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Formulation and Characterization of Buccal Films of Chitosan Based Rizatriptan Benzoate Nanoparticles

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ABSTRACT

Background: In this study, the ionic gelation technique was used to prepare chitosan nanoparticles. During the preparation step, the NPs were loaded with Rizatriptan Benzoate. **Materials and Methods:** These NPs were characterized in terms of size, charge, morphology, drug loading, and drug release. Particle Size and Zeta potential were found to be 476.6 nm 22.6mv respectively. *In-vitro* Drug release was found to be 84.20% after 24 hr for optimized formulation. Separately, buccal films were prepared, and their properties were optimized in terms of weight, surface pH, thickness, folding endurance, and mucoadhesion. After that, the NPs were dispersed in the films and characterized for i*n-vitro* drug release kinetics. **Results:** The thickness of buccal films was found between 0.179 ± 0.012 to 0.275 ±0.015 mm, and buccal films exhibited good folding endurance. *In vitro* disintegration and dissolution times were measured twice and were found to be around 7.80 ± 0.25 to 12.94 ± 0.15 min and 32.87 ± 1.26 to 64.68 ± 0.61 min, respectively. Surface pH was found to be between 6.75 ± 0.07 to 6.78 ± 0.09. **Conclusion:** The release of Rizatriptan Benzoate from the RCNPs buccal films followed a first-order kinetics and a non-fickian Super Case II diffusion. The results suggest that RCNP buccal films could be a potential candidate to achieve optimum drug release for effective treatment of migraine.

Keywords: *In-vitro* permeation, Chitosan, Folding Endurance, Swelling Index, Diffusion Coefficient, Correlation Coefficient.

Introduction

The buccal mucosa is the most practical and easily attainable mucosal membrane among the many mucosal membranes present for the delivery of both locally acting and systemic acting medicinal drugs. Furthermore, because this region is highly vascularized, drugs can enter the blood circulation directly via the internal jugular vein, circumventing first-pass metabolism and increasing drug bioavailability. When compared to other non-oral

medication administration routes, the buccal route has a significant level of patient acceptance (Ship *et al.,* 2022).

Conventional formulations, on the other hand, have a short residence duration at the site of application due to the washing effect of saliva (Jagtap *et al.,* 2020). Mucoadhesive systems such as tablets, gel ointments, and films have been proven to increase drug delivery by prolonging the duration spent at the site of application and allowing for close contact with the absorbing mucoadhesive membranes. Films are the most comfortable and flexible mucoadhesive dosage forms for buccal dispensation, outperforming buccal tablets in terms of flexibility, comfort, and overcoming the short mucosal residence time of ointments and gels. Buccal films not only provide physical protection on wound surfaces, but they also reduce discomfort and improve therapeutic effectiveness. Films have been shown to be an effective way to include and promote a series of releases (Salehi *et al.,* 2017).

Mucoadhesive carriers, like nanoparticles and microparticles, have recently come up as another viable approach for medication delivery through the mucosa. Added benefits of colloidal carriers are the potential to modify medication release and absorption characteristics, protection of pharmaceuticals from biological degradation, enhanced bioavailability of drugs and the option of administering hydrophobic compounds as an aqueous dispersion (Verma *et al.,* 2011). Because of their ability to interact with the mucosal surface that is negatively charged and promote medicine absorption by redesigning tight junctions present between mucosal cells, nanoparticles that are coated with the polysaccharide chitosan have gained interest for their mucoadhesive uses (Rajaram *et al.,* 2017). Chitosan (CS) is a polysaccharide with distinct biological properties that is commonly used in pharmaceutical and biomedical products. Chitosan is a non-toxic, biodegradable and biocompatible polymer. It has been approved for wound dressing by the Food and Drug Administration (FDA) (Haju *et al.,* 2021).

Emulsion crosslinking, reverse micellar spray drying approach, template polymerization, precipitation, ionotropic gelation method, and polyelectrolyte complex-have all been used to make Chitosan Nanoparticles (CS-NPs) (Rao *et al.,* 2013). The ionic gelation method is based on the ionic interaction of positively charged chitosan amino groups with oppositely charged polyanion groups. A crosslinker is the name given to this polyanion. Sodium tripolyphosphate (TPP) is one of the crosslinkers that has been used (Khade *et al.,* 2020).

Based on the foregoing considerations, combining the benefits of mucoadhesive films with those of nanoparticles, such as the potential to achieve a high distribution of the drug throughout the dosage form, protect the drug from degradation, and control the release of a

drug, in a single system appeared to be an intriguing strategy for buccal drug administration. Few investigations on nanoparticle-containing films have been reported in the literature in recent years. The formulation of nanostructured films for Rizatriptan Benzoate buccal administration is described in this paper (Diaz-del *et al.,* 2005).

Migraine is a type of headache that involves pulsating, one-sided pain, as well as other symptoms like vomiting, nausea, and sensitivity to the surroundings, and lasts for 4–48 hr. Prodrome (hours or days before the headache), aura (just before the headache), pain (primary headache), and postdrome (after the headache) are the four stages of migraine (Semalty *et al.,* 2010). Nonsteroidal anti-inflammatory medicines such as acetaminophen and ibuprofen are helpful therapies, but triptans such as sumatriptan, zolmitriptan, eletriptan, naratriptan, Rizatriptan Benzoate, almotriptan, and Rizatriptan Benzoate must be taken in the case of severe and chronic migraine (Subash *et al.,* 2010).

