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# Formulation Design and Evaluation of Olmesartan Mucoadhesive Buccal Tablets

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ABSTRACT

The present study mucoadhesive buccal tablets of Olmesartan can be used to bypass the extensive hepatic first-pass metabolism and improve the bioavailability. The mucoadhesive Buccal tablets of Olmesartan are a drug of choice in the treatment of high blood pressure, heart failure, and diabetic kidneys. The FTIR results revealed that there was no interaction between drugs and other excipients. All the post-compression parameter was within acceptable limits. The *in vitro* drug release was in the range of 85.35% to 99.65% after 8 hrs the very best regression integrity (r) the best fit role model for F1 to F8 used to be zero-order and for F9 it was Higuchi matrix.

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## INTRODUCTION

Olmesartan is in a class of medications called angiotensin II receptor antagonists. It works by blocking the action of certain natural substances that tighten the blood vessels, allowing the blood to flow more smoothly and the heart to pump more efficiently [1]. Frequent administration is necessary to maintain its therapeutic concentration. To maintain the therapeutic concentration of Olmesartan modified release formulations are necessary. The main aim of the work is to prolong the residence time at the site of application or absorption and to facilitate intimate contact with the underlying absorption surface to improve and enhance bioavailability [2].

## MATERIALS AND METHODS

Olmesartan has received a free sample from Medhrisch Pharma, Bangalore. Carbopol 934, HPMC 100 m, Xanthan gum used to be purchased from SD fine chemicals Ltd., Mumbai. Talc, Magnesium stearate, Lactose & sodium hydroxide used to be acquired from SD fine chemicals Ltd., Mumbai. All abundant chemical substances as well as chemical agent utilized in this study, are of analytical grade.

### Methodology

Compatibility study with excipients was performed by FTIR. The unmixed drug its arrangements with excipients encounter FTIR reports [3].

### Formulation of Olmesartan Buccal Tablet

It have been planned out by direct compression method exploitation polymers such as carbopol 934, HPMC K 100 M, Xanthan gum, lactose, magnesium stearate, talc in a different ratio. The ingredients have been visually inspected correctly and blended by agitation in a motor along with pestle [4].

The above-lubricated blend was loaded within tablets victimisation 12 mm Standard concave punches in an 8 Station Rotary Tablet Machine [Table 1].

### Pre Compression Evaluation Parameters

The blended mixture was analyzed for flow characteristics as follows [5].

Angle of repose: $\theta = \tan^{-1}$ (h/r)

Bulk density = Weight of powder/ Bulk volume

Tapped density = Weight of powder/ Tapped volume

Carr's Index (I) = (Tapped Density - Bulk Density)/ (Tapped Density) x100

Hausner's ratio = Tapped density/ Bulk density

### Post Compression Parameters

### Tablet Thickness

Tablet thickness was determined by keeping a tablet in between two arms the Vernier calipers [6].

### Hardness and Friability

It was determined with the help of the Monsanto hardness test. Friability was determined by first weighing 20 tablets are placed in a Roche Friabilator [7]. The friability was calculated using the following equation

%Friability=100(Wo-Wf)/Wo

Where Wo-Wf is the weights of the tablet before and after a test for friability respectively.

### Weight Variation

This test transmits by balancing 20 tablets separately, together with the help of digital balance estimating the average weight, and in respect to each tablet weight to the average weight [8].

### Content Uniformity

Five tablets were accurately weighed and powdered. A quantity of the powder equivalent to 3 mg of Olmesartan was weighed accurately and extracted in 100 ml methanol by shaking for 20 min then samples were analyzed spectrophotometrically at 257 nm [9].

### Moisture Absorption

The swelling rate of the bioadhesive tablets was evaluated by using a 1% agar gel plate. The average weight of the tablet was calculated [10]. The tablets were placed on gel surface in a Petri dish placed in an incubator at $37\pm1^{O}$C.

% Moisture absorption = [(final weight – initial weight) / initial weight] x100.

