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Formulation and evaluation of controlled release matrix tablet of Salbutamol Sulphate using various cellulose polymers

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ABSTRACT

The objective of this study was to formulate and evaluate Salbutamol sulphate, controlled-release matrix tablets dosage form, for the treatment of Chronic Obstructive Pulmonary Disease (COPD), anti asthmatic and bronchodilator agent . The CR tablets were prepared by Wet granulation method using three polymers such as hydroxyl propyl methyl cellulose (HPMC), carboxyl methyl cellulose (CMC) and Methyl cellulose (MC) in varying ratios. Powder blends were evaluated compressibility index and angle of repose, shows satisfactory results. The compressed tablets were then evaluated for various physical tests like content uniformity, drug content uniformity, thickness, uniformity of weight, hardness, and drug content. The results of all these tests were found to be satisfactory. The in vitro dissolution study was carried out for 24 hours using type II dissolution apparatus. Among all the formulation, CMC VI was found to be 96.49% of drug release at the end of 8 hours. This finding reveals that above a particular concentration of CMC and HPMC are capable of providing controlled drug release.

Keywords: Salbutamol sulphate, hydroxyl propyl methyl cellulose, Methyl cellulose, carboxyl methyl cellulose and matrix tablets.

INTRODUCTION

Salbutamol sulphate is an effective anti asthmatic drug used in the treatment of bronchial asthma and chronic bronchitis etc., Daily dosage of four tablets per day of salbutamol sulphate is required for the treatment of acute attacks of asthma. The patient convenience can be improved by giving controlled release tablets containing 4mg or 8mg salbutamol per tablet 8 hourly or 12 hourly. In our experiments the main objective of the project is to formulate a suitable controlled release formulation and evaluation of the drug salbutamol sulphate using different percentage of various hydrophilic cellulose polymers namely HPMC(Hydroxypropyl methylcellulose),CMC(Carboxyl methyl cellulose),MC(Methyl cellulose)And finding the best release of polymer by its In-vitro drug release behaviors.[1]The present work was carried out to prepare controlled release matrix tablets of salbutamol sulphate and to evaluate in-vitro release of the drug from the matrix tablets. It was planned to carry out to Preparation of controlled release matrix tablets of salbutamol sulphate using hydrophilic polymer matrices such Hydroxy propyl methyl cellulose, carboxy methyl cellulose and methyl cellulose.[2-5] Evaluation of physico chemical parameters such as Uniformity of weight, Drug content Uniformity ,Hardness, Thickness ,Evaluation of In-vitro drug release, Determination of order of drug release, Accelerated stability studies.[6-9]

EXPERIMENTAL SECTION

Formulation of Matrix Tablets by Wet granulation

The drug salbutamol sulphate, polymer and lactose were powdered well in a mortar. They were mixed by geometrical mixing. The granulating agent, alcohol: water (3:1) mixture was sprayed on to the powder mixture little by little and blended manually to get a coherent mass. The mass was passed through No.10 sieve to get the granules. The granules were dried in a hot air oven below 60°C. [10]The dry granules were passed through No.20 sieve and retained on No.85 sieve. The talc and magnesium stearate were added and mixed with the granules. The granules were compressed into tablets in single punch tablet machine.(Table 1)

Table 1: Formulation variables of matrix tablets

S.NO	INGREDIENTS	HPMC I	HPMC II	HPMC III
1.	Salbutamol Sulphate	4 mg	4 mgs	4 mgs
2.	HPMC (50%w/w)	1 50 mg	210 mgs	270 mgs
3.	Lactose	132 mg	72 mgs	12 mg
4.	Talc	10mg	10mgs	10mg
5.	Magnesium Stearate	4 mg	4 mgs	4 mg

S.NO	INGREDIENTS	CMC- IV	CMC- V	CMC- VI
1.	Salbutamol Sulphate	4 mgs	4 mgs	4 mgs
2.	HPMC (50%w/w)	210 mgs	270 mgs	270 mgs
3.	Lactose	72 mgs	12 mg	12 mgs
4.	Talc	10mgs	10mg	10mgs
5.	Magnesium Stearate	4 mgs	4 mg	4 mgs

S.NO	INGREDIENTS	MC- VII	MC-VIII	MC- IX
1.	Salbutamol Sulphate	4 mgs	4 mgs	4 mgs
2.	HPMC (50%w/w)	150 mgs	210 mgs	270 mgs
3.	Lactose	132 mg	72 mgs	12 mg
4.	Talc	10mg	10mgs	10mg
5.	Magnesium Stearate	4 mg	4 mgs	4 mg

Physico-Chemical Evaluation of Matrix Tablets[11-15]

Uniformity of Weight: Twenty tablets were selected at random individually weighed and the average weight was calculated. The uniformity of weight was determined according to IP specification. As per I.P. not more than two of individual weights should deviate from average weight by more than 7.5% and none deviate more than twice that percentage (15%)14b.

