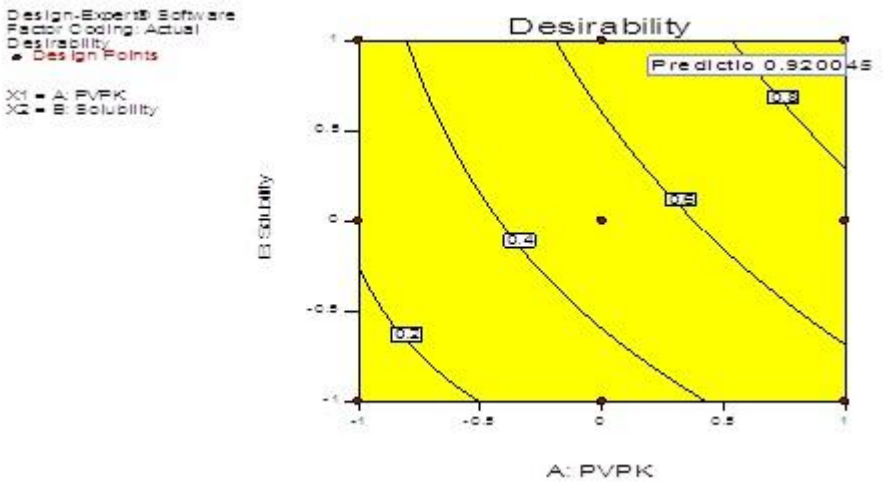

Figure 30: Desirability plot for polymer use Cefuroxime Axetil

The in vitro drug release profile shown by the coded batch as follows

Table 8: Characteristics of Cefpodoxime Proxetil Microcapsules

Batch Run	X_1	X_2	Dissolution (%) after 2 hrs	Permeability (mg/ml)
1	0	-1	53.03±0.269	2.044 ± 0.0115
2	0	1	53.48±0.0252	3.187 ± 0.025
3	-1	1	43.1±0.0325	3.475 ± 0.039
4	1	1	65.36±0.0451	4.267 ± 0.045
5	1	-1	73.8±0.307	2.376 ± 0.008
6	-1	0	44.89±0.120	2.742 ± 0.008
7	-1	-1	39.35±0.043	1.615 ± 0.018
8	1	0	63.0±0.188	2.930 ± 0.012
9	0	0	60.18±0.037	2.911 ± 0.0149

All values are expressed as mean±SD, (number of terms) *n*=3

Effect on Independent valuables

Table 9: ANOVA of independent variables

Dependent variables	Source of variation				Sum of squares	Degree of freedom	F value	P value
	Source	Std. Deviation	R-Square	Predicted R-Square				
Dissolution (T_2)	Linear	4.29	0.8945	0.7505	936.00	2	25.44	0.0012
Permeability	Linear	0.27	0.9118	0.7955	4.50	2	31.00	0.0007

Final Equation in Terms of Coded Factors

The model proposes the following polynomial equation for percentage drug entrapment (Cefpodoxime Proxetil) by Polymer.

