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Research Article

Formulation And Evaluation Of Insitu Forming Floating Gel Of Olanzapine For The Treatment Of Schizophrenia

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ABSTRACT

The purpose of writing this review on floating drug delivery systems was special focus on the principle mechanism of floatation to achieve gastric retention. Conventional oral dosage forms has short residence times & unpredictable gastric emptying time. The idea of gastric retention comes from the need to localize drugs at a specific region of gastrointestinal tract (GIT) such as stomach in the body. Many drugs get absorbed only in the upper intestinal tract, designing such molecules as once-daily formulations are exclusive for these molecules. Thus GI retention platforms had emerged. Gastroretentive drug delivery systems are designed to be retained in the stomach for a prolonged time. Gastroretentive drug delivery systems have potential for use as controlled release drug delivery system. The use of floating drug delivery system is one method to achieve prolonged gastric residence times, providing opportunity for both local & systemic drug action. Thus, gastroretention could help to provide greater availability of new products and consequently improved therapeutic activity and substantial benefits to patients.

INTRODUCTION

The focus of pharmaceutical research is steadily shifted from the development of new chemical entities to the development of novel drug delivery system of existing drug molecule to maximize their effectiveness in terms of therapeutic action, reducing frequency of dosing and wastage of drugs, patient compliance and reduced adverse effects.(1) To minimize drug degradation and loss, to prevent harmful side-effects and to increase drug bioavailability and the fraction of the drug accumulated in the required zone, various drug delivery and drug targeting systems are currently under development. Oral drug delivery is the most desirable and preferred method of drug delivery for achieving both systemic and local therapeutic

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effects. For many drugs, conventional oral formulations provide clinically effective therapy while maintaining the required balance of pharmacokinetic and pharmacodynamics profile with an acceptable level of safety to the patient. The real challenge in the development of a controlled drug delivery system is not just to sustain the drug release but also to prolong the presence of the dosage form in the stomach or the upper small intestine until all the drug is completely released in the desired period of time. The gastro intestinal tract (GIT) is the major route of drug delivery to the systemic circulation. Oral controlled release dosage forms are not suitable for a variety of important drugs, characterized by a narrow absorption window in the upper part of the GIT. This is due to the relatively less transit time of the dosage form in these anatomical segments. Thus after only a short period of less than 6 h, the controlled release formulation has already left the upper GIT and the drug is released in short, non-absorbing distal segment of the GIT. This results in a short absorption phase, which is then accompanied by lesser bioavailability. These types of problem can be overcome by floating drug delivery system.

Materials:

Sodium alginate	Madras pharma
Calcium chloride	Madras pharma
Sodium citrate	Madras pharma
Calcium carbonate	Madras pharma
Deionized water	Sri Vijay Vidhyalaya college of pharmacy

Methodology:

Preparation of In Situ Gelling Solution:

Sodium alginate, at different concentrations (2% w/v, 2.5% w/v, and 3% w/v), will be prepared in deionised water containing calcium chloride (0.15% w/v) and sodium citrate (0.5% w/v). HPMC K100 (0.3% w/v, 0.6% w/v, and 0.9% w/v) will added to it. The sodium alginate solution was heated to 50°C with stirring. After cooling below 40°C, 1.5% w/v of calcium carbonate and drug were added and dispersed well with continuous stirring. This results in sodium alginate in situ gel solution containing olanzapine.

Measurement of Viscosity of In Situ Gelling Solution:

The viscosity of the prepared solutions will be determined using brook field viscometer. The samples (100 ml) were sheared at a rate of 100 r/min using suitable spindle at room temperature. Viscosity measurement for each sample will be done in triplicate, with each measurement taking approximately 30 s.

In Vitro Gelation Study:

Gelation of insitu gelling solution will be carried out by taking 500 ml of 0.1 N hydrochloric acid (HCl, pH 1.2) in a beaker. Accurately measured 10 mL of so lution will be added to HCl with mild agitation that avoids breaking of formed gel. Gelling will observed visually by qualitative measurement.

In Vitro Floating Study:

Floating study of in situ gelling solution will be carried out in 500 ml of 0.1 N HCl (pH 1.2) in a beaker. Accurately measured 10 ml of solution will be added to HCl with mild agitation. Time required for floating on surface after adding solution (floating lag time) and total floating time will be measured.

In Vitro Drug Release Study:

The in vitro release rate of from olanzapine release in situ gel was performed using USP apparatus fitted with paddle (50 r/min) at 37±0.5°C using 500 ml of 0.1 N HCL as a dissolution medium. This speed was slow enough to avoid the breaking of gelled formulation and maintaining the mild agitation conditions believed to exist in vivo. At the predetermined time intervals, 10 ml samples were withdrawn, filtered through a 0.45 µm membrane filter, diluted, and assayed using a Shimadzu UV 1800 double-beam spectrophotometer. Cumulative percentage drug

release (CPR) was calculated using an equation obtained from a calibration curve.