Drug Content Uniformity: Ten tablets were selected at random from each batch. The drug content of each tablet was determined as follows 28a. The tablet was crushed and put into 0.1N HCI. The volume was adjusted to 50ml using 0.1N HCI. Shaken well for 5 minutes and filtered. 5ml of the filtrate was taken and diluted to 100ml. The absorbance was measured at 276nm.

Hardness: Three tablets were taken from each batch and tested for hardness using Monsanto tablet hardness tester.
Thickness: Three tablets were taken from each batch and thickness was measured using vernier caliper.

Invitro Drug Release Studies: Dissolution apparatus UPS (XXIII) model was used for carrying out in vitro drug release studies on the prepared batches of tablets. 900ml of Hydrochloric acid buffer solution pH 1.2 was used. The paddle was rotated at 50rpm. After 2 hours the dissolution medium was changedpH7.2 phosphate buffer. The dissolution was continued fluid until the tablet completely eroded and dissolved. The temperature of the dissolution fluid was maintained at 37°C ± 1°C throughout the study 17. 5ml samples were drawn at periodic intervals viz. 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, 6^{th},, 7^{th}, and 8^{th} hours and it was made up to 10ml with buffer solution. 5ml of fresh dissolution medium was replaced after each time the sample was drawn. The samples were analyzed spectrophotometrically at 276nm for the drug content against the respective buffer blank. The percentage of salbutamol sulphate released at various time intervals was calculated and plotted against time.

Kinetics of Drug Release: The order of drug release can be assessed by graphical treatment of the drug release data.[16] A plot of percentage drug remaining versus time would be linear if the drug release follows zero order (i.e. concentration independent release).The linear equation for zero order drug release plot is

$Ct= C_0 –Kt$
where

Ct = Cone, remaining at time t, C_0= Original cone, t= time, K = release rate

A plot of log of percentage remaining drug versus time would be linear, if the drug release follows first order (i.e., cone dependent release)The linear equation for first order drug release plot is

$$\log C = \log Co - \frac{Kt}{2.302}$$

Accelerated Stability Studies: The selected formulation HPMC-II, CMC-IV and MC-IX were stored at various temperature conditions such as 29°c, 37°c, & 45°c .[17] The stored tablets were examined for 4 weeks for their stability.

RESULTS AND DISCUSSION

Uniformity of Weight: All the batches of tablets were found to pass the weight variation test. (table 2)The percentage deviation of individual tablet weight from the average tablet weight was found to be within the I.P. limits (±7.5%).

Table 2: Uniformity of Weight

Batch Code	Weight in mg
HPMC I_1HPMC I_{20}	298.95 mg
HPMC II_1 -HPMC II_{20}	299.1 5 mg
HPMC III_1 -HPMC III $_{20}$	298.4 mg
CMC IV_1 -CMC IV_{20}	298.85 mg
CMC V_1 -CMC V_{20}	298.75 mg
CMC VI_1-CMC VI_{20}	299.5 mg
MC VII_1-MC VII_{20}	299.7 mg
MC$VIII_1$-MC $VIII_{20}$	299.85 mg
MC IX_1 -MC IX_{20}	299.8 mg

Table 3: Drug content uniformity Test for the matrix tablet formulation coded HPMC -I, HPMC-II, HPMC-III

S. No	Drug content in individual tablets (mg) HPMC -I	Average (mg)	Percentage of average drug content HPMC -I	Drug content in individual tablets (mg) HPMC -II	Average (mg)	Percentage of average drug content HPMC -II	Drug content in individual tablets (mg) HPMC -III	Average (mg)	Percentage of average drug content HPMC -III	Number tablets outside the limit 85 to 115%	Number of tablet outside the limit 75 to 125%
1	3.98	3.94	98.98	3.84	3.95	97.21	4.08	3.95	103.29	Nil	Nil
2	3.89		98.73	4.06		102.78	3.92		99.24		
3	4.11		104.31	3.73		94.43	4.07		103.03		
4	3.92		99.49	3.87		97.97	3.83		96.96		
5	3.92		99.49	4.01		101.51	3.66		92.65		
6	3.92		99.49	3.79		95.94	3.94		99.74		
7	4.08		103.55	3.92		99.24	3.98		100.75		
8	3.92		99.49	4.08		103.29	4.12		104.3		
9	3.83		97.20	4.15		105.06	3.79		95.94		
10	3.87		98.22	4.05		102.53	4.11		104.05		

Table 4: Drug content uniformity Test for the matrix tablet formulation coded CMC –IV, CMC-V, CMC-VI

