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Research Article

FORMULATION AND IN VITRO EVALUATION OF CANAGLIFLOZIN MICROSPHERES BY USING IONOTROPIC GELATION TECHNIQUE

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ABSTRACT:

Microsphere drug delivery methods have been utilized to boost effectiveness, reduce toxicity, and improve patient compliance. Additional benefits of using microspheres to deliver medications include controlled drug release, improved bioavailability, and targeted drug delivery to the desired location. In order to achieve the required therapeutic effect, Carbopol 934p is encapsulated in a biodegradable microsphere delivery system and given orally. The benefit of microsphere formulations over traditional tablet or capsule formulations is that they increase the surface area exposed to the absorption site, boosting medication absorption and reducing drug dose frequency. A non-nucleoside reverse transcriptase inhibitor called Canagliflozin is frequently used to treat human immunodeficiency virus. Canagliflozin microspheres were prepared by Ionotropic Gelation Technique using different ratios of Canagliflozin and Sodium alginate, Pectin, HPMC K15M and Carbopol 934p. Canagliflozin microspheres were evaluated for percentage yield, particle size. Surface morphology, flow properties, drug content and entrapment efficiency and were found to be within the acceptable range. In vitro dissolution studies of the microspheres revealed that the formulation F12 containing Carbopol 934p as a polymer shows maximum drug release at the end of 12 hours, when compared with the other formulations. Drug release kinetics of the optimized formulation states that the formulation F12 follows zero order drug release with Super case II transport mechanism.

Key words: Canagliflozin microspheres, Carbopol 934p, Ionotropic Gelation Technique, SEM.

INTRODUCTION

Novel drug delivery system means of improving the therapeutic effectiveness of incorporated drugs by providing controlled delivery, targeting and sustained delivery. The drugs in to dosage for with the aim of sustaining drug levels and hence drug action is obtained for as prolong period of time in body. Microspheres are carrier drug delivery system which plays an important role in micro-particulate novel drug delivery system. Microspheres are spherical, free flowing, monolithic matrix type. The main goal of the microspheres drug delivery system is to provide therapeutic amount of drug to the target site in the body. Microspheres are designed to release the drug in sustained and controlled manner, improving bioavailability, entrapment efficiency and lowering dose frequency of drug in the dosage form. [1-4]

Microspheres are characterized by small spherical particles ranging from 10 millimeters to a thousand millimeters [5]. Microspheres significantly improve patient compliance by enhancing the absorption of standard drugs while lowering side effects. The main benefit of employing microspheres as a medication delivery technology is the controlled release of the medicament. Microsphere increases patient compliance by lowering dose frequency and maintaining a consistent medication plasma concentration [6].

Canagliflozin is an antidiabetic drug and is chemically (2S,3R,4R,5S,6R)-2-{3-[5-(4-fluorophenyl)-thiophen-2-ylmethyl]-4-methyl phenyl} 6hydroxymethyltetrahydro-pyran-3,4,5-triol[7-10] . Canagliflozin belongs to class a of drugs known as sodium-glucose co-transporter 2 (SGLT2) inhibitors which improves glycemic control in patients with type 2 diabetes. Canagliflozin shows its therapeutic property by lowering blood glucose level by simultaneously acting on kidney to decrease the renal threshold for glucose (RTG) and increased urinary glucose excretion (UGE).[11 -16]

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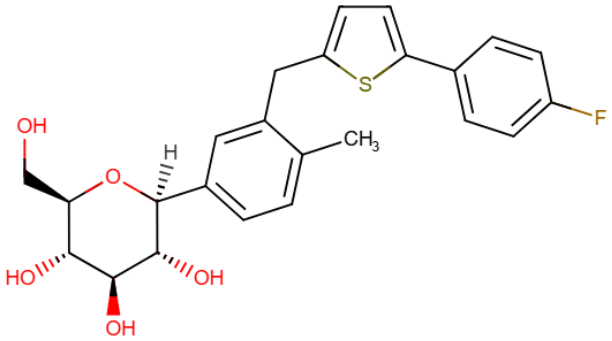

Figure.1 Structure of Canagliflozin

MATERIALS & METHODS USED: Canagliflozin API was procured from Glenmark Pharmaceuticals LTD and HPMC K 100M, Pectin were procured from Spectrum pharmalabs Hyderabad, Carbopol 934p was procured from Shreeji chemicals, Mumbai, Calcium Chloride, Sodium Alginate were S D fine chemical Ltd, Mumbai.

Solubility study:

Excess drug was added carefully using a spatula to 10 ml of the different buffer solutions in a conical flask, while stirring until a heterogeneous system (solid sample and liquid) was obtained. The solution containing excess solid was then capped, and stirred at 150 rpm at room temperature for 24 hours. The solution containing excess solid was filtered using 0.45µm PVDF filter, appropriate dilutions were then made and analyzed using UV spectrophotometer at required nanometer range of drug. The same procedure was fallowed for all selected drugs. (Saturation solubility was carried out at 250C using required different buffers).