Dissolution (Y) = $54.504 + 12.41X_1 + 0.431X_2$

Permeability = $2.63+0.29X_1+0.75X_2$

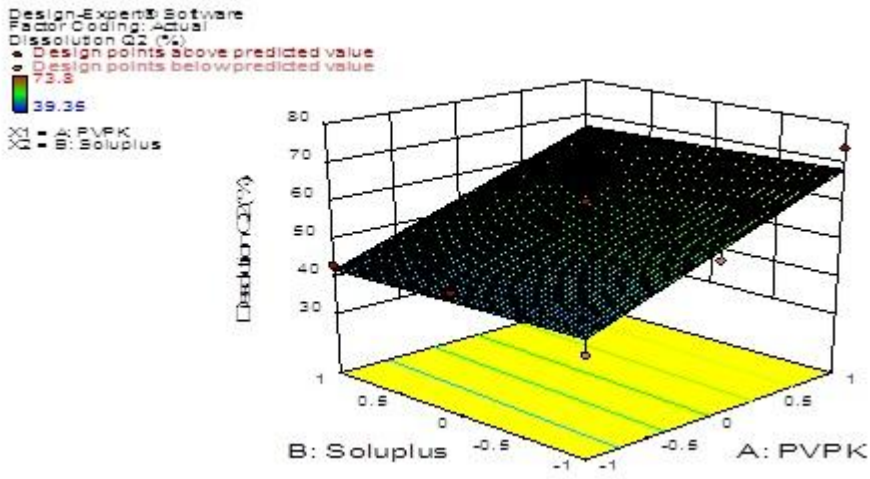

Figure 31: RSM plot for Effect on Dissolution by individual polymer Cefpodoxime Proxetil

From above RSM plot shows that the solubility of drug depends on the concentration of both polymers as concentration of polymer rises the solubility also increases but if compared individual polymer then it concluded that the PVPK 30 is more responsible to enhance the solubility of the drug.

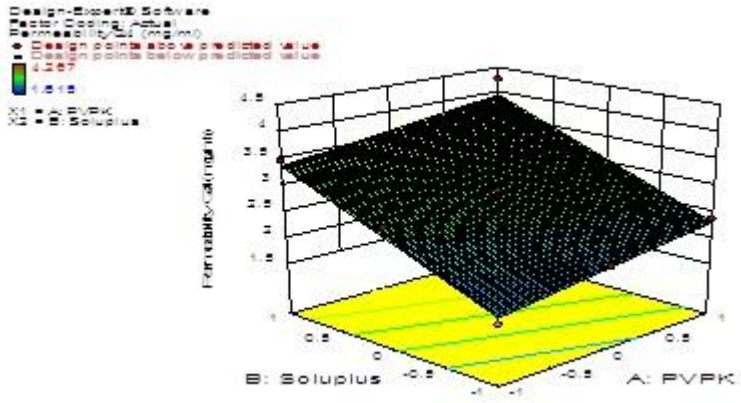

Figure 32: RSM plot for Effect on Permeability by individual polymer Cefpodoxime Proxetil.

From above RSM plot shows that the permeability of drug depends on the concentration of Soluplus while PVPK 30 doesn't play any significant role in permeability enhancement.

Desirability plot for polymer for bioavailability enhancement

The desirability plot shows the most desirable concentration of the batch runs to achive most efficient bioavailability with significant economical and efficient method.

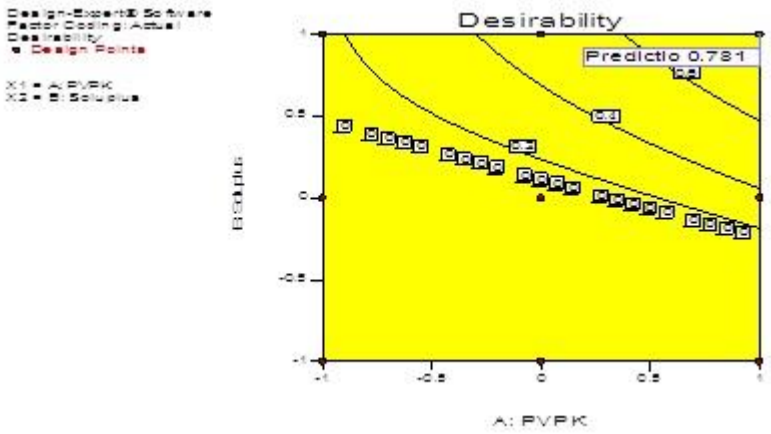

Figure 33: Desirability plot for polymer use Cefpodoxime Proxetil

Table 10: Characteristics of Furosemide Microcapsules

Batch Run	X_1	X_2	Dissolution (%) after 2 hrs	Permeability (mg/ml)
1	0	-1	41.91± 0.029	1.64 ± 0.0115
2	0	1	45.67± 0.029	2.743 ± 0.0110
3	-1	1	28.75±0.020	3.061 ± 0.0086
4	1	1	57.37±0.009	3.554 ± 0.010
5	1	-1	63.01±0.018	1.946 ± 0.008
6	-1	0	33.13±0.022	2.067 ± 0.008
7	-1	-1	24.37±0.022	1.115 ± 0.003
8	1	0	54.25±0.015	2.368 ± 0.006
9	0	0	50.5±0.016	2.397 ± 0.007