S. No	Drug content in individual tablets (mg) CMC -IV	Average (mg)	Percentage of average drug content CMC -IV	Drug content in individual tablets (mg) CMC -V	Average (mg)	Percentage of average drug content CMC-V	Drug content in individual tablets (mg) CMC-VI	Average (mg)	Percentage of average drug content CMC-VI	Number tablets outside the limit 85 to 115%	Number of tablet outside the limit 75 to 125%
1	3.98	3.92	101.53	3.78	3.88	97.42	4.08	3.95	103.29	Nil	Nil
2	3.92		100	3.92		101.03	3.82		96.7		
3	4.06		103.57	3.83		98.71	3.86		97.72		
4	3.84		97.95	3.97		102.31	3.84		97.21		
5	4.04		103.06	3.93		101.28	4.04		102.27		
6	3.76		95.91	3.77		97.16	4.06		102.78		
7	3.82		97.44	3.85		99.22	4.02		106.32		
8	3.98		101.53	3.85		99.22	3.88		98.22		
9	3.91		99.74	3.96		102.06	4.05		102.53		
10	3.89		99.23	3.94		101.54	3.85		97.46		

Drug Content Uniformity: The drug content uniformity was examined as per I.P specification. All the batches of tablet were found to comply with uniformity of content test. (table 3,4,5)None of the individual drug content values was outside the 85 to 115% of the average drug content.

Table 5: Drug content uniformity Test for the matrix tablet formulation coded MC –VII, MC-VIII, MC-XI

S. No	Drug content in individual tablets (mg) MC -VII	Average (mg)	Percentage of average drug content MC - VII	Drug content in individual tablets (mg) MC -VIII	Average (mg)	Percentage of average drug content CMC-VIII	Drug content in individual tablets (mg) MC-XI	Average (mg)	Percentage of average drug content MC-XI	Number tablets outside the limit 85 to 115%	Number of tablet outside the limit 75 to 125%
1	4.05	3.96	102.27	4.08	3.99	102.25	3.82	3.93	97.2	Nil	Nil
2	3.85		97.22	3.82		95.73	4.08		103.81		
3	4.16		105.05	4.06		101.75	3.98		101.27		
4	4.04		102.02	3.74		93.73	3.72		94.65		
5	3.98		100.5	4.15		104.01	4.06		103.3		
6	3.72		93.93	3.95		98.99	3.84		97.7		
7	4.12		104.04	4.12		103.25	4.12		104.83		
8	3.98		100.5	3.98		99.74	3.98		101.27		
9	3.83		96.71	3.85		96.49	3.95		100.5		
10	3.87		97.72	4.15		104.01	3.75		95.41		

Hardness: Tablet require a certain amount of strength or hardness and resistance to friability to withstand mechanical shocks of handling in manufacture, packaging and shipping. The device used for measuring the tablets is 'Monsanto tester[114b].

Table 6: Hardness test of formulations

Batch Code	Average hardness of tablets (in kg/cm^2)	Standard deviation
HPMC-I	2.53	± 0.2776
HPMC II	2.53	± 0.2776
HPMC-III	2.7	±0.2817
CMC – IV	2.4	±0.2812
CMC-V	2.2	±0.2812
CMC –IV	2.2	±0.2812
MC – VII	3.9	±0.2997
MC – VIII	3.9	±0.2997
MC – IX	3.8	±0.2958

Thickness: Three tablets were taken from each batch and thickness was measured using verniercalipher. The observations are presented

Table 7 : Thickness of formuations

Batch Code	Average thickness of tablets (in mm)	Standard deviation
HPMC-I	4.24	± 0.0478
HPMC II	4.45	± 0.0478
HPMC-III	4.44	± 0.0478
CMC –IV	3.76	± 0.0478
CMC-V	3.5	±0.0156
CMC – IV	4.44	± 0.0478
MC-VII	4.1	±0.01884
MC-VIII	3.94	± 0.0478
MC-IX	4.42	± 0.0478

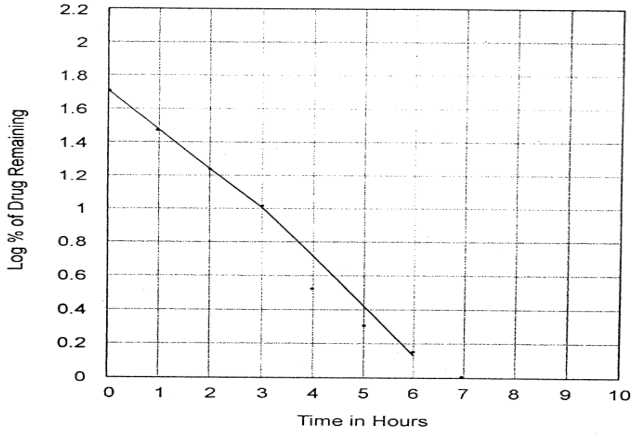
Invitro Drug Release Studies

Table 8: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from HPMC (50% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :HPMC – 1.