Determination of absorption maximum (λ-max):

The wavelength at which maximum absorption of radiation takes place is called as λ max. This λ max is characteristic or unique for every substance and useful in identifying the substance. For accurate analytical work, it is important to determine the absorption maxima of the substance under study. Most drugs absorb radiation in ultraviolet region (190-390nm), as they are aromatic or contain double bonds. Accurately weighed 10mg of drug was dissolved in 6.8 pH phosphate buffer taken in a clean 10ml volumetric flask. The volume was made up to 10ml with the same which will give stock solution-I with concentration 1000µg/ml. From the stock solution-I, 1ml was pipette out in 10ml volumetric flask. The volume was made up to 10ml using 6.8 pH phosphate buffer to obtain stock solution-II with a concentration 100µg/ml. From stock solution-II, 1ml was pipette out in 10ml volumetric flask. The volume was made up to 10ml using 6.8 pH phosphate buffer to get a concentration of 10µg/ml. This solution was then scanned at 200-400nm in UV-Visible double beam spectrophotometer to attain the absorption maximum (λ-max). The sample was analyzed by UV Spectrophotometer at 290 nm.

PREPARATION OF CALIBRATION CURVE

Procedure for standard curve in 6.8 pH phosphate buffer:

10 mg of drug was dissolved in 10 ml of 6.8 pH phosphate buffer by slight shaking (1000 µg/ml). 1 ml of this solution was taken and made up to 10 ml with 6.8 pH phosphate buffer, which gives 100 µg / ml concentration (stock solution). From the stock solution, concentrations of 0.5,1.0,1.5,2,2.5 and 3ml was withdrawn and add in 10ml volumetric flasks separately then we get 5, 10, 15, 20,25 and 30 µg/ml in 6.8 pH phosphate buffer were prepared. The absorbance of diluted solutions was measured at particular nanometer and a standard plot was drawn using the data obtained. The correlation coefficient was calculated.

FORMULATION DESIGN

Table.1 Formulation design for Canagliflozin microspheres using different ratios of drug and polymers.

Formulation code / Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
Canagliflozin	100	100	100	100	100	100	100	100	100	100	100	100
Sodium alginate	100	100	100	100	100	100	100	100	100	100	100	100
Pectin	50	100	150	200	--	--	--	--	--	--	--	--
HPMC K15M	--	--	--	--	50	100	150	200	--	--	--	--
Carbopol 934p	--	--	--	--	--	--	--	--	50	100	150	200
Calcium chloride	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Distilled water	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s

Preparation of Canagliflozin microspheres.

Method used: Ionic Gelation Technique:

Microspheres of Canagliflozin were prepared by ionotropic gelation method using Drug & Sodium alginate, and Polymers like Pectin, HPMC K15M, Carbopol 934p and calcium chloride.

Step 1: Add the weighed quantity of Sodium alginate was dissolved in 25ml of distilled water.

Step 2: Next to this, weighed quantity of drug and polymers were added to sodium alginate solution with stirring at about 800 rpm.

Step 3: The mixture was extruded through a 22G syringe needle into drop wise to 100 ml of calcium chloride (1%) solution under continuous stirring. Stirring was continued for 60 minutes. The obtained microspheres were filtered and washed with purified water and then dried for 12 hours at 40°C. Preparation of microspheres was optimized based on entrapment efficiency and release data

EVALUATION OF CANAGLIFLOZIN MICROSPHERES

FTIR analysis:

The drug-polymer interactions were studied by FTIR spectrometer, Shimadzu 8400 S. 2% (w/w) of the sample, with respect to a potassium bromide (KBr; SD Fine Chem. Ltd., Mumbai, India) was mixed with dry KBr. The mixture was ground into a fine powder using mortar and then compressed into a KBr discs in a hydraulic press at a pressure of 10000 PSI. Each KBr disc was scanned 10 times at a resolution of 2 cm–1 using Happ-Genzel apodization. The characteristic peaks were recorded

MICROMERETIC PARAMETERS:

Bulk Density: Bulk density of a compound varies substantially with the method of crystallization, milling or formulation. It is determined by pouring pre-sieved blend into a graduated cylinder via a large funnel and measure the volume and weight as is given by

Tapped density: Tapped density is determined by placing a graduated cylinder containing known mass of blends on a mechanical tapped apparatus, which is operated for a fixed number of taps until the powder bed volume has reached a minimum volume. Using the weight of the drug in the cylinder and this minimum volume, the tapped density may be computed.

Compressibility Index: The compressibility index of the granules was determined by Carr's compressibility index.

Hausner's ratio: Hausner's ratio was determined as the ratio between the tapped density to that of the bulk density.

Angle of repose: The manner in which stresses are transmitted through a bed and beds response to applied stress is reflected in the various angles of friction and response. The most commonly used of these is angle of repose, which may be determined experimentally by a number of methods. The method used to find the angle of repose is to pour the powder in a conical heap on a level flat surface and measure the inclined angled with the horizontal pile.

Particle Size

It is possible to use ordinary microscope for particle size determination in the range of 0.2 to above 100 μm to measure particle size of individual microsphere.55All the microspheres were evaluated with respect to their size and shape using optical microscope fitted with an ocular micrometer and a stage micrometer. Ocular micrometer was calibrated with the stage micrometer. Slides of dilute suspensions of microspheres in liquid paraffin were prepared and slides were placed on mechanical stage of microscope. The diameter of 100 microspheres was measured randomly by optical microscope and average particle size was determined.

Scanning electron microscopy (SEM)

In the pharmaceutical industry, SEM may be used as a qualitative tool for the analysis of drug substance and drug product in order to obtain information on the shape and surface structure of the material. SEM plays an important role in the characterization of nanoscale and sub-micron particles. It has been used to determine surface topography, texture and to examine the morphology of fractured or sectioned surfaces. The examination of the surface of polymeric drug delivery systems can provide important information about the porosity and microstructure of device.

