Available online on 15.01.2019 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

Open Access Research Article

Formulation and evaluation of chitosan films containing sparfloxacin for the treatment of periodontitis

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ABSTRACT

In the present study an attempt has been made to formulate and evaluate a sustained release periodontal film of Sparfloxacin with biodegradable, cost effective polymer Chitosan. The objective of the study was to formulate intra-pocket periodontal films, which could be easily placed into the periodontal pocket, and thus be capable of delivering therapeutic concentrations of drug. Sparfloxacin is an antibiotic, showing wide spectrum antibacterial activity against a number of periodontal pathogens. Hence Sparfloxacin is selected as model for site specific delivery, i.e., into periodontal pocket for the treatment of periodontitis. In the present investigation Chitosan films containing Sparfloxacin were prepared by solution casting method using acetic acid. The copolymers HPMC K4M, Sodium CMC and Eudragit RL 100 in the concentrations of 10%, 20% and 30% w/w of Chitosan were added into the polymeric solution. Propylene glycol was used as plasticizer. FT-IR and UV spectroscopic methods revealed no interaction between Sparfloxacin and polymers. The drug loaded films were evaluated for their thickness, weight variation, content uniformity, tensile strength, percent elongation, percentage moisture loss, surface pH, folding endurance, *in- vitro* drug release studies, *in - vitro* antibacterial activity and stability studies. Periodontal films showed initial burst release of drug on 1st day and then the release was sustained for a period of 8 days. *In – vitro* antibacterial activity was carried out on *staphylococcus aureus* and the antibacterial activity was retained for 96 hours. *In - vitro* release from periodontal films was fit to kinetic models to reveal drug release kinetics.

Keywords: Periodontitis, Sparfloxacin, Bio-adhesive polymers.

Article Info: Received 04 Nov 2018; Review Completed 13 Dec 2018; Accepted 19 Dec 2018; Available online 15 Jan 2019

Cite this article as:

Naik S, Raikar P, Ahmed MG, Formulation and evaluation of chitosan films containing sparfloxacin for the treatment of periodontitis, Journal of Drug Delivery and Therapeutics. 2019; 9(1):38-45

DOI: http://dx.doi.org/10.22270/jddt.v9i1.2245

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INTRODUCTION

The term Periodontitis comes from two terms "peri' = around, "odont" = tooth, "itis" = inflammation.[1] Periodontal diseases are infections of the structures around the teeth, which include the gums, periodontal ligament and alveolar bone.[2] Periodontal diseases include conditions such as chronic periodontitis, aggressive periodontitis, systemic diseases associated periodontitis and necrotizing periodontitis.[3] This pocket provides an ideal environment for the growth and proliferation of anaerobic pathogenic bacteria.[4] Clinically, as the disease progresses, the periodontal pocket, which is somewhat deeper than the sulcus of a healthy tooth, gets deeper with further destruction of the tooth's supporting structures, often resulting in tooth loss.[5] The microorganisms colonizing the subgingival area represent the principal etiological factor in the development of the inflammation and tissue destruction.[4]

There are many antimicrobial agents used in the management of periodontal diseases. Tetracyclines and metronidazole are the agents most frequently used in the management of periodontal disease.[6] The diagnosis of periodontal conditions is often made on clinical grounds, but microbial sampling of pocket flora is of value in determining the type of antimicrobial therapy. Although a number of bacterial species are thought to be associated with periodontitis, few attempts have been made to detect bacterial species comprehensively from periodontal sites. Two species (*Mogibacterium timidum* and *Porphyromonas gingivalis*) were detected significantly more frequently in subgingival plaque of periodontitis subjects than of healthy subjects, suggesting that these two species are closely related to periodontitis.[7] *Porphyromonas gingivalis* is a Gram-negative anaerobe that has been strongly implicated as an etiological agent in human periodontal diseases. It produces a wide range of proteolytic enzymes that might potentially act as virulence factors.[8]

In present study Sparfloxacin was selected as the model antibacterial drug which is against gram-positive bacteria (especially *Streptococus pneumonia, Staphylococcus, Enterococcus), Bacteroides fragilis,* other anaerobes and mycobacteria.[5] Periodontal film was formulated using Chitosan as Biodegradable Polymer along with in varying concentrations bio-adhesives polymers (HPMC K4M, Sodium CMC, Eudragit RL 100). Various pharmaceutical quality control tests were carried out to evaluate drug loaded periodontal films. Films were also tested for their suitability in periodontitis.