Table 8

Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	1.43	35	63	1.806
2	1.97	49.4	50.4	1.7031
3	2.87	71	27	1.447
4	3.23	80	18	1.2786
5	3.5	89	9	0.9
6	3.6	92.4	7.4	0.874
7	3.71	92	6	0.844
8	3.74	93.4	6.24	0.7954

Fig. 1: Plot Showing Relation Between Log% Amount remaining to be Released vs. time

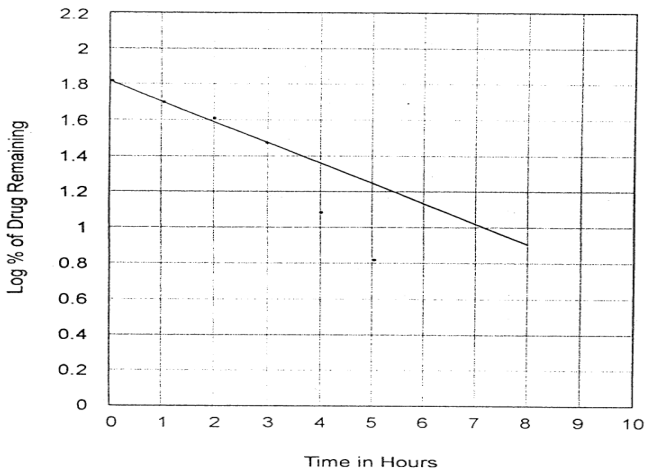


Slope : 0.1506
Regression Coefficient : 0.9738

Table 9: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from HPMC(70% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :HPMC – II

Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	1.25	31.44	68.44	1.8344
2	1.64	40.44	59.4	1.7742
3	2.15	53	45	1.6616
4	2.87	71	27	1.4469
5	3.41	85.4	14.4	1.1602
6	3.6	92.4	7.4	0.874
7	3.95	98	0.9	0
8	3.94	98	0.4	0

Fig. 2: Plot Showing Relation Between Log% Amount remaining to be Released vs. time

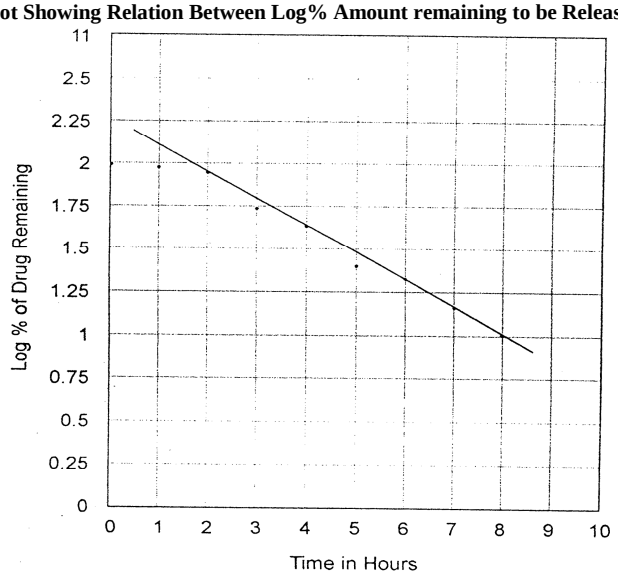


Slope : 0.1959
Regression Coefficient : 0.97098

Table 10: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from HPMC(90% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :HPMC – lll

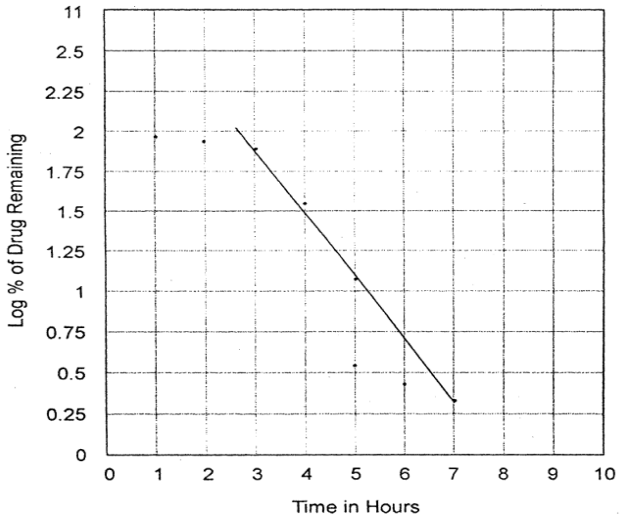
Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	0.45	11.14	88.69	1.948
2	0.72	14	81	1.9137
3	1.26	31.4	68.4	1.8355
4	1.8	44	54	1.7402
5	2.16	52	44	1.6626
6	2.88	70	26	1.447
7	3.24	80	17	1.2786
8	3.6	89	9	0.9

Fig. 3: Plot Showing Relation Between Log% Amount remaining to be Released vs time