Rizatriptan Benzoate is a second-generation triptan that comes in Tablet and orally disintegrating Tablet (wafer) forms and has several advantages over other members of the class. The gastrointestinal tract absorbs Rizatriptan Benzoate quickly. It reaches maximal plasma concentrations faster than other Triptans, resulting in immediate pain relief. Rizatriptan Benzoate is a convenient, reliably effective medication for migraine headaches that patients prefer over other options. At 24 hr, Rizatriptan Benzoate increases migraine-specific quality of life (Jadhav *et al.,* 2013). There are certain advantages of loading Rizatriptan Benzoate in NPs and then dispersing them into buccal films rather than scattering Rizatriptan Benzoate directly into the buccal films. NPs can be employed to control the release of drugs and allow for greater medication absorption. Finally, NP-containing films exhibit higher mucoadhesive qualities than blank films, according to several studies (Anroop *et al.,* 2021).

The ionic gelation process was employed to make chitosan nanoparticles in this study. The NPs were loaded with Rizatriptan Benzoate during the preparation process. The size, charge, shape, drug loading, and drug release of these NPs were all studied. Buccal films were made separately, and their weight, surface pH, thickness, folding durability, and mucoadhesion were all adjusted. The NPs were then disseminated across the films and analyzed (Mahajan *et al.,* 2011).

Materials and methods

Materials

Rizatriptan Benzoate was provided as a gift sample by Apotex Labs, Bangalore. Chitosan and Tripolyphosphate (TPP) were obtained from Sigma Aldrich; acetic acid glacial, and methanol were obtained from HiMedia Laboratories. Polyox was obtained from Sigma Aldrich.

Preparation of Chitosan-Coated Rizatriptan Benzoate Nanoparticles

The ionotropic gelation process was used to prepare nanoparticles with some alterations to get the necessary particle size. In a nutshell, a 0.2 percent w/v low molecular weight chitosan solution was made in water with 0.5 percent v/v glacial acetic acid. Stirring at 900 rpm dissolved the precisely weighed quantity of medication. 0.1M NaOH solution is used to modify the pH of the resulting solution to the required level. Using a syringe pump, 0.2 percent w/v of Tripolyphosphate solution was introduced drop by drop to the drug-polymer solution at a flow rate of 0.5mL/min. Initial testing determined that the ratio of chitosan to TPP should be 4:1. The inclusion of TPP resulted in the production of drug-loaded nanoparticles almost instantly. Different batches of chitosan solution and drug were created to optimize the formulation, with the pH of the chitosan solution and drug varied. For comparative investigations, other formulation parameters were kept constant.

Table (1): Ingredients used in Chitosan-Coated Rizatriptan Benzoate Nanoparticles

S.No	Formulation	Ingredients			Chitosan: TPP	pH
		Drug(mg)	Chitosan(mg/mL) (volume added)	TPP(mg/mL(volume added)		
1	F1	150	2 (10mL)	2 (2.5mL)	4:1	3.6
2	F2	150	2 (10mL)	2 (2.5mL)	4:1	4.6
3	F3	150	2 (10mL)	2 (2.5mL)	4:1	5.6
4	F4	150	2 (10mL)	2 (3.3mL)	3:1	3.6
5	F5	150	2 (10mL)	2 (3.3mL)	3:1	4.6
6	F6	150	2 (10mL)	2 (3.3mL)	3:1	4.6

Characterization of Chitosan-Coated Rizatriptan Benzoate Nanoparticles

Particle Size

In polymeric nanoparticle dispersions, the Horiba Scientific SZ-100 with dynamic laser light scattering technology was used to determine the mean particle size and polydispersity index (PDI) (Prapurna Chandra *et al.,* 2024). The dispersions were diluted 100 times with deionized water before being measured at a 90° angle. The pH of the samples ranged from 3.6-4.6. The particle size was tested three times.

Zeta potential (ZP)

Using the laser light scattering technique, the zeta potential of various formulations was determined using the Horiba scientific SZ-100. Double distilled water was used to dilute the mixture properly (Dasari et al., 2021). The measurements were taken at a 90° angle.

Fourier Transform Infra-Red Spectroscopy (FT-IR)

Agilent technologies were used to record the FT-IR spectra of chitosan, Rizatriptan Benzoate, and RCNPs. IR absorbance scans of samples were examined for variations in the strength of the sample peaks in the wavenumber range of 400-4000cm^{-1}.

***In-vitro* drug release from RCNPs**

The release of Rizatriptan Benzoate from CS-NPs was investigated *in vitro* by using dialysis bags. 10 mg Rizatriptan Benzoate samples were placed in a dialysis bag and tied at both ends of a dissolving medium containing 100 mL of artificial saliva, which was agitated at 50 rpm. Experiments were conducted at a temperature of 37±0.5°C. To prevent evaporation of the dissolving medium, it was covered with aluminum foil (Sireesha *et al.,* 2017). 2.38 g of disodium phosphate, 0.19 g of mono potassium phosphate, and 8 g of sodium chloride were dissolved in 1 liter of distilled water, and the pH was corrected to 7.4 with phosphoric acid. At specific time intervals (0,1,2,3,4,5,6,7,8,12,24 hr), 1mL samples from each beaker were taken and replaced with the same amount of artificial saliva. After that, each removed sample is diluted to 10mL. A UV-visible spectrophotometer set to 240m was used to determine the medication concentration (Avachat *et al.,* 2013).

Entrapment Efficiency (%EE)

Ultracentrifugation (Remi, Mumbai) at 16000 rpm for 60 min at 4°C separated the solution instantly. The concentration of Rizatriptan Benzoate in the collected clear supernatant sample was determined using a UV spectrophotometer set to 240 nm (Dungarwal *et al.,* 2016).