MATERIALS AND METHODS

Materials

Sparfloxacin was received from Aristo Pharmaceuticals Pvt. Ltd, Mumbai as a free gift sample. Chitosan as Biodegradable Polymer was purchased from Loba Chemie Ltd, sodium carboxy methyl cellulose as mucoadheesive polymer and Dibutyl phthalate as Plasticizer were purchased from Sd- fine chem limited, Mumbai, HPMC K4M as a Mucoadhesive Polymer was received from Colorcon Asia Pvt. Ltd. Goa. Eudragit RL 100 was purchased from Ozone International, Mumbai. Propylene glycol as Plasticizer was purchased from Chemport (India) Private Limited, Mumbai. Acetic acid as a Solvent was purchased from Loba Chemie Ltd. Mueller Hinton Agar Medium, Soyabean Casein Digest Medium (Tryptone Soya Broth) were purchased from Himedia Laboratories Pvt. Ltd.

Preformulation studies

The sample of Sparfloxacin was subjected to UV Spectral analysis, λ max determination; IR Spectral analysis and Melting point determination for confirm identity and purity of drug sample. Drug-excipient compatibility study was carried out using FTIR spectroscopy.

Calculation of Sparfloxacin dose to be incorporated in the Periodontal Films [9]

Sparfloxacin is available in the market as a tablet (200 mg). The dose recommended for the treatment of anaerobic infection is 0.5g to 1g i.v., followed by 1 g daily as a single or in two divided doses for 5 to 10 days. Thus oral therapy with 200 mg every 12 hours is substituted as soon as possible. As the dose of sustained release film is reduced to 1/400 that of the tablet form therefore a dose of 0.5 mg per periodontal film was fixed.

Internal diameter of petridish = 8.8 cm

Internal surface area of petridish = πr^2

= $22 / 7 \times (4.4)^2$

= $60.83\ cm^2$

= $6083\ mm^2$

Surface area of Periodontal film = $0.6 \times 0.2\ cm^2$

= $0.12\ cm^2$

= $12\ mm^2$

Therefore, $12\ mm^2$ contains 0.5 mg of Sparfloxacin

$6083\ mm^2$ contains x mg of Sparfloxacin

x = 253.4 mg of Sparfloxacin

Preparation of drug loaded Periodontal Films

Periodontal Films were prepared by solvent casting technique; formulation of film is given in Table 1. An accurately weighed amount of Chitosan (2%w/v) was soaked in aqueous acetic acid (1%v/v) for 24 hours to get a clear solution, which was filtered through muslin cloth to remove undissolved polymer (chitin). Then, the accurately weighed amounts of copolymers (HPMC K4M, Sodium CMC, Eudragit RL 100) in varying concentrations (10%, 20%, 30% w/w) of Chitosan were added. Mixing was continued until a clear solution of polymers in solvent was obtained. After the complete dissolution of the polymer, plasticizer was added to the polymer solution (Propylene glycol). Accurately weighed amount of drug (Sparfloxacin) was homogenously dispersed in the above polymeric solution by constant stirring. After complete mixing, the beaker was kept aside for 10 minutes to remove the entrapped air bubbles. This dispersion was then poured into aluminium lined clean glass petri-dishes placed on a level platform. The solvent was allowed to evaporate under controlled conditions by covering the petri-dishes with a glass funnel by placing a loose cotton plug into the stem of funnel at room temperature for 24 hours. After complete evaporation of solvent, cast films were obtained were then cut into pieces of $6 \times 2\ mm^2$, wrapped into aluminium foil and stored in dessicator at room temperature till further evaluation studies.