Slope : 0.1316
Regression Coefficient : 0.9624

Fig. 4: Plot Showing Relation Between Log% Amount remaining to be Released vs time



Slope : 0.18465
Regression Coefficient : 0.96439

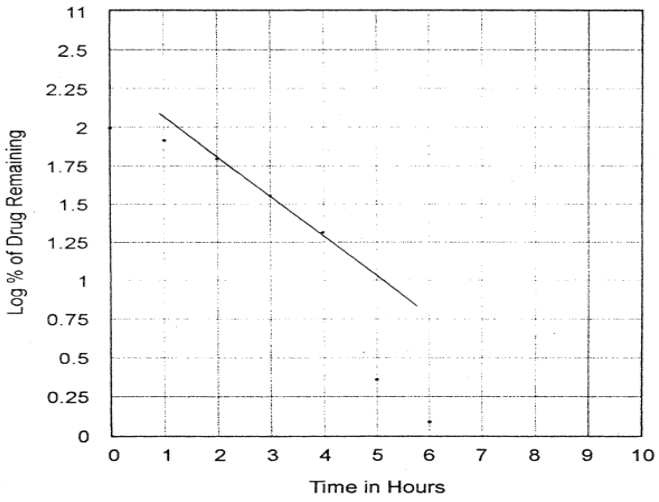
Table 11: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from CMC(50% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :CMC – IV

Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	0.35	8	90	1.958
2	0.74	17	81	1.9137
3	1.25	31.4	68.4	1.8355
4	2.14	53	45	1.6626
5	3.41	85.4	14.4	1.1612
6	3.85	96.4	3.4	0.543
7	3.87	96	4	0.477
8	3.91	97	1	0.3

Table 12: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from CMC(70% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :CMC - V

Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	0.17	4.4	95.4	1.97
2	0.8	22.4	77.4	1.8892
3	1.25	40.4	59.4	1.7744
4	2.51	62	36	1.5681
5	3.23	80	18	1.2786
6	3.5	89	9	0.9
7	3.5	97.4	2.4	0.3978
8	3.93	98	1.4	0.175

Fig. 5: Plot Showing Relation Between Log% Amount remaining to be Released vs time

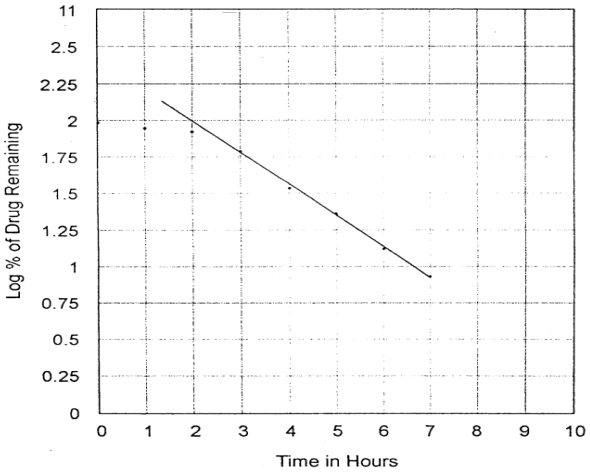


Slope : 0.1982
Regression Coefficient : 0.9698

Table 13: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from CMC(90% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :CMC -VI

Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	0.17	4.4	95.4	1.97
2	0.53	13.4	86.4	1.9323
3	1.25	31.4	68.4	1.8355
4	1.7	44	54	1.7402
5	2.51	62	36	1.5681
6	3.05	76.4	23.4	1.37
7	3.41	85.4	14.4	1.1612
8	3.95	98	0.9	0.9

Fig. 6: Plot Showing Relation Between Log% Amount remaining to be Released vs time

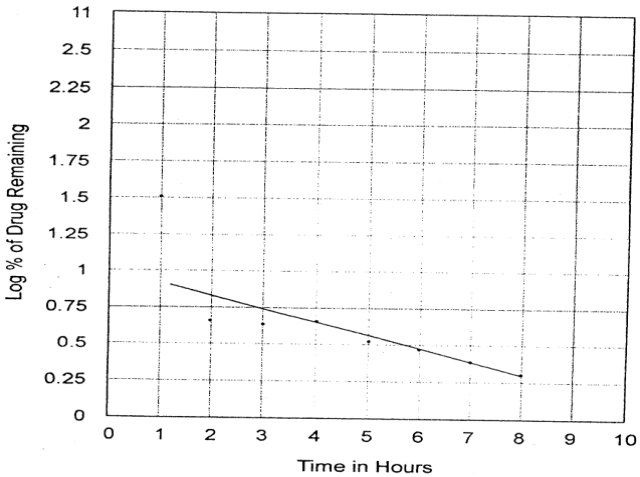


Slope : 0.1373
Regression Coefficient : 0.9762

Table 14: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from MC(50% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :MC - VII

Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	2.6	67.4	32.4	1.5118
2	3.7	94	4	0.6988
3	3.81	95.4	4.4	0.6531
4	3.84	96.24	3.74	0.573
5	3.86	96.74	3.24	0.5117
6	3.88	97.24	2.74	0.4392
7	3.9	97.74	2.24	0.352
8	3.91	97	1	0.3

Fig. 7: Plot Showing Relation Between Log% Amount remaining to be Released vs time

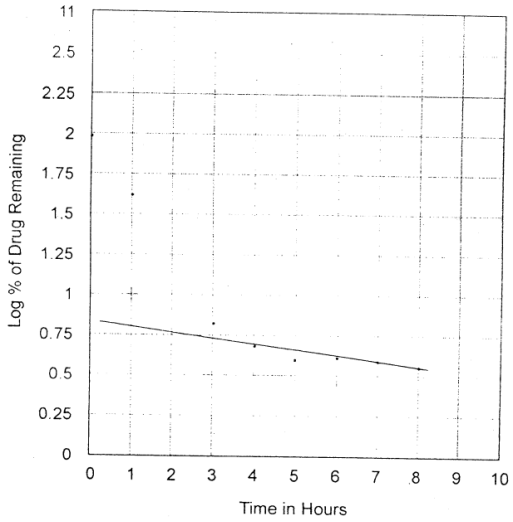


Slope : 0.0072
Regression Coefficient : 0.9038

Table 15: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from MC(70% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7.2) thereafter) Batch Code :MC – VIII

Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug remaining
1	2.15	53	45	1.6626
2	3.23	80	18	1.2786
3	3.75	93	5	0.778
4	3.4	94	4	0.6988
5	3.81	95.4	4.4	0.601
6	3.83	95	3	0.6531
7	3.86	95.74	3.24	0.5117
8	3.88	96.25	2.74	0.4392

Fig. 8: Plot Showing Relation Between Log% Amount remaining to be Released vs time

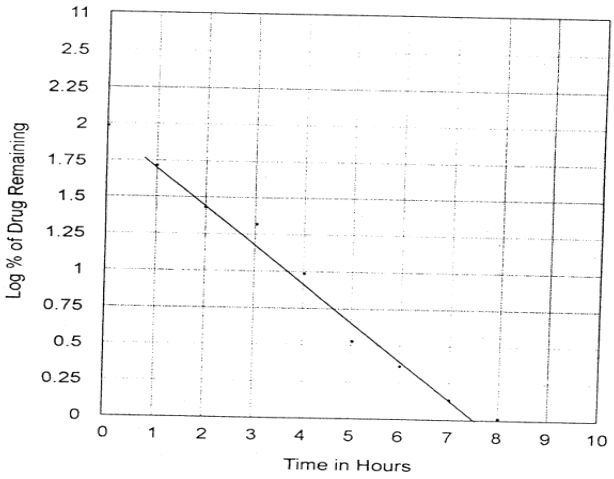


Slope : 0.1336
Regression Coefficient : 0.9644

Table 16: In-vitro release Date of Salbutamol Sulphate from Matrix tablets prepared from MC(90% w/w).(Dissolution medium Hydrochloric acid buffer (pH1.2) for 1st2hrs and phosphate buffer (pH 7,2) thereafter) Batch Code :MC - IX

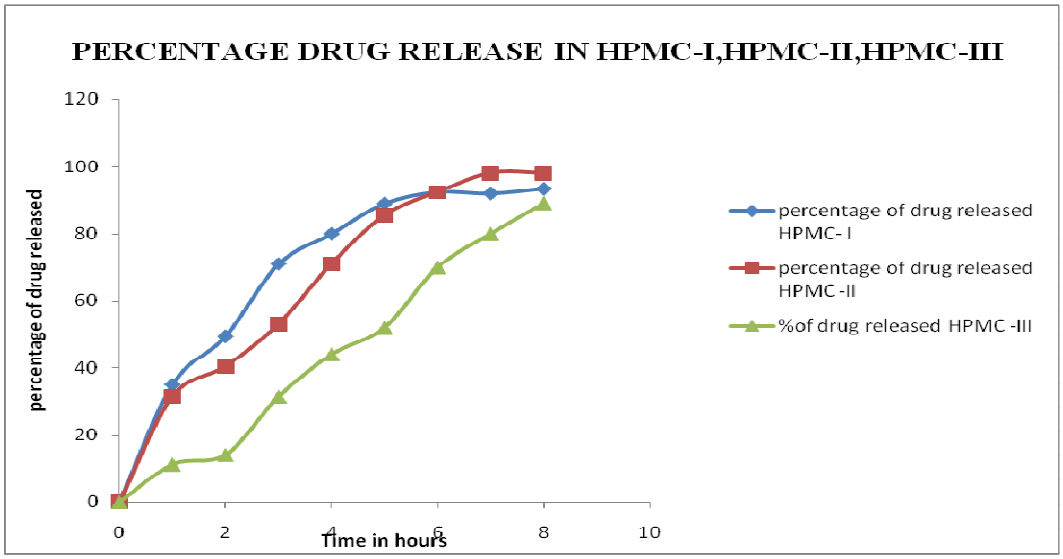
Time in hours	Cumulative amount of drug released in mg	Percentage of drug released	Percentage of drug remaining	Log percentage of drug Remaining
1	1.7	44	55	1.7403
2	2.87	71	28	1.4417
3	3.23	80	19	1.2787
4	3.5	89	10	1
5	3.86	95.75	3.25	0.5118
6	3.95	98	1	0
7	3.85	98	1	0
8	3.95	98	1	0