Procedure for SEM Analysis:

Mounting: The dried samples were lightly sprinkled on a double adhesive carbon tape, which was stuck to analuminum stub.

Coating: Thin coating of an electron dense metal (platinum) was applied to the mounted sample using JEOL JFC-1600 Ion Sputter Coater which is having a vacuum chamber. The chamber was evacuated using a rotary pump and inert carrier gasargon was introduced to produce partial vacuum of 10-2 mmHg. The argon atmosphere ionized by electrodes located near platinum metal foil, thereby heavy metal atoms were ejected from the foil, covering the mounted sample with finely dispersed coating.

Imaging: The sample were removed from the Ion Sputter and mounted on a sample holder of JEOL JSM-6360 SEM and scanned by an electron beam Scanning Microscope. These electrons were collected with detector

which produced three dimensional images of the sample surface on TV screen attached to the microscope. The images were printed on photographic film using at various magnifications.

Actual drug content

10 mg of microspheres were accurately weighted and transferred in a 50 ml volumetric flask. Volume was adjusted with 1% SLS and microspheres were dissolved by ultra-sonication for 3 h at25 °C. The samples were filtered through 0.2 µm membrane filter. 5 ml from the sample solution was transferred to 50 ml volumetric flask and volume was adjusted to 50 ml with same medium and absorbance of samples was measured at 290 nmusing UV-spectrophotometer. Actual drug content (AC)and was calculated using following equations. All analyses were carried out in triplicate.

$$AC(\%)=Mact/Mms\times100$$

Entrapment efficiency

The 100mg of the Canagliflozin weight equivalent nano sponge was analyzed by dissolving the sample in 10ml of distilled water. After the drug was dissolved 10ml of clear layer of dissolved drug is taken. Thereafter the amount of drug in the water phase was detected by a UV-spectrophotometric method at 290 nm(U.V Spectrophotometer, systronics). The test was repeated with another nanoparticulate sample. The amount of the drug in the suspension was analyzed by centrifugation at 500rpm for 5 mins and by measuring the concentration of the drug in the clear supernatant layer by the UV-spectrophotometric method. The concentration of the drug is determined with the help of calibration curve. The amount of drug inside the particles was calculated by subtracting the amount of drug in the aqueous phase of the suspension from the total amount of the drug in the nanoparticle suspension. The entrapment efficiency (%) of drug was calculated by the following equation.

Percentage yield:

The indomethacin microspheres obtained after drying was weighed. Percentage yield value was calculated as follows:

$$\%\ yield = (Weight\ of\ microspheres)/(Total\ solids\ weight)\times100$$

In vitro Dissolution Studies:

The dissolution test measures the amount of time required for certain percentage of the drug substance in a tablet to go into solution under a specified set of conditions. It describes a step towards physiological availability of the drug substance, but it is not designed to measure the safety or efficacy of the formulation being tested.

In-vitro release profile:

- Medium : 6.8 pH Phosphate Buffer
- Apparatus : USP I (Basket)
- Speed : 75 rpm
- Time : 1hr, for every 2hrs up to 12hr
- Temperature : 37.5 °C
- λ max : 290 nm

Perform the test on microspheres place in each dissolution vessel containing 900ml of 6.8 pH Phosphate Buffer maintained at 37 °C ± 0.5 °C. At specified time withdrawn required amount the sample and replace the same amount with (maintain sink conditions) phosphate buffer, then absorbance was taken and calculate percentage release.

Release Kinetic Models: One of the most important and challenging areas in the drug delivery field is to predict the release of the active agent as a function of time using both simple and sophisticated mathematical models. The importance of such models lies in their utility during both the design stage of a pharmaceutical formulation and the experimental verification of a release mechanism. In order to identify a particular release mechanism, experimental data of statistical significance are compared to a solution of the theoretical model. It is therefore clear that only a combination of accurate and precise data with models accurately depicting the physical situation will provide an insight into the actual mechanism of release.

To analyse the mechanism for the drug release and drug release rate kinetics of the dosage form, the data obtained was fitted in to Zero order, First order, Higuchi matrix, Krosmeyers-Peppas and Hixson Crowell model. In this by comparing the R-values obtained, the best-fit model was selected.

RESULTS AND DISCUSSION

Solubility study:

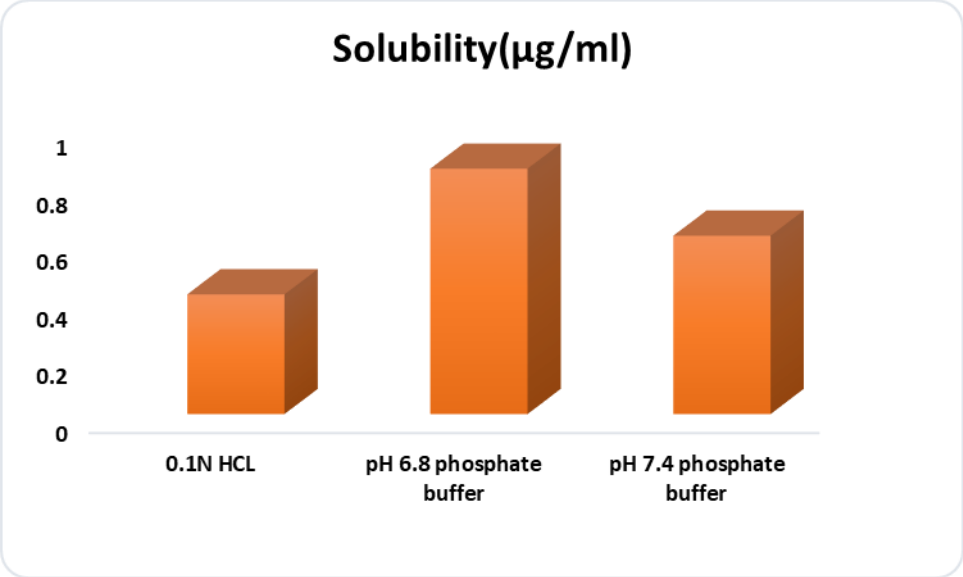

Figure.2 UV spectra of Canagliflozin at 290 nm

Discussion: From the above obtained solubility studies we can say solubility of the drug is more in 6.8 pH Buffer than the other buffers.

UV SPECTRUM OF CANAGLIFLOZIN

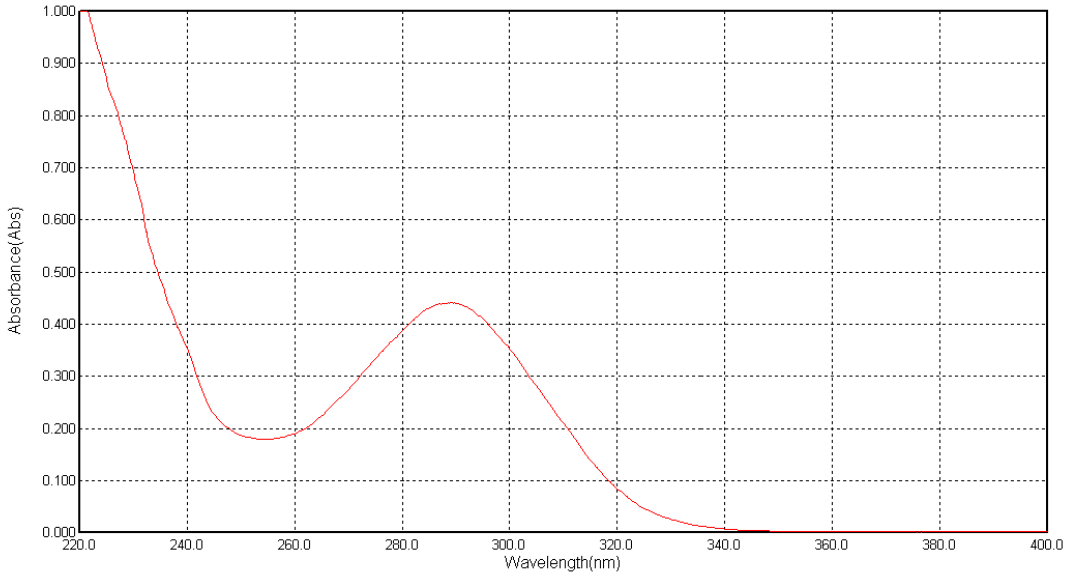

Figure.3 UV spectra of Canagliflozin at 290 nm

Discussion:

The maximum absorbance of the Canagliflozin was found to be at 290 nm. Hence the Wavelength of 290 nm was selected for analysis of drug in dissolution media.

STANDARD CALIBRATION CURVE

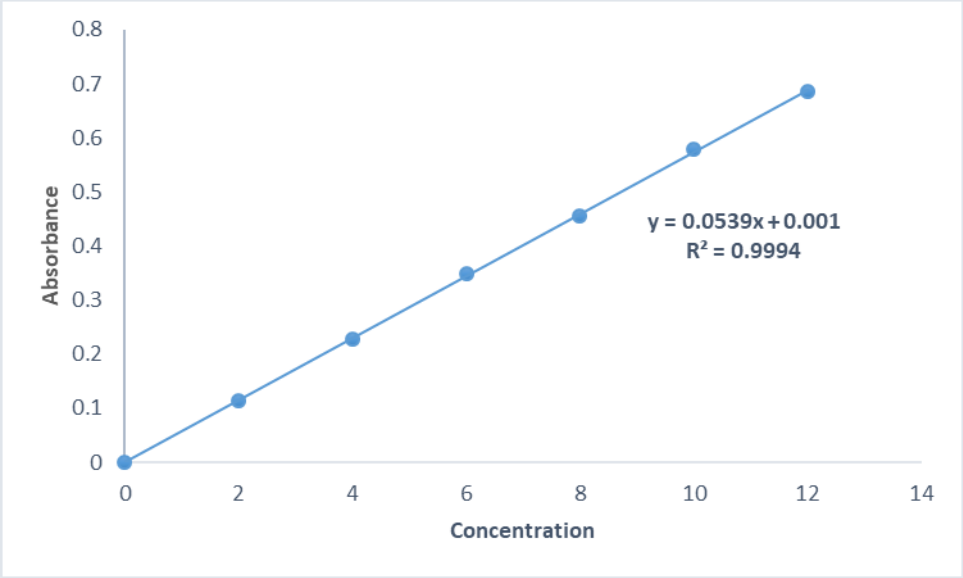

Figure.4 Standard calibration data of Canagliflozin in 6.8 pH Buffer

Discussion:

The linearity was found to be in the range of 2-12 g/ml in 6.8 pH phosphate buffer. The regression value was closer to 1 indicating the method obeyed Beer-lambert's law.