Table 1: Formulation of Sparfloxacin Periodontal Films

Ingredients	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}
Sparfloxacin (mg)	253	253	253	253	253	253	253	253	253	253
Chitosan (mg)	200	200	200	200	200	200	200	200	200	200
HPMC K4M (% w/w Chitosan)	_	10	20	30	_	_	_	_	_	_
Sodium CMC (% w/w Chitosan)	_	_	_	_	10	20	30	_	_	_
Eudragit RL100 (% w/w Chitosan)	_	_	_	_	_	_	_	10	20	30
Propylene glycol (ml)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Acetic acid (ml)	10	10	10	10	10	10	10	10	10	10

Evaluation of drug loaded Periodontal Films:

1. Appearance [10]

The drug loaded periodontal films were observed for colour and physical form or appearance.

2. Thickness uniformity of the films [11]

The thickness of each film was measured using screw guage (thickness tester) at different positions of the film and the average was calculated.

3. Uniformity of weight of the films [11]

Drug loaded periodontal films (6×2mm^2) were cut from 10 different places of the same formulation and weighed on electronic balance and the average weight was calculated.

4. Surface pH [12]

Drug loaded Periodontal films were left to swell for 1 hour on the surface of the agar plate, prepared by dissolving 2% w/v agar in warmed double distilled water with constant stirring and poured into the petridish to solidify at room temperature. The pH paper was placed on the surface of the swollen film and the pH was determined. The mean of three readings was recorded.

5. Folding endurance [10,13]

The folding endurance is expressed as the number of folds (number of times the film is folded at the same place, either to break the strip/ film or to develop visible cracks). This test gives an indication of brittleness. The drug loaded periodontal films was folded in the centre, between the fingers and the thumb and then opened. This was termed as one folding. The process was repeated till the film showed rupture (d) or cracks in centre of film or folded up to 100 times which is considered satisfactory to reveal good film properties. The total numbers of foldings were named as folding endurance value. This test was carried out on all the drug loaded films for three times and the mean of three readings was recorded.

6. Tensile strength and Percent elongation[14,15]

Simple type of apparatus for laboratory use has been designed for measuring tensile strength and percent elongation.

Figure 1: Locally designed Tensile strength and Percent elongation tester

It consists of Dynamometer with scale expressed in Newton and Gram. The end of the dynamometer consists of weighing pan attached to dynamometer by means of hook. A drug loaded periodontal film of size (approximately 3×1 cm^2) was cut on a glass plate with a sharp blade, so that it had a smooth margin and its dimensions were determined. Both the ends of the film were fixed between adhesive tape one end being attached to dynamometer and the other end attached to weighing pan to give support to the film and to keep the film straight while stretching. To determine the percent elongation and tensile strength, weights were gradually added to the weighing pan to increase the pulling force till the film ruptured.

Percent elongation was calculated by applying the following equation:

$$\text{Percent elongation} = \frac{\text{Increase in length}}{\text{Original length}} \text{ X } 100$$

Tensile strength was calculated after the film ruptured by observing the break force that is directly been noted from the tester. The force is given in Newton and the tensile strength is calculated by applying the following equation:

$$\text{Tensile strength} = \frac{\text{Force at break (N)}}{\text{Initial cross sectional area of the film (mm2)}}$$

7. Percentage moisture loss [11]

6 films of different concentrations of size (6×2 mm) were weighed accurately, and then, they were kept in desiccators for 3 consecutive days and then reweighed. The percentage moisture loss was calculated by the applying the following equation:

$$\text{Percentage mositure loss} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \text{X } 100$$

8. Drug content uniformity [11]

The prepared film formulations were analyzed for drug content by taking film (size of 6×2 mm) from each batch and individually dissolved in 5 ml of pH 6.6 phosphate buffer in a beaker. The dispersion was kept overnight in dark place. The dispersion was filtered. Then 0.1 ml of the filtered solution was diluted to 10 ml with phosphate buffer of pH 6.6 in a 10 ml volumetric flask. Drug concentrations were determined by taking three readings, using a UV visible spectrophotometer at 290 nm. The polymeric solution without drug served as blank.