Preparation of Films Containing Rizatriptan Benzoate chitosan Nanoparticles

The Rizatriptan Benzoate mucoadhesive buccal films were prepared using the Solvent casting method, which is simple and low-cost to operate. In 10 mL of produced chitosan nanoparticles, different concentrations of polyol were dissolved and swirled for 1 hr at 400 rpm at 60°C, according to Table 2. Plasticizers such as glycerol are utilized. The solution was put into a 35-cm^2 petri dish and baked for 48 hr at 40°C to allow the solvent to evaporate. A cutter chopped the resulting films into 6 cm^2 pieces for further investigation. Six different formulations of RB-loaded mucoadhesive films were created for this study.

Table (2): Ingredients used in formulation of buccal films

Formulation	Polyox (mg)	Gellan gum (mg)	Glycerol (mL)
F1	100	0	1.5
F2	200	0	0.5
F3	100	100	1.5
F4	150	150	2.0

F5	300	100	1.5
F6	400	0	1.5

Table 2 provides a full explanation of six formulations (F1–F6). Physical features, drug content homogeneity, mucoadhesion strength, and an *in vitro* release study were all examined. Each measurement was carried out twice, with the average values presented. In addition, SEM was used to assess the physicochemical features of improved films.

Characterization of buccal films

The physical appearance of all the formulations was visually evaluated for color, cracks, smoothness, and transparency. Using an electronic scale (Shimadzu), the weight of randomly selected three films (1x1cm) from each formula was measured and the mean value was determined (Boateng *et al.,* 2014).

Buccal film thickness

The thickness of film is an important criterion for determining the homogeneity of formulation component distribution. In five distinct sections of each formulation, the thickness of the film was determined using a screw gauge. The maximum difference between all five regions in the film should be less than 5%. The average data were utilized to conduct further research (Kumria *et al.,* 2016).

Folding endurance

The film's folding durability was measured by folding a tiny strip of the film ($2\times2cm^2$) repeatedly until it broke. The folding endurance value is the number of times a film can be folded without breaking (Montenegro-Nicolini *et al.,* 2017).

Surface pH

To see if each film produces irritation to the mucosa of the buccal cavity, the surface pH of all formulations was measured. The films (1x1cm) were immersed in 1mL distilled water at room temperature for 1 hr. A pH meter (ELICO pH meter (L1613)) was used to measure the pH by putting the electrode into contact with the film's surface (Gilhotra *et al.,* 2014).

Swelling ratio (%)

After recording the weight of a 2×2 cm^2 film (W1), the swelling properties of the films were measured by immersing them in PBS (pH 6.8) at 37°C. Films were taken from PBS solution at 5 min intervals and excess PBS was filtered with filter paper until the films deteriorated (Younes *et al.,* 2015).

Fourier Transform Infrared (FTIR) spectroscopy

To study probable chemical interactions between Rizatriptan Benzoate benzoate and other film formulation components, FTIR spectra of 10 mg of Rizatriptan Benzoate benzoate

and freeze-dried buccal film formulation with and without Rizatriptan Benzoate benzoate (Agilent technologies carry 630 FTIR) were utilized. Each sample was scanned at a resolution of 2 cm^{-1} in the wavenumber range of 400–4000 cm^{-1}.

Scanning electron microscopy analysis

The outside macroscopic structure of the buccal film was examined using the SEM. SEM images of the Rizatriptan Benzoate benzoate pure drug, blank film, a film containing RB drug, and film having RB-loaded chitosan nanoparticles were taken (Cheung *et al.,* 2015).

***In-vitro* disintegration and dissolution time study**

The same approach outlined in the United States Pharmacopeia (USP) was employed to evaluate *in-vitro* disintegration and dissolution time. Cut the films into 22 cm2 pieces and place them in a petri dish containing 15 mL PBS (pH 6.8). They were then placed in a 37°C incubator shaker with a 50 rpm rotating speed. When the films began to disintegrate *in vitro,* the disintegration time was determined, and the dissolution time was determined when they were entirely dissolved in PBS (Nair *et al.,* 2013).

***In-vitro* drug release from buccal film loaded with RCNPs**

Films (0.6x0.6cm) filled with RCNPs equivalent to 0.22mg Rizatriptan Benzoate were used in the *in-vitro* study. Each film was placed in a dialysis bag with 2mL of artificial saliva, which was then immersed in 8mL of artificial saliva and agitated at 100rpm at 37°C. At different time points, 1mL samples from each dissolution flask were withdrawn and replaced with the same quantity of artificial saliva, which was then examined by UV. This experiment was carried out in three duplicates (n=3) (Anroop *et al.,* 2021).

Results and Discussion

Particle Size

The prepared Rizatriptan Benzoate-loaded chitosan nanoparticles (RCNPs) were analyzed for particle size and found to be 476.6 nm. The colloidal nanoparticle size was ranging from 50-1000 nm. The loading of the Rizatriptan Benzoate in the chitosan matrix leads to an increase in the particle size.

The RCNP particle size was within the range as shown in Figure 1.