EVALUATION OF CANAGLIFLOZIN MICROSPHERES

Drug polymer interaction (FTIR) study

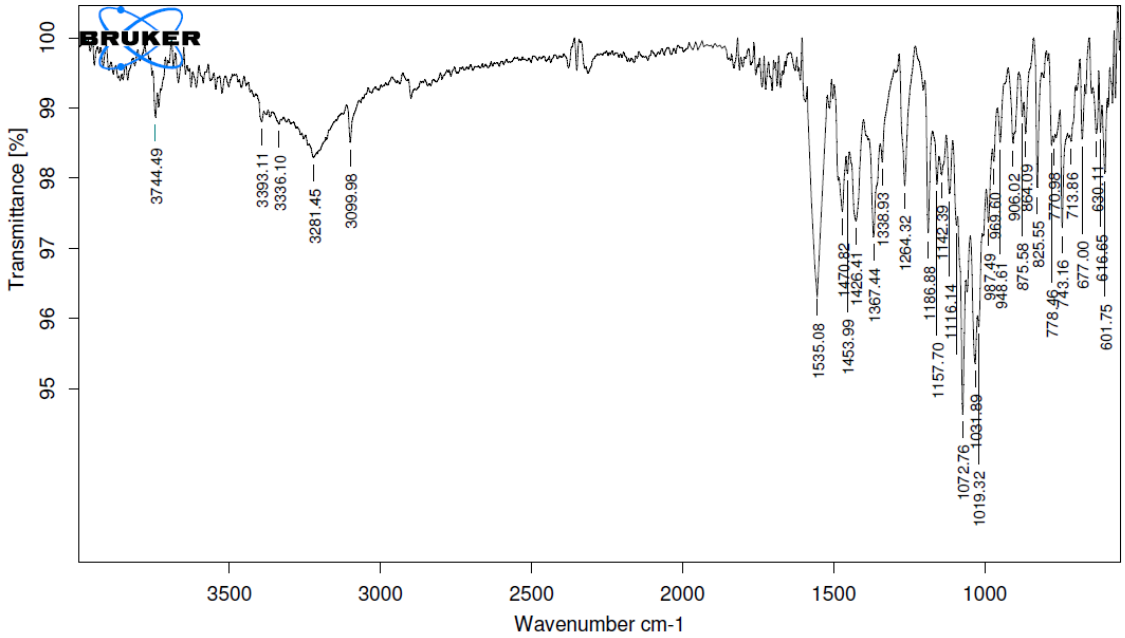

Figure.5 IR spectra of pure Canagliflozin

Optimized Formulation

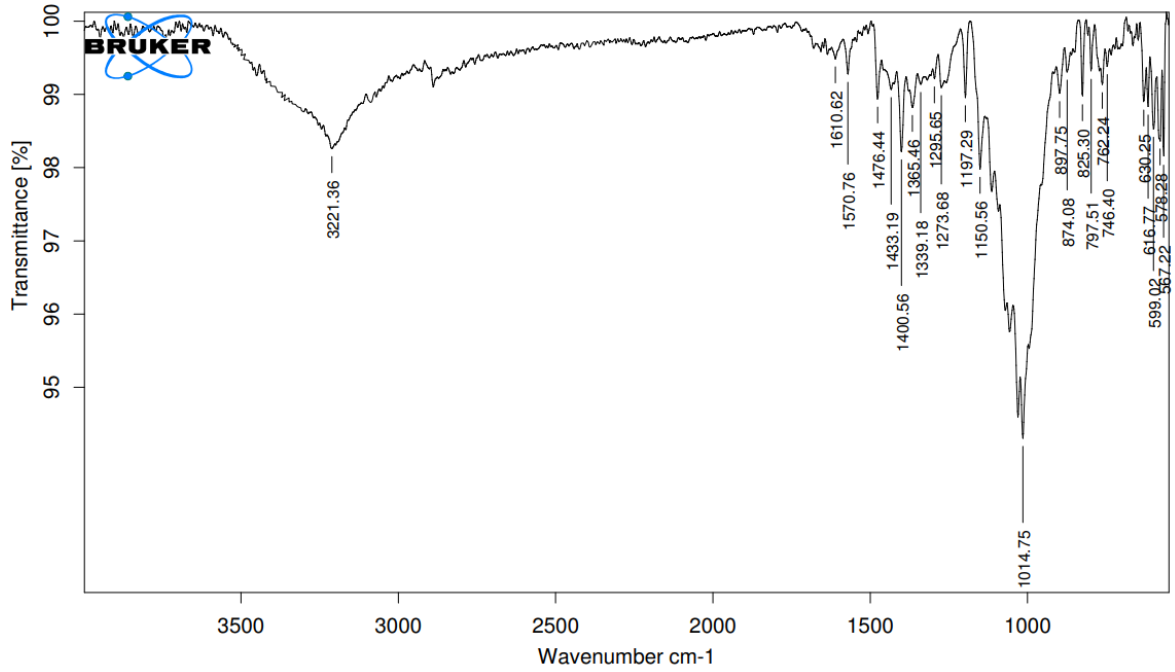

Figure.6 IR spectra of optimized formulation

Discussion:

From the drug excipient compatibility studies we observed that there are no interactions between the pure drug (Canagliflozin) and optimized formulation (Canagliflozin+ excipients) which indicates there are no physical changes.