9. Accelerated stability studies [16]

Stability of pharmaceutical preparation can be defined as the "capability of particular formulation in a specific system to remain within its physical, chemical, microbiological, therapeutic and toxicological specifications throughout its shelf life". The purpose of stability testing is to provide evidence on how the quality of a substance or drug product varies with time under the influence of variety of environmental factors such as temperature, humidity, and light, enabling recommended storage conditions re-test periods and shelf-lives to be established.

ICH guidelines:

Long-term testing 25 ± 2^{0}C/60% ± 5% RH for 12 months.

Accelerated testing 40 ± 2^{0}C/75% ± 5% RH for 6 months.

Procedure:

The drug loaded periodontal films were subjected to short term stability testing. The films of size 6×2mm^2 were weighed and wrapped in aluminium foil, and placed in petriplates which were kept in a stability chamber maintained at 40 ± 2^{0}C and 75 ± 5% RH for 1 month. Changes in the appearance and drug content of the stored films were investigated during the period and after 3 months.

10. *In-vitro* drug release study [11]

The pH of gingival fluid lies between 6.5-6.8, thus phosphate buffer pH 6.8 was used as simulated gingival fluid. A static dissolution model was adopted for the dissolution studies as the film should be immobile in the periodontal pocket. Films of known weight and dimension (6×2mm^2) were placed separately in small vials sealed with rubber closures containing 1.0 ml of phosphate buffer (pH 6.6) and kept at 37˚C for 8 days. In interval of 1 day, the buffer was drained off and replaced with fresh phosphate buffer of pH 6.6. The drained buffer solution was suitably diluted to 10 ml with phosphate buffer pH 6.6 and the concentration of the drug in the buffer was determined by UV Spectrophotometry at 290 nm. The procedure was continued for 8 days and the cumulative percentage of drug release was calculated and plotted against time.

11. *In-vitro* antibacterial activity [17]

Formulation: Periodontal Films of 25 mm^2 containing 0.89 mg of drug (Sparfloxacin)

Disc Diffusion Procedure

Media Used: Mueller Hinton Agar Medium and Soyabean Casein Digest Medium.

Temperature: Agar plates are brought to room temperature before use.

Procedure:

a. Using a loop or swab, the colonies of *Staphylococcus aureus* (aerobic gram positive organism i.e. commonly found in Periodontitis) were transferred to the tube with Soyabean casein digest medium.

b. The tube was then rotated in between the palms and then was allowed to incubate for 12 hrs. at 37˚C.

c. Uninnoculated sterile Mueller Hinton Agar Medium was poured into sterile petriplates (approx. 10 ml) and was allowed to solidify for 15 mins.

d. Innoculated sterile Soyabean Casein Digest Medium was then overlayered on top of the previously solidified agar plate.

e. After 5 mins the drug loaded Periodontal films (5×5 mm^2) were placed on the semi dried inoculated plates using sterile forcep and press slightly in the centre of the film using the forcep so that strip gets adhered to the media which is important to show the activity of the Periodontal film.

f. Plates were then incubated at 37ºC in incubator for 48 hrs.

g. After 48 hrs. of incubation the periodontal films were transferred to freshly seeded agar plates and incubated for an additional 48 hrs.

h. The diameter of inhibition zone was measured to nearest whole millimetre by holding the measuring device.

12. *In- vitro* Drug Release kinetics [12,18]

To analyse the mechanism for the drug release and release rate kinetics of the dosage form, the data obtained from *in-vitro* drug release studies was fitted into four models of data treatment as follows:

Zero order (cumulative percentage of drug released v/s time)

First order (log cumulative percentage of drug remaining v/s time)

Higuchi model (cumulative percentage of drug release v/s square root of time)

Korsmeyer – Peppas model (log cumulative percentage drug release v/s log time).

RESULTS AND DISCUSSION

Periodontal films of Sparfloxacin were developed using different natural and synthetic polymers and characterized for various pharmaceutical parameters. The details of result and discussion are given in the following section.