Fig. 9: Plot Showing Relation Between Log% Amount remaining to be Released vs time



Slope : 0.29041
Regression Coefficient : 0.8920

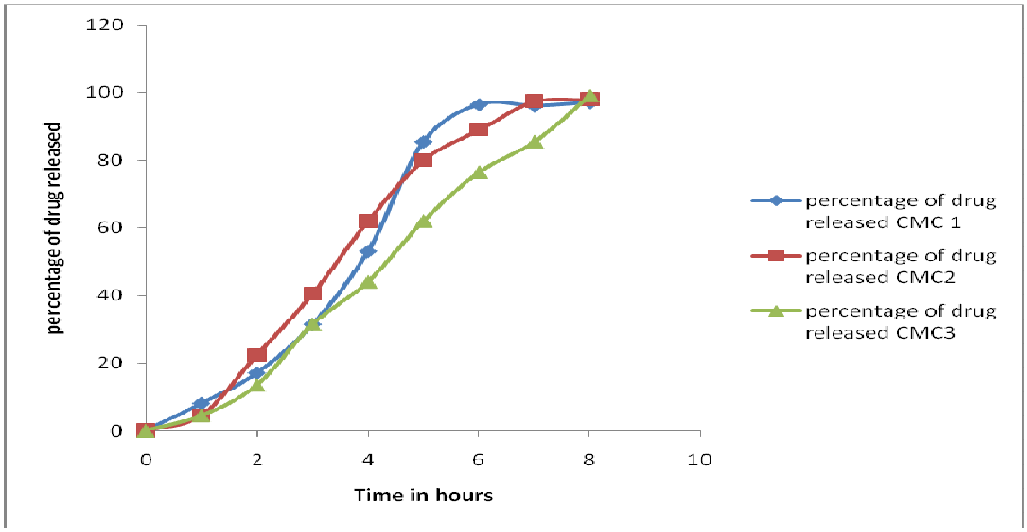
Fig 10: Plot showing relation between percentage amount drug released vs time from matrix tablets prepared from HPMC Batch (I-III)



	HPMC I	HPMC II	HPMC III
Slope	8.107142857	10.64285714	11.86607143
Regression Coefficients	0.19385	0.97382	0.99670

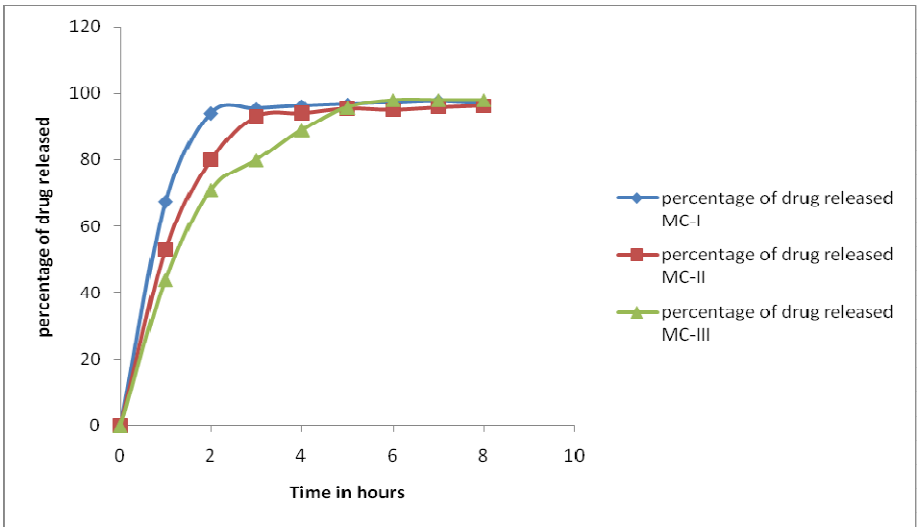
Amongst the various HPMC based matrix tablet formulations, the one prepared with 70 % w/w Hydroxy Propyl methyl cellulose (Formulation coded HPMC-II) could satisfactorily retard the release to give the desired drug release pattern (Table 9) (Fig.2) Upon kinetic interpretation of the dissolution profile, data revealed that the formulation HPMC I found to show first order kinetic release and formulations HPMC II, HPMC III, found to follow zero order drug release kinetics [Table No. 34] The formulation HPMC II containing 70% w/w of Hydroxy Propyl methyl cellulose showed about 99% release in 7hrs. This indicates that the drug release from this formulation follows perfect zero order kinetics.