FLOW PROPERTIES

Characterization of Canagliflozin microspheres:

Table.2 Characterization of Canagliflozin microspheres

Parameter	Bulk density (gm/cc)	Tapped density (gm/cc)	Hausner's ratio	Compressibility index
F1	0.348±0.007	0.424±0.005	1.21±0.01	22.47±1.47
F2	0.352±0.009	0.443±0.009	1.18±0.02	20.25±1.21
F3	0.365±0.005	0.451±0.001	1.16±0.01	18.36±1.16
F4	0.379±0.009	0.465±0.009	1.15±0.01	17.84±1.13
F5	0.351±0.008	0.443±0.005	1.24±0.02	20.62±1.47
F6	0.365±0.007	0.458±0.009	1.22±0.01	19.41±1.35
F7	0.373±0.007	0.469±0.007	1.19±0.01	17.18±1.24
F8	0.384±0.004	0.472±0.003	1.16±0.02	16.47±1.45
F9	0.359±0.003	0.443±0.009	1.18±0.01	20.48±1.36
F10	0.367±0.005	0.450±0.007	1.16±0.01	17.42±1.42
F11	0.379±0.001	0.463±0.005	1.15±0.02	15.24±1.28
F12	0.389±0.005	0.474±0.007	1.14±0.01	13.42±1.57

Discussion: The formulations F1 to F12 found to have varying bulk density, tapped density, compressibility index and Hausner's ratio, which ranged from 0.348±0.007 gm/cc to 0.389±0.005 gm/cc, 0.424±0.005gm/cc to 0.474±0.007gm/cc, 15.47±0.12% to 22.47±1.47 % and 1.14±0.01 to 1.21±0.01 respectively. The observed values were within I.P limits and also demonstrate good flow property for the developed formulation (Table).

Table.3 Particle size, Drug Entrapment Efficiency of Canagliflozin microspheres

Formulation Code	Particle Size (µm)	Drug Content	Entrapment Efficiency	Percentage Yield
F1	94.15±1.33	95.24±1.14	59.25±1.92	93.18±1.21
F2	96.74±0.81	96.37±1.25	64.18±1.11	94.24±1.14
F3	98.78±1.12	97.46±1.37	67.26±1.85	96.29±1.29
F4	97.15±1.14	98.62±1.24	69.45±1.25	97.42±1.35
F5	94.15±0.18	96.43±1.59	61.26±2.74	95.46±1.29
F6	95.18±1.29	96.20±1.12	65.48±2.15	85.24±1.55
F7	97.62±1.18	97.45±1.37	68.25±1.36	96.26±1.97
F8	96.78±1.74	98.18±1.45	70.16±1.84	97.45±1.01
F9	100.00±0.74	97.37±1.20	65.18±1.45	96.38±1.18
F10	98.62±1.26	97.45±1.26	68.24±1.84	96.15±1.26
F11	96.45±1.85	98.72±1.37	70.74±1.24	97.34±1.45
F12	98.82±1.68	99.26±1.46	73.26±1.95	98.86±1.12

Discussion: The formulations F1 to F12 found to have varying particle size, which ranged from 94.15±1.33µm to 100.00±0.74µm, The drug content of formulations F1 to F12 was found to be 95.24±1.14-99.26±1.46. Entrapment efficiency of formulations F1 to F12 was found to be 59.25±1.92-73.26±1.95 and the percentage yield of formulations F1 to F12 was found to be in between 93.18±1.21-98.42±1.12%.

Scanning electron microscopy analysis (SEM)

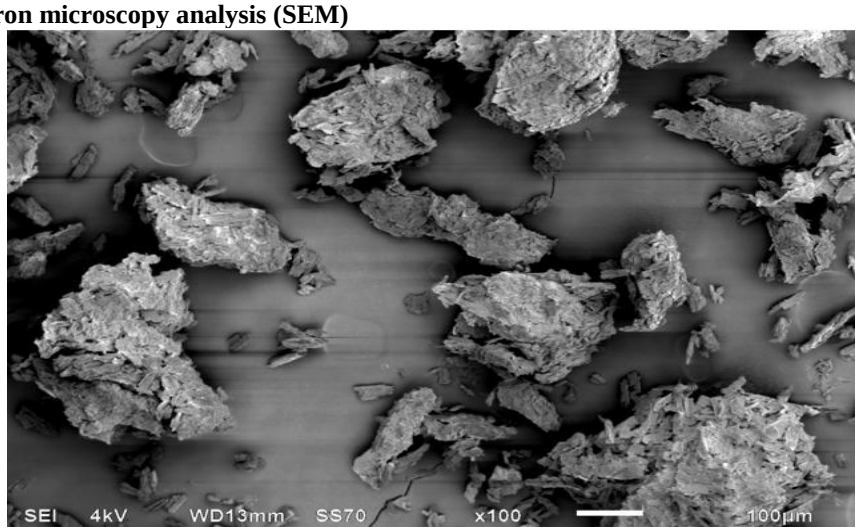

Figure.7 Scanning electron microscopy analysis (SEM)

Discussion: The optimized formulation was evaluated for its surface morphology by using Scanning electron microscopy. The outer surface of the microspheres was found to be smooth. The surface topography revealed a semi spherical surface for all the formulations and a round cavity enclosed by an outer shell composed of the drug and polymer. The particle size was found to be 100µm.