1. Identification of drug

The received sample of Sparfloxacin was subjected to UV Spectral analysis and λ max determination, IR Spectral analysis and Melting point determination. The result thus obtained confirms the purity of drug sample. Excipients were investigated for their compatibility with Sparfloxacin using FTIR as non-thermal method of compatibility analysis. Based on the results of FTIR analysis the excipients were found to be compatible with Sparfloxacin.

2. Appearance

All the polymer combinations used for fabrication of periodontal films showed good film properties and reproducibility. The fabricated films were thin, flexible, elastic and smooth.

3. Thickness uniformity of the films

Thickness of each film was measured at six different points and average thickness with standard deviation was calculated. The thicknesses of various films are given in the Table 2. The data of film thickness indicates that there was no much difference in thickness within the formulations.

4. Uniformity of weight of the films

Drug loaded periodontal films (0.14cm^2) were tested for uniformity of weight and the results of weight uniformity are given in the Table 2. The data of weight variation of films indicates that there was no much difference in weight variation within the formulations.

5. Surface pH

Surface pH of all the formulations were found to have pH between 6-7.This reveals that prepared films would not alter the pH of the gingival fluid in the periodontal pocket. Hence the chances of irritation are very less.

6. Folding endurance of films

Folding endurance value for the entire drug loaded periodontal films were found to be more than 50 folds. It indicates that all formulations had satisfactory film flexibility.

7. Tensile strength and Percent elongation

The tensile strength of all the drug-loaded periodontal films was studied and given in Table 3. The effective cross linking was observed on addition of Eudragit RL 100 as a copolymer, which also shows higher tensile strength when compared to other formulations. The tensile strength of the films were in the order of F10 > F9 > F8 > F7 > F6 > F5 > F4 >F3 > F2 > F1. The tensile strength was less for the F1 formulation (formulation without copolymer) and was higher for the films containing copolymer (30% w/w of Chitosan). As the concentration of copolymer increased tensile strength of the film also increased, this may be due to the increased

toughness and rigidity of the polymeric film. Percent elongation of all the drug loaded periodontal films was studied and given in Table 3. The order of percent elongation of the film is in the order of F9 > F10 > F8 > F7 > F6 > F5 > F3 > F4 > F2 > F1.

8. Percentage moisture loss

Percentage moisture loss of all the drug loaded periodontal films was studied and given in Table 3. Low moisture loss helps the formulation to remain stable and prevent from being completely dried and brittle. The order of percentage moisture loss of the films is in the order of F6 > F1 > F5 > F3 > F7 > F4 > F2 > F9 > F8 > F10.

9. Drug content uniformity

Percentage drug content of prepared formulations is given in Table 3. It was observed from the result that there was the uniformity in drug content and it was within pharmacopoeial limits.

Table 2: Data of thickness, weight variation, surface pH and folding endurance of drug loaded periodontal films from F1-F10

Formulation	Thickness (mm) n=6	Weight variation (mg) n=6	Surface pH n=1	Folding endurance n=1
F1	0.334±0.00450	3.028±0.07527	6	78
F2	0.334±0.00626	4.037±0.27868	6	86
F3	0.339±0.00400	4.261±0.12247	7	80
F4	0.362±0.01265	4.844±0.25033	6	94
F5	0.333±0.00825	3.600±0.29097	7	92
F6	0.336±0.00600	2.750±0.34496	6	88
F7	0.363±0.01386	3.966±0.33262	7	95
F8	0.354±0.00510	4.233±0.32659	6	94
F9	0.339±0.00268	5.133±0.16329	7	78
F10	0.349±0.00632	4.986±0.16329	7	90

Table 3: Data of Tensile strength, per cent elongation, percentage moisture loss and drug content of drug loaded periodontal films from F1–F10