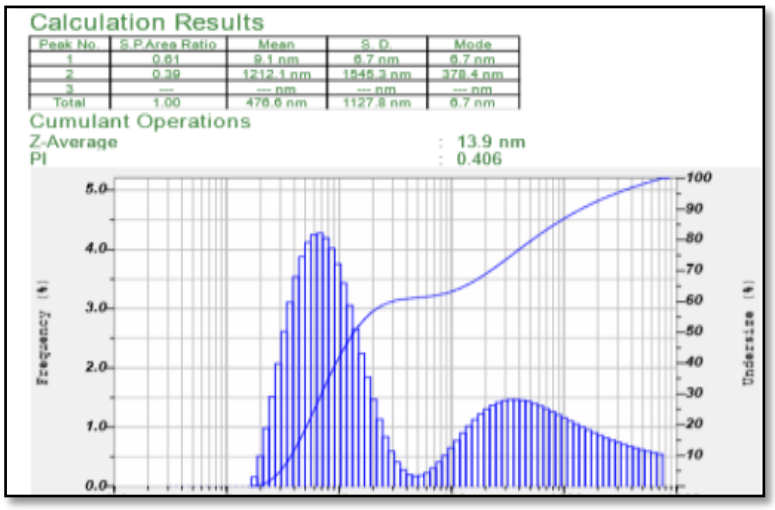

Figure (1): Particle size of RCNPs

Zeta potential

Zeta potential values generally range from -30 to 30. The mean Zeta potential of RCNPs was found to be 22.6mv as shown in Figure 2. Zeta potential values generally range from -30 to 30. The mean Zeta potential of RCNPs was found to be 22.6mv as shown in Figure 2. Hence the value indicates successful loading of the Rizatriptan Benzoate into the chitosan matrix.

Entrapment efficiency (%EE)

The % entrapment efficiency (%EE), value was found to be 78.70%. The result reveals the drug was successfully entrapped in the nanoparticle and the encapsulated drug was loaded into the unit weight of the nanoparticle.

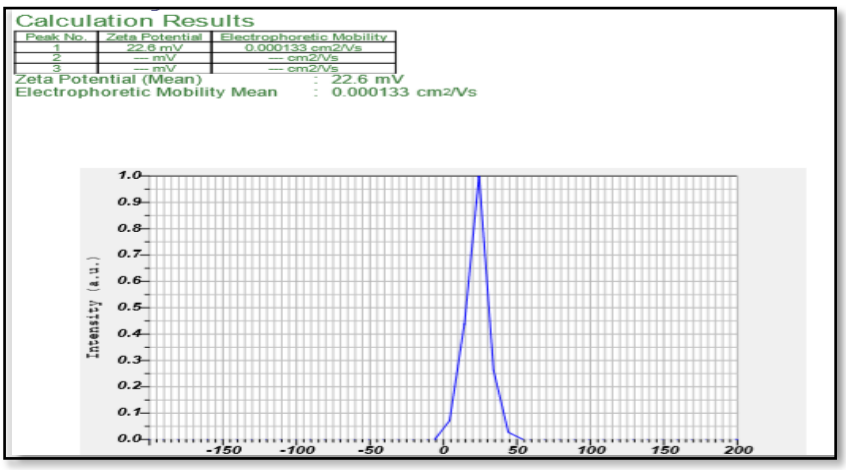

Figure (2): Zeta potential of RCNPs.

Fourier Transform Infrared (FTIR) spectroscopy

FTIR was used to look for potential interactions between RB and other ingredients in the buccal film formulation (polyox, glycerol,). The signal at 1603 cm^{-1} in the FTIR spectra of RB is attributed to C=C stretching in aromatic rings. C–N stretching in tertiary amines is

responsible for the significant absorption peak at 1349 cm^{-1}. C–O stretching in carboxylic acid has a comparable peak at 1291 cm^{-1} (Figure 4a)[36]. The spectra for components of a buccal film formulation (a film without RB) are shown in Figure 4b. C–H stretching vibration in an alkane was attributed to the peak at 2878 cm^{-1}. C–O stretching in the hydroxyl group[36] is responsible for the peaks at 1092 and 1466 cm^{-1}. The FTIR spectra of a film containing RB with an optimized formulation are shown in Figure 4C. Although there may be some interaction between the medicine and the film components, no new peaks or significant peak changes are identified.

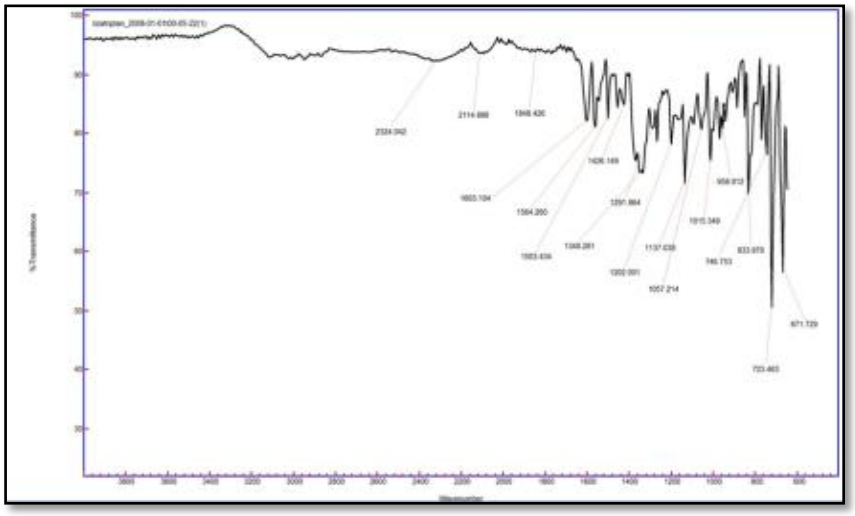

Figure (3A): FTIR Spectra of Rizatritan.