### *In-vitro* Dissolution

The USP type II paddle apparatus in 6.8 PH phosphate buffer (900 ml) at $37^{0}$C$\pm0.5^{0}$C at speed 50±5 rpm. At specified time intervals, 5 ml samples were collected and immediately replaced with an equal volume of fresh medium [11].

Samples were suitably diluted and analyzed by using UV spectrophotometer at 257 nm.

### Bioadhesive Strength

The height of the lower vial was adjusted so that a tablet could adhere to the mucosal tissue on the upper vial. A constant force was applied on the upper tablet of polymer (D) was vial for 2 minutes after which it was removed and the upper vial was then connected to the balance [Figure 1]. Then, the weight on the right side pan was slowly added in an increment of 0.5 g till the two vials just separated from each other [12]. The total weight (gm) required to detach two vials was taken as a measure of mucoadhesive strength [Figure 2].

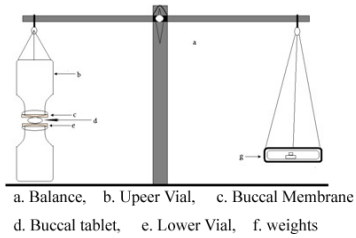


**Figure 1: Modified Physical Balance**

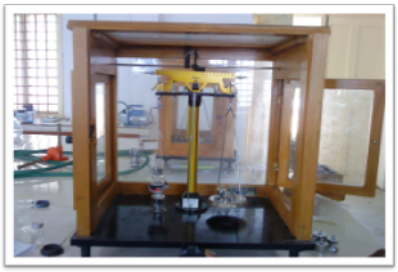

**Figure 2: *In vitro* Assembly for Mucoadhesive Strength**

### Kinetic Treatment

The data acquired from the *in vitro* dissolution tests obtain the kinetic track record analysis [13].

Zero-order kinetics: $Q_t = Q_o + K_o t$

First-order kinetics: $Q_t = log\ Q_o + K_1 t/2.303$

Higuchi model: $Q_t = K_H \cdot t^{1/2}$

Korsmeyer-Peppas release model: $Mt/\ M_\infty = K \cdot t^n$

## RESULTS AND DISCUSSION

### Compatibility Studies

From drug excipient compatibility trend analysis, we referred to the absence of interactions between pure drug and excipients [Figure 3 & Table 2].

### Derived Properties of Powder

The blend of materials became tested as characteristics like angles of repose, bulk densities, tapped den-

**Table 1: Composition of Olmesartan Mucoadhesive Buccal Tablets**

| Formula Code | Drug (mg) | CP934 (mg) | HPMC K 100M (mg) | Xanthan gum (mg) | Lactose (mg) | Talc (mg) | Mg.Ster (mg) |
|---|---|---|---|---|---|---|---|
| $F_1$ | 3 | 35 | – | 5 | 102 | 1 | 2 |
| $F_2$ | 3 | 50 | – | 5 | 89 | 1 | 2 |
| $F_3$ | 3 | - | 35 | 5 | 109 | 1 | 2 |
| $F_4$ | 3 | – | 50 | 5 | 89 | 1 | 2 |
| $F_5$ | 3 | 30 | 30 | 5 | 79 | 1 | 2 |
| $F_6$ | 3 | 15 | 30 | 5 | 94 | 1 | 2 |
| $F_7$ | 3 | 25 | 50 | 5 | 64 | 1 | 2 |
| $F_8$ | 3 | 20 | 40 | 10 | 74 | 1 | 2 |
| $F_9$ | 3 | 30 | 53 | 7 | 44 | 1 | 2 |

**Table 2: FTIR Functional Groups**

| FTIR Spectrum | OH Groups | C=O Group | Aromatic CH | Aliphatic CH |
|---|---|---|---|---|
| Drug | 3605 | 1693, 1620 | 3008, 2973 | 2873 |
| Drug + Carbopol 934 | 3448 | 1620, 1697 | 3008, 2973 | 2870 |
| Drug + HPMC K100M | 3432 | 1690, 1620 | 2973 | 2875 |
| Drug + Xantham Gum | 3464 | 1689, 1620 | 2937 | 2870 |