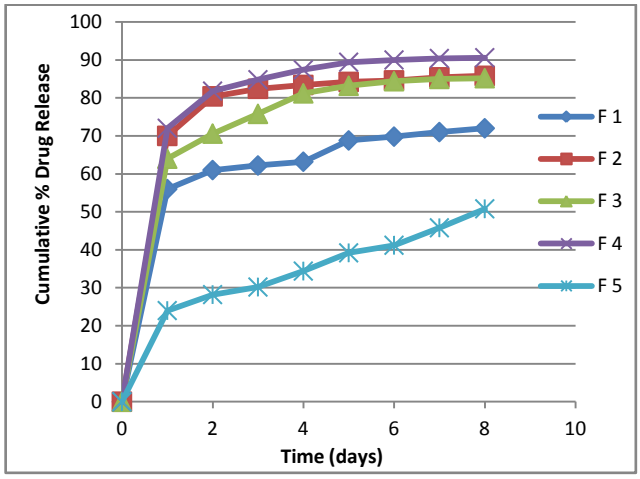
Formulation	Tensile strength (N/mm^2) n=3	Percent elongation (n=1)	Percentage moisture loss (n=3)	%Drug content (n=6)
F1	0.543±0.057	10	7.75±3.560	93.73±1.769
F2	0.643±0.045	11	5.97±2.635	95.97±0.711
F3	0.734±0.097	14	7.29±1.351	93.94±1.658
F4	0.831±0.089	13	6.28±1.584	95.30±1.424
F5	0.982±0.056	16	7.59±1.761	94.83±1.086
F6	1.360±0.057	17	9.48±6.805	92.70±3.141
F7	1.376±0.049	19	6.47±2.592	96.62±1.488
F8	1.500±0.063	20	5.79±0.463	86.90±2.034
F9	1.576±0.084	25	5.93±2.698	89.10±0.636
F10	1.586±0.011	23	5.03±0.666	88.70±0.699

In-vitro drug release

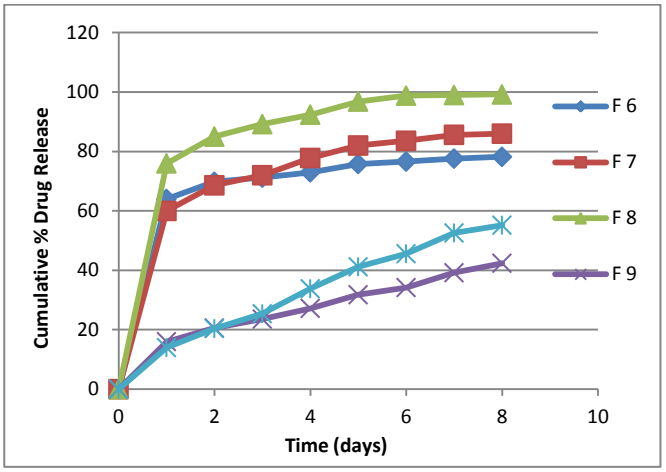
The data of percentage drug release from *in-vitro* studies of all formulations are shown in Tables 4 and Graph 1 and 2.

Table 4: *In-vitro* Dissolution study data (Cumulative % drug release v/s time of F1 to F10)

Time (days)	Cumulative % drug released (n = 3)									
	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}
0	0±0.000	0±0.000	0±0.000	0±0.000	0±0.000	0±0.000	0±0.000	0±0.000	0±0.000	0±0.000
1	57.0±1.210	71.0±0.231	65.0±0.347	73.0±0.225	25.0±0.245	66.0±0.129	64.0±0.369	74.0±0.268	18.0±3.247	14±0.112
2	62.0±1.053	81.4±0.111	71.6±0.554	82.8±0.639	29.2±0.325	69.8±0.668	69.6±1.240	86.0±0.328	20.6±6.587	21.4±0.367
3	63.2±0.285	83.4±0.365	76.8±0.147	85.8±0.489	30.2±0.887	72.2±0.850	73.0±3.221	89.2±1.287	24.6±0.257	26.4±0.945
4	64.2±0.741	84.4±0.224	82.2±0.665	88.4±0.654	35.4±0.654	74.0±0.687	78.8±0.687	91.4±4.221	28.2±0.963	33.8±0.357
5	68.8±0.358	85.2±0.335	84.2±0.331	89.4±0.664	39.2±0.025	76.8±0.544	83.0±1.325	97.8±3.224	33.8±0.374	44.2±0.331
6	69.8±0.552	85.6±0.479	85.4±0.987	91.0±6.321	42.2±0.658	77.6±0.224	84.6±0.224	98.8±0.687	34.2±0.887	46.6±0.023
7	720±0.321	86.4±0.894	86.0±0.259	91.4±0.367	46.8±0.369	78.6±0.360	85.6±0.398	99.2±0.369	40.2±0.950	53.6±0.874
8	73.0±0.411	86.8±0.547	86.2±0.647	91.6±0.114	51.8±0.036	79.2±0.298	87.0±4.221	99.4±3.240	42.4±0.987	56.2±0.698