All values are expressed as mean±SD, (number of terms) *n*=3

Effect on Independent Variables

Table 11: ANOVA of independent variables

Dependent variables	Source of variation				Sum of squares	Degree of freedom	F value	P value
	Source	Std. Deviation	R-Square	Predicted R-Square				
Dissolution (T_2)	Linear	4.60	0.9113	0.8026	1302.88	2	30.82	0.0007
Permeability	Linear	0.23	0.9263	0.8198	4.05	2	37.71	0.0004

Final Equation in Terms of Coded Factors

The model proposes the following polynomial equation for percentage drug entrapment (Furosemide) by Polymer

Dissolution (Y) = $54.504 + 12.41X_1 + 0.431X_2$

Permeability = $2.63+0.29X_1+0.75X_2^2$

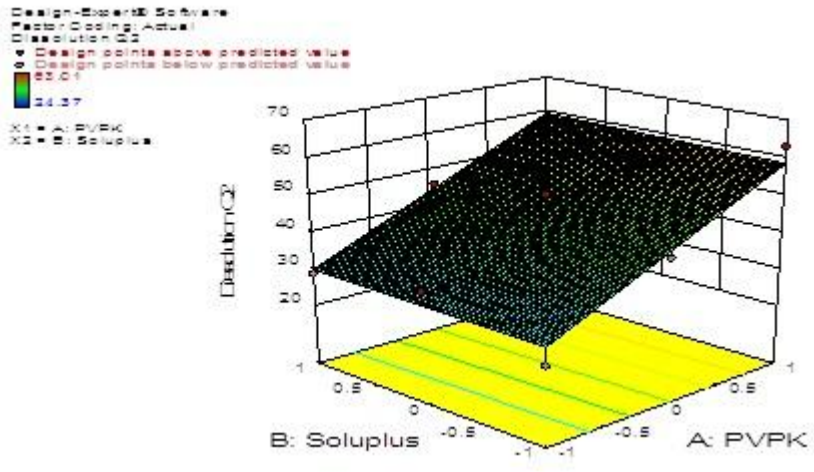

Figure 34: RSM plot for Effect on Dissolution by individual polymer Furosemide

From above RSM plot shows that the solubility of drug depends on the concentration of both polymers as concentration of polymer rises the solubility also increases but if compared individual polymer then it concluded that the PVPK 30 is more responsible to enhance the solubility of the drug.

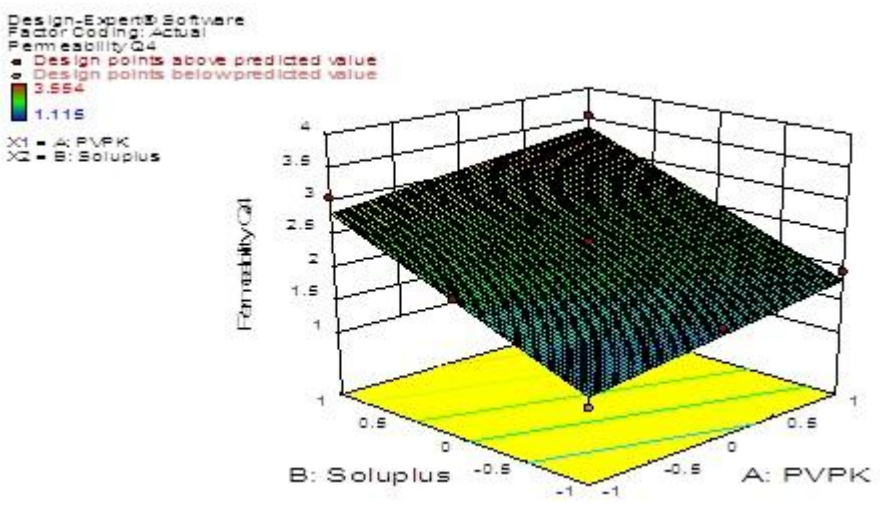

Figure 35: RSM plot for Effect on Permeability by individual polymer Furosemide

From above RSM plot shows that the permeability of drug depends on the concentration of Soluplus while PVPK 30 doesn't play any significant role in permeability enhancement