In vitro dissolution studies of Canagliflozin:

Table.4 Dissolution profile of Canagliflozin formulations (Mean ± SD; n=1)

Time (hrs)	F1	F2	F3	F4	F5	F6
0	0	0	0	0	0	0
1	49.38±1.45	52.14±1.26	37.58±1.36	29.12±1.34	45.45±1.51	35.54±1.18
2	57.75±1.15	61.45±1.89	45.15±1.54	38.45±1.75	59.42±1.78	42.84±1.34
4	75.78±1.47	78.45±1.87	61.84±1.67	49.26±1.13	69.45±1.30	65.14±1.48
6	88.98±1.54	90.28±1.56	78.85±1.59	57.45±1.26	85.98±1.19	79.28±1.70
8	98.12±1.23	98.89±1.25	90.45±1.65	79.45±1.75	98.41±1.07	91.74±1.35
10			98.58±1.45	88.37±1.45		98.75±1.75
12				98.26±1.57		

Table.5 Dissolution profile of Canagliflozin formulations (Mean ± SD; n=1)

Time (hrs)	F7	F8	F9	F10	F11	F12
0	0	0	0	0	0	0
1	38.17±1.45	31.18±1.15	38.47±1.98	43.45±1.25	37.48±1.98	39.19±1.77
2	47.32±1.95	38.15±1.70	49.81±1.84	55.67±1.24	42.48±1.75	51.86±1.15
4	69.67±1.46	47.26±1.21	57.61±1.24	67.48±0.98	56.71±1.85	63.84±1.09
6	83.20±1.45	52.42±1.85	79.64±1.02	79.51±1.65	69.24±1.24	72.74±1.48
8	93.16±1.52	69.26±1.61	88.24±1.24	88.54±1.21	78.48±1.26	85.85±1.70
10	99.49±1.24	85.45±1.31	98.64±1.84	99.61±1.74	89.64±1.74	94.69±1.36
12		98.26±1.05			98.51±1.42	99.07±1.22

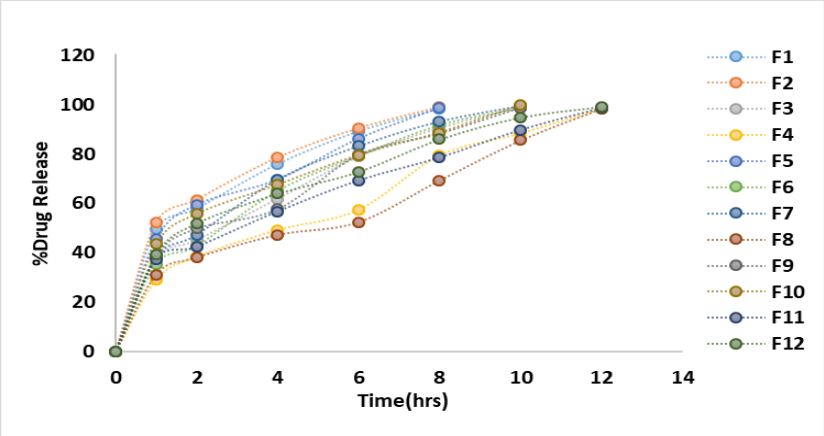

Figure.8 *In vitro* dissolution profile of Canagliflozin formulations F1-F12

Discussion: The formulations F1- F4 prepared with (ratios range 1:0.5, 1:1, 1:1.5 and 1:2) concentration of polymer like Pectin and drug release as shown in Table. As the polymer concentration was increases the drug release time was increases. The formulations F1, F2 showed burst effect and released 98.12±1.23% and 98.89±1.25% at the end of 8thhr. The formulations F3 showed drug release was 98.58±1.45%, at the end of 10th hr respectively, and formulations F4 showed the drug release 98.58±1.45% at th end of 12th hour.

The formulations F5- F8 prepared with (ratios range 1:0.5, 1:1, 1:1.5 and 1:2) concentration of polymer like HPMC K15M and drug release as shown in Table. As the polymer concentration was increases the drug release time was increases. The formulations F5, releases 98.41±1.07% at the end of 8thhr. The formulations F6, F7 drug release was 98.75±1.75%, 99.49±1.24% at the end of 10thhr and and formulations F8 showed the drug release of 98.26±1.05% at the end of 12th hr. The formulations (F9, F10, F11 and F12) were tried with Carbopol (ratios range 1:0.5, 1:1, 1:1.5 and 1:2) as retardant being insoluble in gastric pH. The formulations F9,F10 was found to be 98.64±1.84%, 99.61±1.74% at the end of 10hrs and F11,F12 was found to be 98.51±1.42%, 99.07±1.22% at end of 12th hour. The formulation F12 was made with the Carbopol in the drug polymer ratio of 1:2 and drug release was found to be 99.07±1.22% at the end of 12hrs with better drug release pattern, thus F12 was considered as optimized formulation as shown in table and Fig.