Graph 1: Comparative *in-vitro* drug release profile of Sparfloxacin loaded Periodontal films (F1 to F5)



Graph 2: Comparative *in-vitro* drug release profile of Sparfloxacin loaded Periodontal films (F6 to F10)

Stability studies:

The formulations were subjected to stability studies at 40 ± 2 ^{0}C and 75 ± 5% RH for 3 month as per ICH guidelines. Films were investigated for the appearance, surface pH, folding endurance and drug content during the period of stability study. The result thus obtained proves the stability of developed peridontal film.

***In–vitro* antibacterial activity**

In-vitro antibacterial activity was performed using microbial strains of *Staphylococcus aureus*. The zones of inhibition formed due to Sparfloxacin loaded periodontal film formulations were observed after 48hrs and 96hrs of incubation. The results of antibacterial activity are shown in Table 5. The result of study showed that the antibacterial activity of sparfloxacin retained when developed as periodontal film.

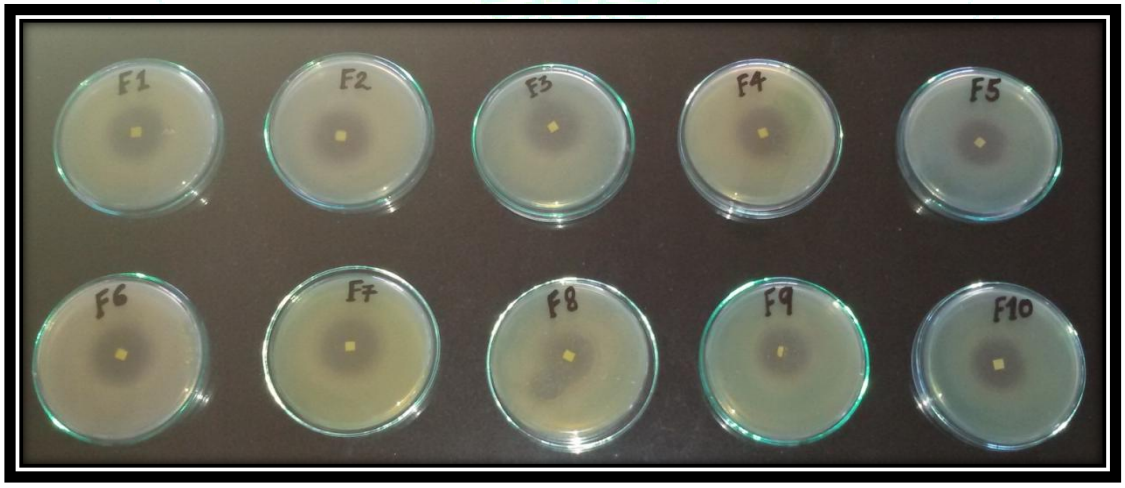


Figure 2: Zone of inhibition after 48 hrs of incubation of Sparfloxacin loaded periodontal films