Desirability plot for polymer for bioavailability enhancement

The desirability plot shows the most desirable concentration of the batch runs to achive most efficient bioavailability with significant economical and efficient method.

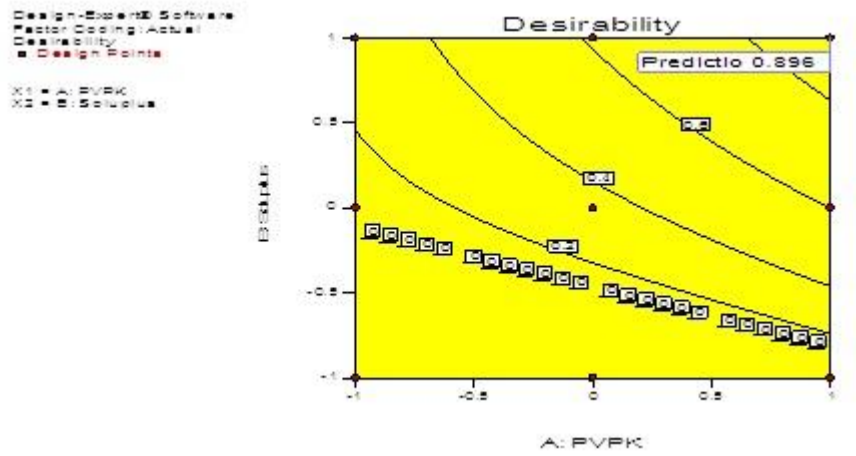

Figure 36: Desirability plot for polymer use Furosemide

The in vitro drug release profile shown by the coded batch as follows

Table 12: In Vitro Drug Release Profile

Time (min)	CA	CP	Fur	CA (1 1)	CP (1 1)	Fur (1 1)
0	0	0	0	0	0	0
10	0.0034± 0.0276	0.0048± 0.0088	0.0576± 0.0091	16.978± 0.199	18.486± 0.243	13.434± 0.183
20	0.0077± 0.0545	0.0083± 0.010	0.0721± 0.0096	24.983± 0.723	26.273± 0.614	19.978± 0.161
30	0.0115± 0.0373	0.0126± 0.140	0.0858± 0.0215	38.218± 1.017	39.263± 0.470	32.344± 0.324
60	0.0279± 0.0355	0.0294± 0.110	0.1143± 0.0135	54.9876± 0.623	56.98± 1.530	46.478± 0.395
90	0.0529± 0.150	0.0683± 0.104	0.1722± 0.0640	60.353± 1.576	63.91± 0.454	53.394± 0.424
120	0.067± 0.110	0.0893± 0.154	0.1903± 0.0468	66.484± 1.738	65.361± 0.520	57.378± 0.096

CONCLUSIONS

The solvent evaporation method is very much useful in obtaining the encapsulation of water insoluble drug coated with water soluble polymer blend with high throughput by statistical method central composite design. For the solvent evaporation method, the polymers blend was selected depending on encapsulation efficiency of the polymer to be used in microencapsulation. In this system the acetone solubilised polymer blend and liquid paraffin forms a primary emulsion with the help of 0.1% of tween 80. The microcapsules form due to coating of polymer blend after evaporation from the organic solvent onto the core suspended in oil phase. The polymer blend prepared as per microencapsulation efficiency of polymer as well as drug release study and permeability study. The microencapsulation can be effective in bioavailability enhancement due to its micron size range and coating of individual particles effective in drug dissolution.

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