**Table 3: Evaluation of Blend Characteristics of Olmesartan**

| Formulation Code | Bulk Density (gm/cc) | Tapped density (gm/cc$^3$) | Compressibility Index (CI) | Angle of repose ($\theta$) ± S.D (n=3) |
|---|---|---|---|---|
| $F_1$ | 0.415 | 0.48 | 16.66 | 27.65± 1.18 |
| $F_2$ | 0.395 | 0.45 | 13.28 | 28.695± 1.39 |
| $F_3$ | 0.371 | 0.43 | 14.18 | 29.031± 1.58 |
| $F_4$ | 0.432 | 0.50 | 13.33 | 27.030± 1.60 |
| $F_5$ | 0.382 | 0.47 | 14.70 | 28.654± 1.83 |
| $F_6$ | 0.317 | 0.43 | 14.28 | 29.374± 1.69 |
| $F_7$ | 0.427 | 0.49 | 15.85 | 27.321± 1.54 |
| $F_8$ | 0.411 | 0.47 | 14.94 | 28.541± 1.32 |
| $F_9$ | 0.384 | 0.44 | 13.65 | 29.612± 1.12 |

**Table 4: Physical Characteristics of Olmesartan Blend**

| Formulation Code | Thickness (mm) ± S.D. | Diameter (mm) | Hardness (kg/cm$^2$) ± S.D. (n=3) | Friability (%) |
|---|---|---|---|---|
| $F_1$ | 3.19 ± 0.015 | 7.2 | 5.2 ± 0.447 | 0.72+0.03 |
| $F_2$ | 3.22 ± 0.057 | 7.1 | 5.4 ± 0.548 | 0.79±0.02 |
| $F_3$ | 3.41 ± 0.072 | 6.9 | 5.8 ± 0.447 | 0.80±0.07 |
| $F_4$ | 3.32 ± 0.061 | 7.2 | 5.6 ± 0.548 | 0.69±0.04 |
| $F_5$ | 3.51 ± 0.150 | 7.3 | 5.4 ± 0.548 | 0.74±0.05 |
| $F_6$ | 3.35 ± 0.106 | 7.4 | 6.6 ± 0.543 | 0.78±0.06 |
| $F_7$ | 3.21 ± 0.112 | 7.2 | 6.1 ± 0.501 | 0.71±0.03 |
| $F_8$ | 3.35 ± 0.106 | 7.4 | 6.2 ± 0.442 | 0.68±0.06 |
| $F_9$ | 3.35 ± 0.106 | 7.5 | 6.6 ± 0.512 | 0.61±0.08 |

**Table 5: Evaluation of Olmesartan Tablet**

| Formulation Code | Average weight of Tablet ± S.D. (n=3) | Mucoadhesive strength (gms) ± S.D. (n=3) | %Moisture Absorption | % Drug content ± S.D. (n=3) |
|---|---|---|---|---|
| $F_1$ | 149.0 ± 0.16 | 12.0 ± 0.12 | 22.06 ±1.95 | 96.1 ± 1.31 |
| $F_2$ | 150.9 ± 0.12 | 14.1±0.18 | 27.73 ±0.42 | 99.4 ± 1.52 |
| $F_3$ | 148.8 ± 0.16 | 16.0 ± 0.16 | 31.80 ±0.30 | 98.5 ± 1.31 |
| $F_4$ | 151.7 ± 0.16 | 18.50±0.24 | 34.80 ±0.56 | 97.1 ± 1.46 |
| $F_5$ | 150.2 ± 0.08 | 19.1±0.3 | 37.25 ±1.32 | 97.8 ± 1.45 |
| $F_6$ | 150.8 ± 0.54 | 19.5±0.24 | 39.48 ±1.41 | 98.3 ± 1.00 |
| $F_7$ | 150.2 ± 0.51 | 22.30±0.26 | 35.48 ±1.32 | 98.5 ± 1.64 |
| $F_8$ | 148.6 ± 0.54 | 23.1±0.42 | 37.48 ±1.76 | 96.1 ± 1.32 |
| $F_9$ | 149.8 ± 0.05 | 24.40±0.55 | 39.54 ±1.41 | 99.4 ±0.89 |