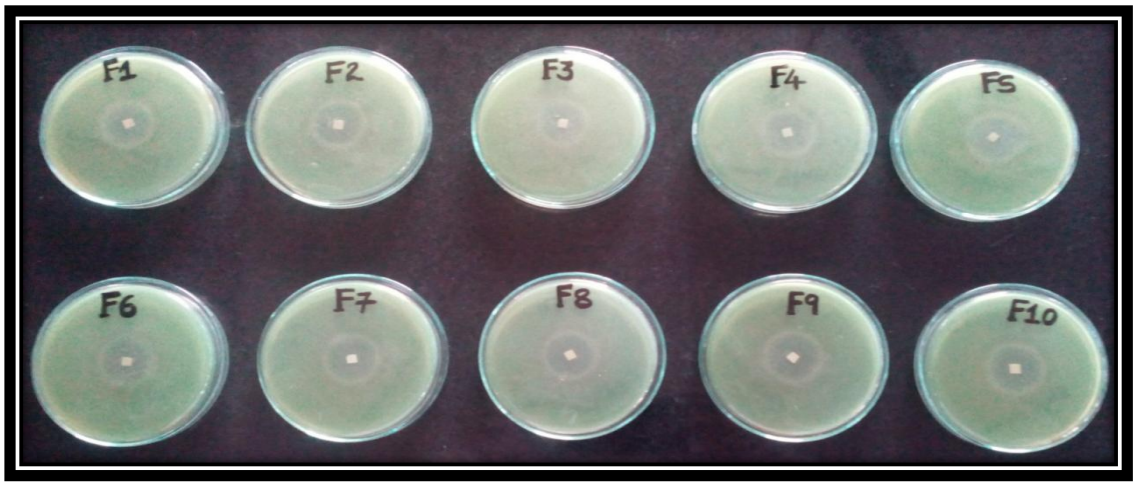


Figure 3: Zone of inhibition after 96 hrs of incubation of Sparfloxacin loaded periodontal films

Table 5: *In-vitro* antibacterial activity of Sparfloxacin Periodontal films

Formulations	Zone of inhibition after 48 hrs of incubation (mm)	Zone of inhibition after 96 hrs of incubation (mm)	Total zone of inhibition (mm)
F1	12	26	38
F2	36	27	63
F3	40	24	64
F4	37	26	63
F5	35	26	61
F6	36	27	63
F7	37	27	64
F8	40	25	65
F9	35	26	61
F10	34	25	59

Release Kinetics of formulations

The in-vitro drug release data of prepared the Sparfloxacin loaded periodontal films were subjected to statistical analysis using linear regression analysis to ascertain the mechanism of drug release. The results of linear regression analysis including regression coefficient are presented in Table 6. The result obtained showed that the prepared film follows first order drug release kinetic and drug was released by diffusion mechanism.

Table 6: Release Kinetics Profile of F1 – F10 formulations

Formulation	Mathematical model				
	Zero order kinetic (R^2)	First order kinetic (R^2)	Higuchi plot (R^2)	Korsmeyer-Peppas plot	
				Slope (n)	(R^2)
F1	0.8353	0.9029	0.6751	0.829	0.5027
F2	0.8688	0.9007	0.7971	0.854	0.6560
F3	0.6225	0.8391	0.8119	0.844	0.6319
F4	0.8352	0.8564	0.8311	0.897	0.6329
F5	0.8146	0.8913	0.6896	0.991	0.5083
F6	0.8540	0.8618	0.7351	0.847	0.5710
F7	0.7567	0.8544	0.7720	0.822	0.5972
F8	0.7315	0.8474	0.8166	0.883	0.6112
F9	0.7962	0.8428	0.7432	0.879	0.5355
F10	0.8056	0.8613	0.7825	0.992	0.5633

CONCLUSIONS

Periodontal films of Sparfloxacin were designed using Chitosan, HPMC K4M, Na CMC and Eudragit RL 100 and evaluated for the physiochemical characteristics including *in-vitro* drug release. *In vitro* drug release studies were carried out by static dissolution method using pH 6.6 buffer solution for period of 8 days. All the films showed an initial burst release and then the release was controlled and extended for the period of study. The study shows first order release of drug with diffusion mechanism. The prepared formulations were subjected for antimicrobial activity by using strains of *staphylococcus aureus* and the antimicrobial activity was retained for 96 hours. The formulations were subjected to stability studies, the results thus obtained showed no significant changes in the formulation.

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