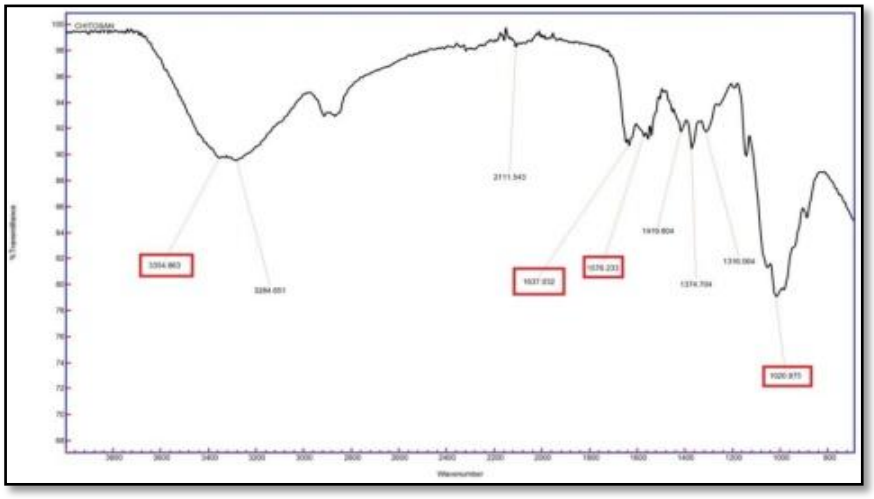

Figure (3B): FTIR Spectra of Chitosan.

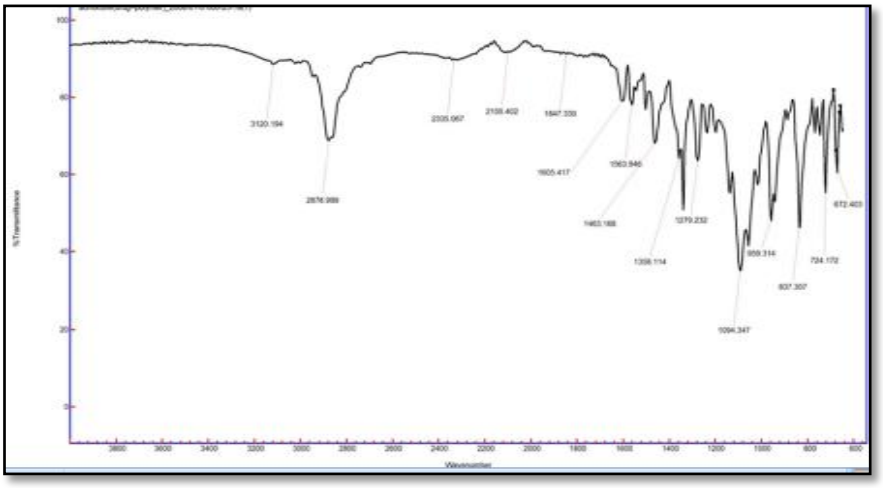

Figure (3C): FTIR Spectra of RCNPs.

***in-vitro* Drug release**

The *in-vitro* release data was examined using five mathematical models to investigate the release kinetics of Rizatriptan Benzoate from RCNPs: Hughchi model, zero order, first order, and Korsmeyer-Peppas model. The regression coefficient method was used to examine the data, and the regression coefficient values for each model were calculated (Table 4). The greatest R2 value of 0.9619 indicated that the kinetic profile of Rizatriptan Benzoate release from RCNPs in PBS followed the first-order model. This means that the rate of medication release is proportional to its concentration. The Higuchi model explained the release of pharmaceuticals from insoluble matrixes, while the zero order model characterized situations where the drug release rate is independent of its concentration.

The processes of drug release from NPs were investigated using the power law model. When more than one type of drug release phenomenon is present, this model is useful for studying drug release from polymeric structures. Relaxation of the polymer and diffusion are postulated as two separate mechanisms. The release profile of an active agent can be classified into the Fickian model (Case I) and the Non-Fickian model (Case II) depending on the value of n. (Case II, anomalous case, and Super Case II). When n =0.5, the model is a Fickian model (Case I), with diffusion governing drug release. When n=1, the non-Fickian (Case II) model is used. The expansion or relaxing of polymeric chains is the mechanism of drug release in the Non-Fickian model. When 0.5 is the same. Finally, when n>1, the Super Case II model occurs. Tension and breaking of the polymer are proposed in this scenario.
In other words, polymeric chain erosion occurs, and it is frequently associated with swellable and erodible polymers.[32]The non-Fickian Super Case II diffusion is represented by the n value of the NPs generated in this study, which is 1.7212 in the Korsmeyer- Peppas model. This shows that the main process of drug release is the degradation of the CS-NPs.

Table (3): *In-vitro* drug release from RPNPs.

Time (Hrs)	Conc. (µg/mL)	Vol. of dissolution medium (mL)	Amt of drug (µg)	Amt of drug (mg)	% drug released	% drug remaining	Log % drug remaining
0	0	100	0	0	0	100	2
1	13.05	100	1305	1.30	13.05	86.95	1.93
2	16.31	100	1631	1.63	16.31	83.69	1.92
3	18.67	100	1867	1.86	18.67	81.33	1.91
4	23.66	100	2366	2.36	23.66	76.34	1.88
5	31.62	100	3162	3.16	31.62	68.38	1.83
6	37.23	100	3723	3.72	37.23	62.77	1.79
8	63.12	100	6312	6.21	62.12	37.88	1.57
12	75.17	100	7517	7.51	75.17	24.83	1.39
24	84.20	100	8420	8.42	84.20	15.80	1.19

CHARACTERIZATION OF THE BUCCAL FILMS

The rupturing resistance and mechanical strength of buccal films were determined by measuring folding endurance. Mechanical strength grew in tandem with folding endurance. All formulas' folding endurance was tested over 100 times, indicating good flexibility.

Swelling ratio (%)

Figure 4 depicts the swelling ratio of all formulations. Each film's swelling ratio was measured until it degraded. At various intervals in time, the swelling ratio was measured. Up to 30 min, the F6 formulation, which had the highest concentration of POLYOX, demonstrated the highest swelling ratio (29%).