**Table 6: *In-vitro* Drug Release of Mucoadhesive Buccal Tablets**

| Time (Hrs) | % Drug Release | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 |
| 1 | 11.57 | 13.37 | 16.76 | 13.14 | 15.98 | 17.18 | 17.89 | 15.06 | 10.64 |
| 2 | 26.87 | 34.86 | 25.33 | 27.64 | 22.15 | 36.38 | 24.25 | 28.76 | 35.23 |
| 3 | 32.27 | 43.44 | 36.55 | 36.44 | 36.80 | 45.56 | 33.67 | 34.56 | 43.76 |
| 4 | 43.29 | 53.55 | 46.74 | 48.31 | 47.50 | 56.76 | 42.86 | 56.24 | 55.34 |
| 5 | 62.75 | 54.82 | 55.52 | 66.22 | 65.48 | 61.33 | 51.66 | 66.22 | 66.55 |
| 6 | 72.46 | 65.61 | 74.76 | 79.78 | 76.34 | 65.40 | 70.88 | 78.90 | 72.23 |
| 7 | 81.55 | 73.43 | 85.34 | 82.21 | 86.88 | 76.54 | 81.45 | 87.34 | 82.34 |
| 8 | 91.74 | 85.35 | 96.15 | 95.42 | 94.50 | 87.24 | 93.06 | 97.53 | 99.65 |

**Table 7: Release Order Kinetics of Olmesartan Mucoadhesive Buccal Tablets**

| Formulation | $r^2$ values | | | | n values |
|---|---|---|---|---|---|
| | Zero Order | First Order | Higuchi | Korsmeyer - Peppas | Korsmeyer-Peppas |
| F1 | 0.515 | 0.602 | 0.945 | 0.924 | 1.146 |
| F2 | 0.561 | 0.689 | 0.827 | 0.928 | 1.166 |
| F3 | 0.731 | 0.821 | 0.758 | 0.876 | 1.156 |
| F4 | 0.929 | 0.915 | 0.813 | 0.733 | 1.186 |
| F5 | 0.927 | 0.909 | 0.722 | 0.824 | 1.176 |
| F6 | 0.959 | 0.877 | 0.871 | 0.764 | 1.286 |
| F7 | 0.973 | 0.866 | 0.755 | 0.887 | 1.156 |
| F8 | 0.956 | 0.724 | 0.847 | 0.795 | 1.226 |
| F9 | 0.927 | 0.870 | 0.925 | 0.931 | 1.163 |