Fig 11: Plot showing relation between percentage amount drug released vs time from matrix tablets prepared from CMC Batch (IV-VI)



	CMC IV	CMC V	CMC VI
Slope	15.1071	14.4107	13.9821
Regression Coefficients	0.96249	0.97188	0.99706

Fig 12: Plot showing relation between percentage amount drug released vs time from matrix tablets prepared from MC Batch (VII-IX)



	MC VII	MC VIII	MC IX
Slope	1.7083	4.4107	6.8303
Regression Coefficients	0.68042	0.78076	0.8776

Amongst the various carboxy methyl cellulose based matrix tablet formulations, the one prepared with 90% w/w carboxymethyl cellulose (Formulation coded CMC - VI) Showed best result (Fig.6) to give the desired release pattern. The formulations CMC V, and CMC VI showed zero order kinetics of drug release. The formulation CMC IV showed first order release kinetics (Table No 17). The formulation CMC VI containing 90% w/w of CMC showed about 99% release of drug in 6 hrs. Amongst the various methyl cellulose based matrix tablet formulations the one prepared with 90 % w/w methyl cellulose (Formulation coded MC IX) showed best result (Fig. 9) to give the desired drug release pattern. All the formulations based on methyl cellulose where found to follow first order release kinetics. The formulation MC-IX containing 90% w/w of methyl cellulose showed about 99% release of drug in 6 hours. The drug release pattern of different formulations indicated that the rate of drug release gradually decreased, as the percentage of polymer was increased from 50% w/w to 90% w/w (Table 17).

Table 17: Data of determination of order of drug release

Batch code	Regression Coefficient of zero order plot	Regression coefficient of first order plot	Order of Drug release
HPMC I	0.91385	0.9738	First Order
HPMC II	0.97382	0.97098	Zero Order
HPMC III	0.99670	0.9624	Zero Order
CMC IV	0.96249	0.9762	First Order
CMC V	0.97188	0.9698	Zero Order
CMC VI	0.99706	0.96439	Zero Order
MC VII	0.68042	0.9038	First Order
MCVIII	0.78076	0.9644	First Order
MC IX	0.8776	0.8920	First Order

Table 18: Batch Code HPMC II

S. No.	Temp in C	No. of weeks	Drug concentration in mg	Drug concentration in percentage
1	Initial	0	4	100
2	29°C	1	3.99	99.75
		2	3.98	99.5
		3	3.96	99
		4	3.95	98.75
3	37°C	1	3.91	97.75
		2	3.85	96.25
		3	3.79	94.75
		4	3.72	93
4	45°C	1	3.82	95.5
		2	3.75	93.75
		3	3.70	92.5
		4	3.68	92

Table 19: Batch Code CMC – VI

S. No.	Temp in C	No. of weeks	Drug concentration in mg	Drug concentration in percentage
1	Initial	0	3.99	99.75
2	29°C	1	3.98	99.5
		2	3.96	99
		3	3.95	98.75
		4	3.94	98.5
3	37°C	1	3.91	97.75
		2	3.85	96.25
		3	3.79	94.75
		4	3.76	94
4	45°C	1	3.82	95.5
		2	3.75	93.75
		3	3.70	92.5
		4	3.60	90

Table 20: Batch Code MC - IX

S. No.	Temp in C	No. of weeks	Drug concentration in mg	Drug concentration in percentage
1	Initial	0	3.95	98.75
2	29°C	1	3.94	98.5
		2	3.9	97.5
		3	3.87	96.75
		4	3.8	95
3	37°C	1	3.81	95.25
		2	3.79	94.75
		3	3.66	91.5
		4	3.6	90
4	45°C	1	3.59	89.7
		2	3.58	89.5
		3	3.56	89
		4	3.52	88

ACCELERATED STABILITY STUDIES

The selected formulation HPMC-II, CMC-IV and MC-IX were stored at various temperature conditions such as 29°c, 37°c, & 45°c . The stored tablets were examined for 4 weeks .(Table 18, 19, 20).

CONCLUSION

From the above results and discussion, it is concluded that the sustained release matrix tablet of Salbutamol sulphate containing HPMC (Formulation coded HPMC-II) which are taken as ideal or optimized formulation of sustained release matrix tablet for 12 h release as it fulfils all the requirements for sustained release tablet and appears to be assessed further by conducting bioavailability studies in human volunteers and long term stability testing.

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