Surface pH

The effect of pH on buccal mucosa was analyzed by measuring films surface pH. The surface pH of Rizatriptan Benzoate benzoate films was measured in the range of 6.92 ± 0.09 to 6.78 ± 0.09 for all formulations (Table 3). Results revealed that the surface pH of films is in the range of healthy human saliva, which is 6.3–7.3.

Buccal film thickness

The accuracy of drug concentration in different sections of each film is proportional to the uniformity of thickness and drug content. The film thickness was found to be in the range of 0.179± 0.012 to 0.275 ±0.015 mm after all measurements were duplicated.

Table (4): Surface pH and thickness of the film.

Formulation	Surface pH	Thickness (mm)
F1	6.75 ± 0.07	0.179 ± 0.012
F2	6.97 ± 0.06	0.287 ± 0.008
F3	6.56 ± 0.04	0.278 ± 0.027
F4	6.94 ± 0.08	0.266 ± 0.038
F5	6.65 ± 0.07	0.169 ± 0.016
F6	6.78 ± 0.09	0.275 ± 0.015

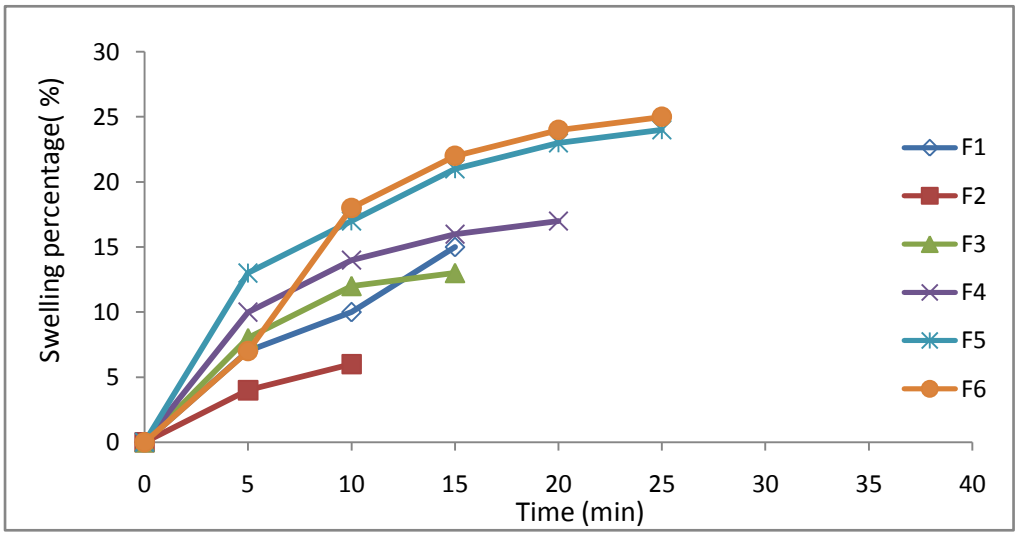

Figure (4): Swelling Ratio of RCNPS of buccal films

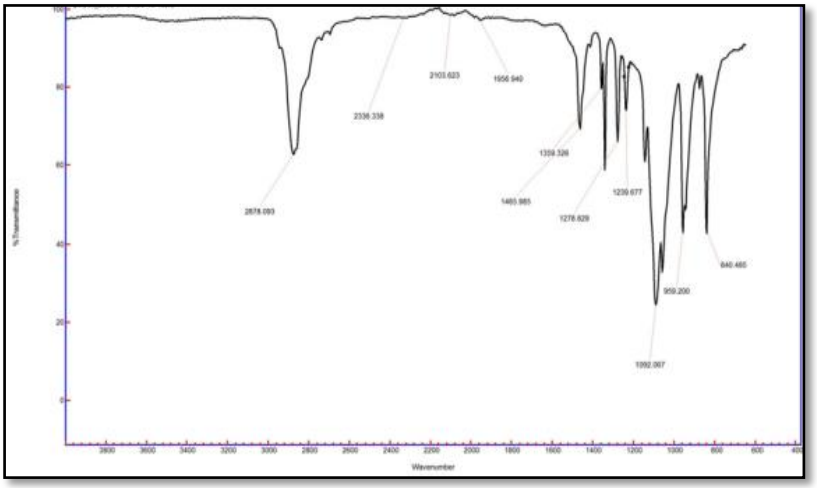

Figure (5A): FTIR Spectra of films without drug.

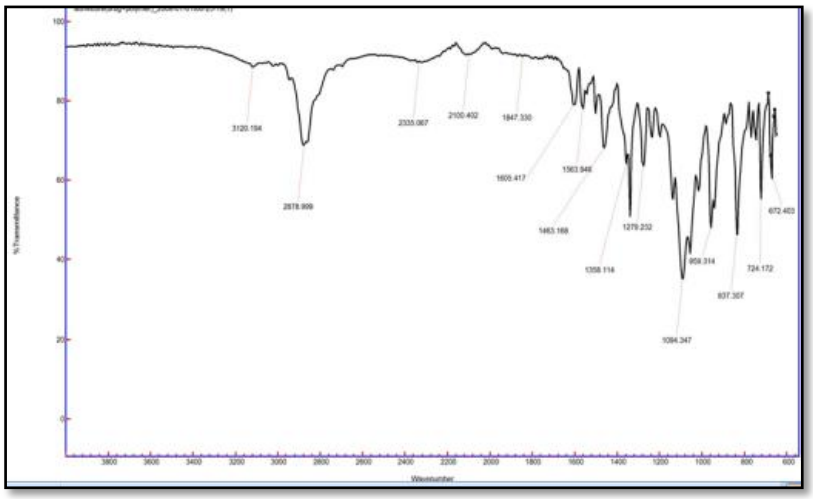

Figure (5B): FTIR of RCNP films.