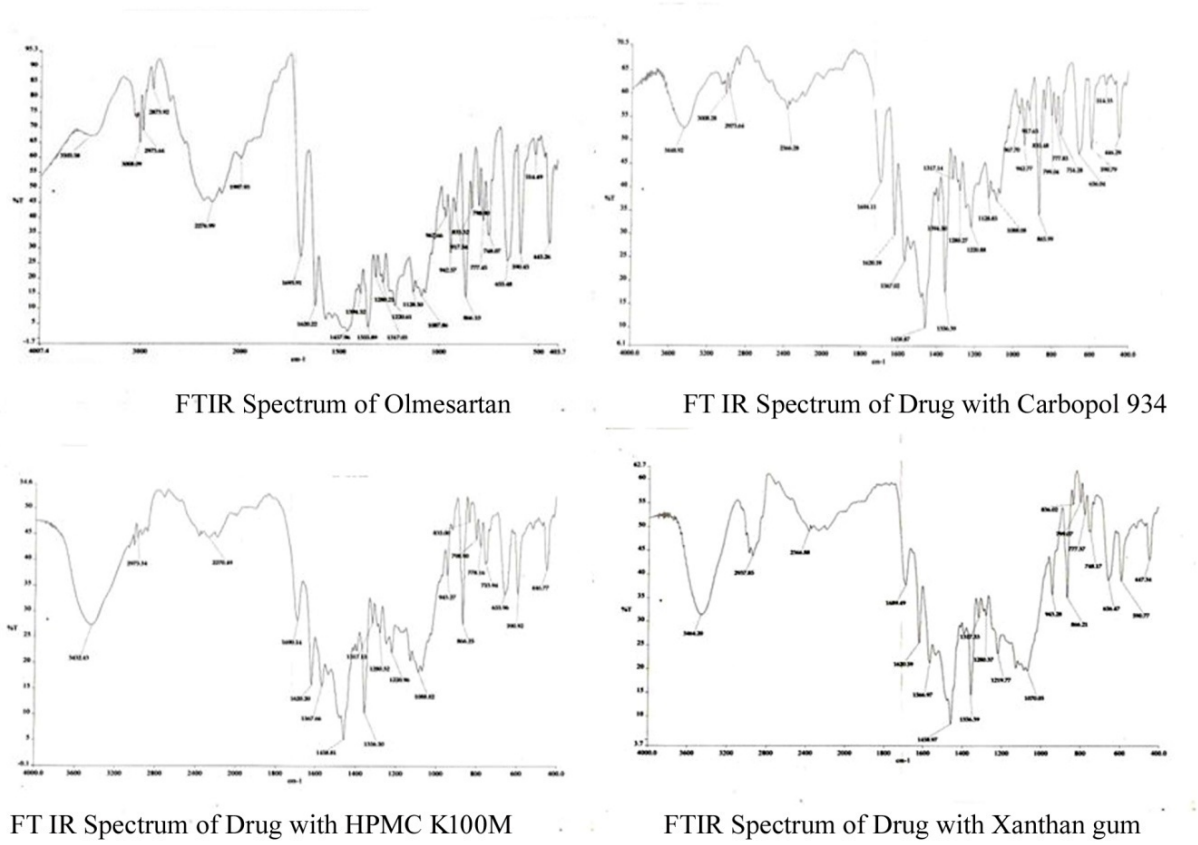


**Figure 3: FTIR Spectrum of Drug with Carbopol 934, HPMC K100M & Xantham Gum**

sity, Compressibility index have it good flow characteristics and flow rates [Table 3].

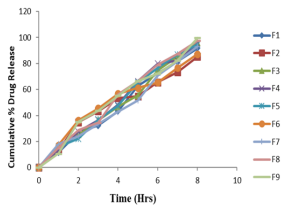


**Figure 4: *In vitro* release studies for different formulations**

### Thickness and Diameter

The thickness of All the formulations encounter ultimate within the range of 3.19 ± 0.015 mm to 3.51 ± 0.150 mm. diameter of all formulation was found to be 6.9 mm to 7.5 mm.

### Hardness

All the formulations encounter ultimate within the range of 5.2 ± 0.44 kg/sq.cm. to 6.6 ± 0.54 kg/sq.cm.

### Friability

All the formulations encounter ultimate within the range of 0.69 % to 0.80 % [Table 4].

### Average Weight

All the formulations encounter ultimate within the range of 148.6 ± 0.54 % to 151.7 ± 0.16 %.

### Mucoadhesive Strength

All the formulations encounter ultimate within the range 12.0 ± 0.16 gm to 24 .50 ± 0.26 gm.

### Moisture Absorption

All formulation follow the variety of 22.06 ±1.95 % to 39.54 ±1.41%.

### Drug Content

All formulation follow the variety of 96.1 ± 1.31 % to 99.4 ±0.89 % [Table 5].

### *In vitro* Drug Release Studies

Among all the formulations $F_9$ showed the drug release of 99.65% [Table 6,Figure 4].

### Drug Release Studies

According to the very best regression integrity (r) the best fit role model for F1 to F8 used to be zero-order and for F9 it was Higuchi matrix [Table 7].

## CONCLUSION

Based on the results of pre compression & post compression evaluation tests it can be concluded that formulation F9 was the best formulation for the buccal drug delivery system. Hence, the mucoadhesive buccal tablets of Olmesartan might be prepared as well as better bioavailability plus extended therapeutic effect well management. From the result and conclusion of the research work, it can be concluded that Olmesartan can be delivered via buccal route for better bioavailability and enhanced patient compliance.