Evaluation of drug release kinetics of optimized formulation (F12):

ZERO ORDER PLOT

Figure.8 Optimized formulation zero order plot of Canagliflozin (F12)

FIRST ORDER PLOT

Figure.9 Optimized formulation first order plot of Canagliflozin (F12)

HIGUCHI PLOT

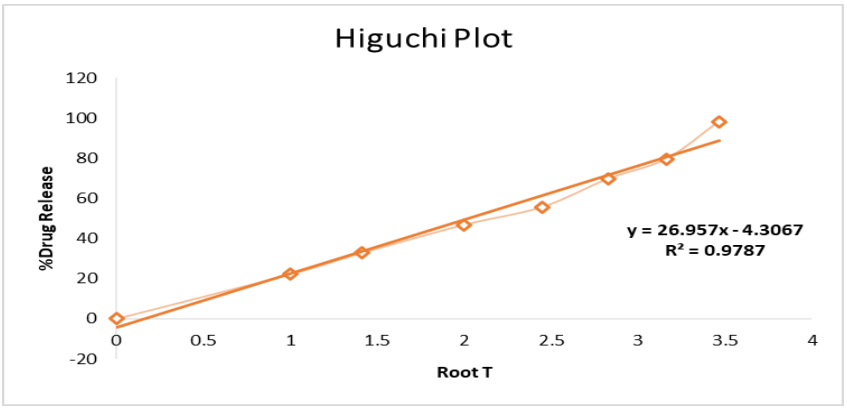

Figure.10 Optimized formulation Higuchi plot of Canagliflozin (F12)

PEPPAS PLOT

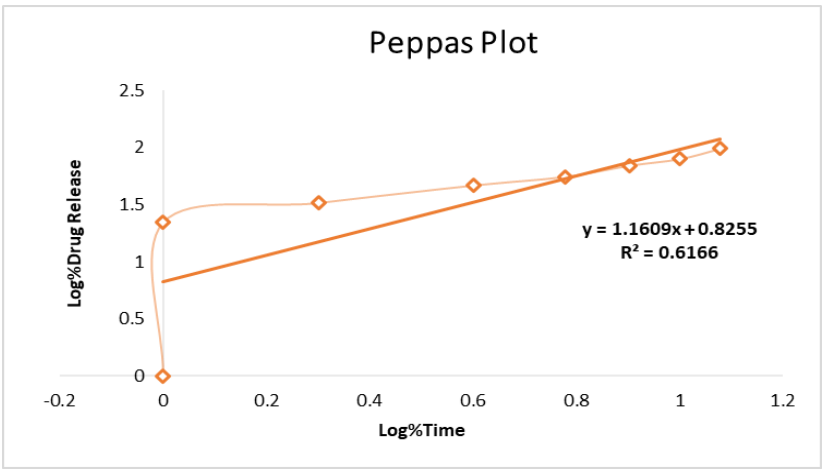

Figure.11 Optimized formulation Peppas plot of Canagliflozin (F12)

Discussions: The optimized formulation F12 has coefficient of determination (R2) values of Zero order, First order, Higuchi and Korsmeyer Peppas of 0.853, 0.762, 0.978 and 0.616 respectively. A good linearity was observed with the zero order. The slope of the regression line from the Higuchi plot indicates the rate of drug release through mode of diffusion, and further confirms the diffusion mechanism. The data fitted into the Korsmeyer Peppas equation which showed linearity with slope n value of 1.160 for optimized formulation F12. This n value indicates the coupling of (swelling, polymer relaxation) diffusion and erosion mechanism. Thus, it indicates the drug release from the tablet follows Super case transport mechanism. The presence of swelling and cross linked polymers within the matrix structure might be responsible for the drug release controlled by more than one process. Thus, with regarded to release kinetics, the optimized batch F12 follows best fitted for zero order drug release with Super case II transport mechanism.

SUMMARY AND CONCLUSION

The goal of present work is to provide a therapeutic amount of (Canagliflozin) to the proper site in the body and also to achieve and maintain the desired Canagliflozin concentration. An attempt was made to prepare microspheres of Canagliflozin ionic gelation techniques by using polymers like Sodium alginate, Pectin, HPMC K15M and Carbopol 934p achieve an oral controlled release of the Canagliflozin. In pre formulation study, estimation of Canagliflozin was carried out by Microprocessor UV-VIS Single beam Spectrophotometer (YIS-294) spectrophotometer at λ_{max} 290 nm using pH 6.8 phosphate buffer as buffer, which had a good reproducibility and this method was used in entire study. All the formulations were subjected for evaluation. Results of pre formulation studies, FTIR, % yield, drug content, buoyancy time and entrapment efficiency, *in vitro* dissolution and release kinetics shown satisfactory results. The FTIR Spectra revealed that, there was no interaction between polymers and Canagliflozin. Entrapment efficiency was increased with increased polymer concentration. From the results it can be inferred that there was a proper distribution of Canagliflozin in the microspheres and the deviation was within the acceptable limits. On the basis of release data and graphical analysis formulation F12 showed a good Sustained release profile with maximum entrapment efficiency because of high polymer concentration. The co-efficient of determination indicated that the release data was best fitted with zero order kinetics. The diffusion exponent 'n' values of Korsemeyer- Peppas model was found to be in the range of 1.160 for the Canagliflozin microspheres prepared with drug and chitosan indicating Super case II transport mechanism of drug through Canagliflozin microspheres. Hence, from the above obtained data it can be summarized that it is possible to formulate controlled release microspheres of Canagliflozin by ionic gelation technique using polymers like Sodium alginate, Pectin, HPMC K15M and Carbopol 934p and the optimized formulation occur by using drug and polymer ration as Canagliflozin : Carbopol 934p (F12) in 1 : 2 ratio.

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