Scanning Electron Microscopy analysis

SEM was employed to examine the surface morphology of RB, film without RB, and film with RB, as shown in Figure 4. Only the Rizatriptan Benzoate benzoate sample shows a regular crystal structure in a representative scanning electron micrograph (Figure 6a). Without the RB, the film has a homogeneous structure with small pores (Figure 6b). The images of film formulations with and without RB have the same look on the surface, according to the results.

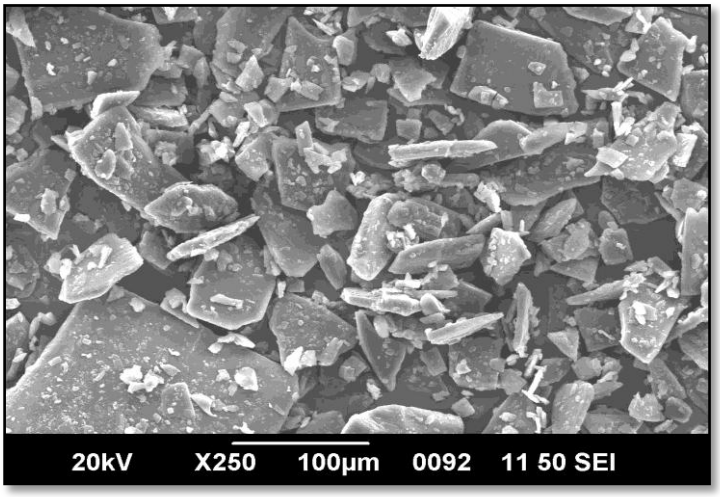

Figure (6A): SEM image of RCNP films

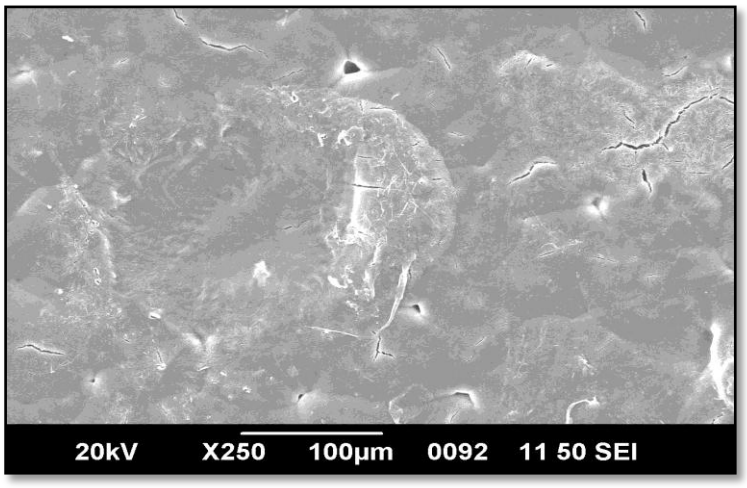

Figure (6B): SEM image of BF of films

***In-vitro* disintegration and dissolution time study**

In-vitro disintegration and dissolution times were measured two times and were found to be around 7.80 ± 0.25 to 12.94 ± 0.15 min and 32.87 ± 1.26 to 64.68 ± 0.61 min, respectively. Table 4 shows the results of *in vitro* disintegration and dissolving time for all formulations. Increases in polymer concentration and viscosity, as expected, could hasten disintegration and dissolution time.

***In-vitro* drug release study from buccal film-loaded RCNPs**

The release of the drug was controlled by both the NPs and the films, however, the film caused the drug release to be delayed more. This suggests that the polymer acts as an additional barrier to medication release. The release of Rizatriptan Benzoate from the NPs followed a first-order kinetics and a non-Fickian Super Case II diffusion, as previously mentioned. The release data was examined based on four mathematical models: Hughchi model, zero order, first order, and Korsmeyer-Peppas model, to investigate the release kinetics of Rizatriptan Benzoate from the buccal film after loading them with RCNPs. The kinetic profile of Rizatriptan Benzoate release was determined to follow the first-order model (r^2 0.9644) based on r^2 values. The n value was found to be 1.34 using the Korsmeyer-Peppas model. The presence of n>1 values suggests that polymer swelling and erosion, rather than diffusion, controls drug release. Before loading the particles in the film, the same method was discovered to control the release of Rizatrptan from the NPs.

Table (5): Disintegration and dissolution time of buccal films.

Formulation	Disintegration time(min)	Dissolution time(min)
F1	7	32
F2	8	34
F3	9	38

F4	10	41
F5	11	42
F6	12	64

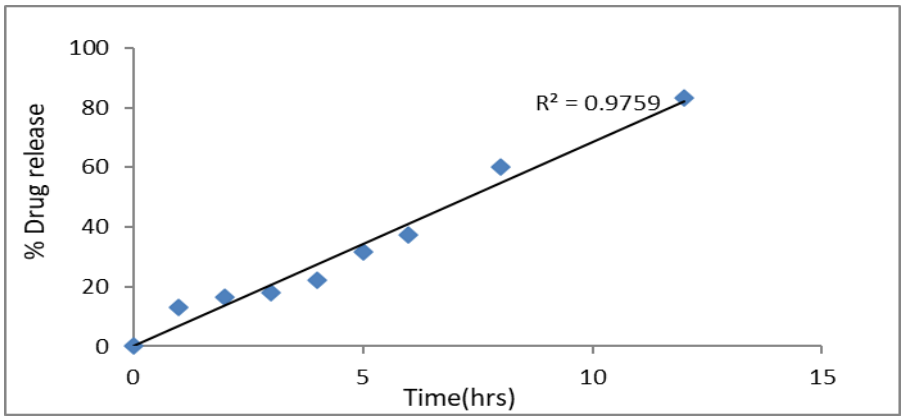

Figure (7a): Zero Order Kinetics.