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### Conflict of Interest

The authors testify that they got no conflict of interest in that study.

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## REFERENCES

[1] Amir H. Shojaei. Buccal Mucosa As A Route For Systemic Drug Delivery: A Review. *Journal of Pharmacy & Pharmaceutical Sciences*, 1(1):15–30, 1998.

[2] Bruno Fonseca-Santos and Marlus Chorilli. An overview of polymeric dosage forms in buccal drug delivery: State of art, design of formulations and their in vivo performance evaluation. *Materials Science and Engineering: C*, 86:129–143, 2018.

[3] Angela Abruzzo, Teresa Cerchiara, Federica Bigucci, Maria Caterina Gallucci, and Barbara Luppi. Mucoadhesive Buccal Tablets Based on Chitosan/Gelatin Microparticles for Delivery of Propranolol Hydrochloride. *Journal of Pharmaceutical Sciences*, 104(12):4365–4372, 2015.

[4] S Neelima, C Siva Kumari, M Pradeep Kumar, P Anitha, and M Purushothaman. Development and Evaluation of Colon Targeted compressed Coating tablets of Etodolac. *Journal of Global Trends in Pharmaceutical Sciences*, 7(4):3512–3519, 2016.

[5] Gazzi Shanker, Chegonda K. Kumar, Chandra Sekhara Rao Gonugunta, B. Vijaya Kumar, and Prabhakar Reddy Veerareddy. Formulation and Evaluation of Bioadhesive Buccal Drug Delivery of Tizanidine Hydrochloride Tablets. *AAPS PharmSciTech* , 10(2):530–539, 2009.

[6] Harini Amballa, Navaneetha Kaluva, Sree Giri Prasad Beri, Krishna Mohan Chinnala, and Mayuri Konda. Formulation and Characterization of Eplerenone Mucoadhesive Buccal Tablets. *Research Journal of Pharmacy and Technology*, 14(6):3097–3103, 2021.

[7] Burak Çelik. Risperidone mucoadhesive buccal tablets: formulation design, optimization and evaluation. *Drug Design, Development and Therapy*, 11:3355–3365, 2017.

[8] T. Srikrishna, Anees K. Mohammad, Priyanka S. Lakshmi, K. Lavanya, B. Mounika, and Krishna M. Murali. Design, Development and Evaluation of Buccal Tablets of Pregabalin. *Research Journal of Pharmacy and Technology*, 10(2):579–588, 2017.

[9] J Ravi Kumar Reddy and Y Indira Muzib. Formulation and Evaluation of Mucoadhesive Buccal Film of Amiloride Hydrochloride. *Journal of Global Trends in Pharmaceutical Sciences*, 3(3):828–835, 2012.

[10] Ananta Choudhury, Sujoy Das, Satish Dhangar, Sumit Kapasiya, and Abhishak Kanango. Development and Characterization Buccoadhesive Film of Ciprofloxacin Hydrochloride. *International Journal of PharmTech Research*, 2(2):1050–1057, 2010.

[11] S A Yehia, O N El-Gazayerly, and E B Basalious. Fluconazole Mucoadhesive Buccal Films: In Vitro/In Vivo Performance. *Current Drug Delivery*, 6:17–27, 2009.

[12] Ranjith Kumar Averineni, Subramanian Ganesa Sunderajan, Srinivas Mutalik, Usha Nayak, Gopal Shavi, Karthik Armugam, Sreenivasa Reddy Meka, Sureshwar Pandey, and Udupa Nayanabhirama. Development of mucoadhesive buccal films for the treatment of oral sub-mucous fibrosis: a preliminary study. *Pharmaceutical Development and Technology*, 14(2):199–207, 2009.

[13] S. Singh, S. Jain, M. S. Muthu, S. Tiwari, and R. Tilak. Preparation and Evaluation of Buccal Bioadhesive Films Containing Clotrimazole. *AAPS PharmSciTech*, 9(2):660–667, 2008.

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