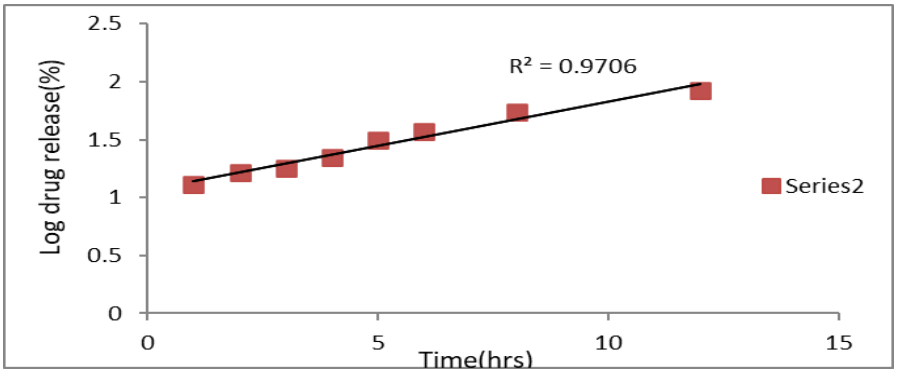

Figure (7b): First Order Kinetics.

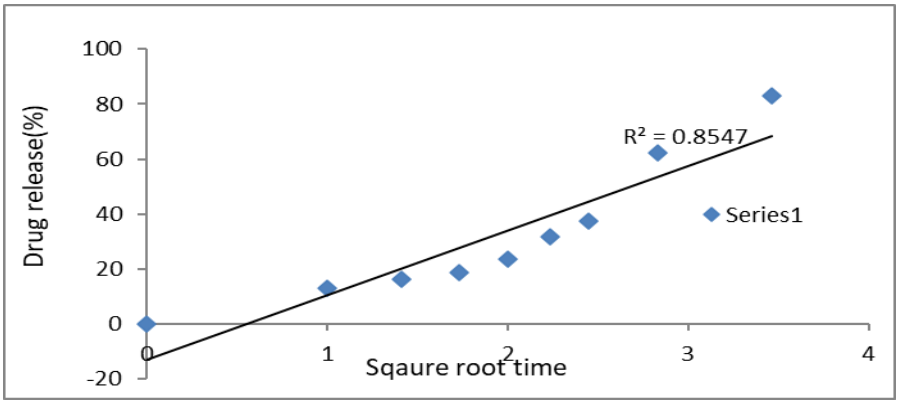

Figure (7c): Higuchi Model

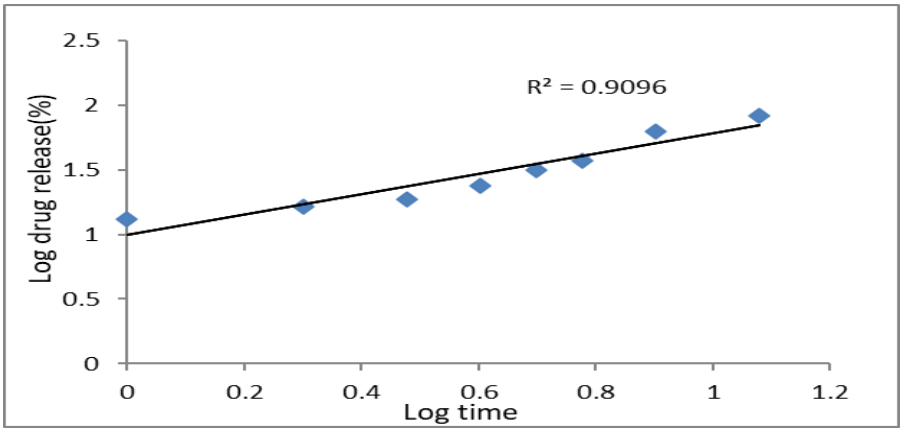

Figure (7d): Kormeyer-Peppas Model.

Table (6): Drug Release Kinrtics of Buccal Films.

Formulation	**Zero order**	**First order**	**Higuchi**	**Korsemeyer-peppas**	
				r^2	**n**
RCNPs	0.9296	0.9619	0.9177	0.9517	1.71
The buccal film containing RCNPs	0.9312	0.9644	0.9261	0.9411	1.34

Summary

In this study, the ionic gelation technique was used to prepare chitosan nanoparticles. The release of Rizatriptan Benzoate from the RCNPs buccal films followed a first-order kinetics and a non-Fickian Super Case II diffusion. RCNP films and buccal films containing plain Rizatriptan Benzoate are evaluated for ex-vivo permeation study. The results showed that the drug permeation characteristics of the optimized RCNPs film (504 µg/cm2) were significantly better than the film containing plain drug (320 µg/cm2). The results suggest that RCNP buccal films could be a potential candidate to achieve optimum drug release for effective treatment of migraine.

Conclusions

In this study, the ionic gelation technique was used to prepare chitosan nanoparticles. During the preparation step, the NPs were loaded with Rizatriptan Benzoate. These NPs were characterized in terms of size, charge, morphology, drug loading, and drug release. Separately, buccal films were prepared, and their properties were optimized in terms of weight, surface pH, thickness, folding endurance, and mucoadhesion. After that, the NPs were dispersed in the films and characterized.

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