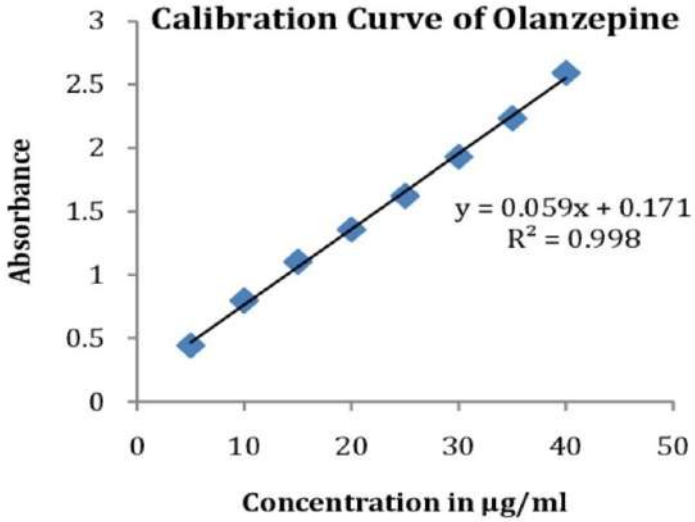
Stability studies:

Stability studies will be performed as per the ICH guidelines for short term, intermediate and accelerated studies.

RESULT AND DISCUSSION:

Standard curves for Olanzapine

The plot of peak area against concentration of olanzapine was found to be linear in the range of 10 to 60µg/mL with correlation coefficient of 0.9996.



This threshold is in line with findings from positron emission tomography (PET) studies that suggest optimal drug efficacy (65%-80% D2-receptor occupancy) between 17 and 44 ng/mL.

Conclusions:

We suggest a therapeutic reference range of 20-40 ng/mL for olanzapine oral and LAI formulations.

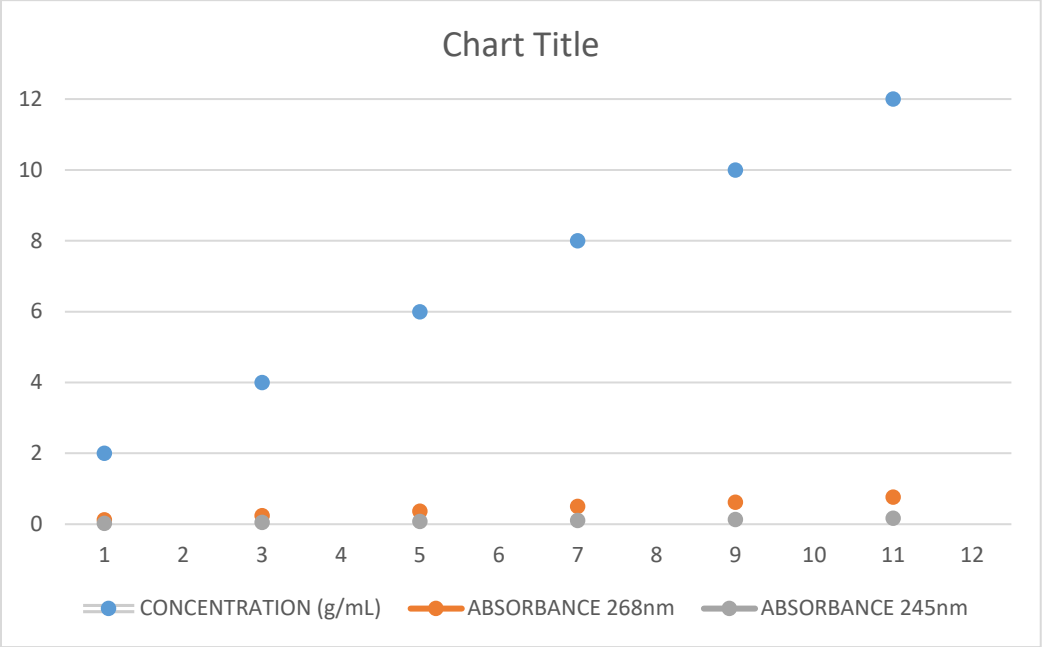
Generally, olanzapine is well tolerated. The pharmacokinetics of olanzapine are linear and dose-proportional within the approved dosage range. Its mean half-life in healthy individuals was 33 hours, ranging from 21 to 54 hours. It has been reported that a favourable response with olanzapine is maximised at doses of 10 mg/day to 15 mg/day (perhaps lower in nonsmoking females) (Bishara 2013). However, lower or higher doses may be used and the relationship between olanzapine dose, efficacy and side effects remains contradictory between studies.

Absorbance values for calibration curves of ATR at 268 and 245 nm

CONCENTRATION (g/mL)	ABSORBANCE	
	268nm	245nm
2	0.12878	0.02782
4	0.24756	0.05264
6	0.37096	0.08296
8	0.50512	0.11161
10	0.62368	0.13909
12	0.76792	0.16704

Two new methods for the determination of olanzapine, based on UV spectrophotometry and non-aqueous titration, have been developed. The UV absorbance of the methanolic solution of

olanzapine was measured at 2 26nm. The method obeys Beer's Law from 0.1 µg to 50 µg/ml and the inter-day precision of UV procedure is 0.97%.



Measurement of Viscosity of In Situ Gelling Solution

Viscosity is a measure of the thickness of a fluid. In situ gelling formulations are drug delivery systems which typically exist in a liquid form at room temperature and change into gel state after application to the body in response to various stimuli such as changes in temperature, pH and ionic composition. Their biomedical application can further be improved by incorporating drug nanoparticles into in situ gelling systems in order to prolong drug release, reduce dosing frequency and improve therapeutic outcomes of patients, developing highly functional but challenging dosage forms. The inclusion of mucoadhesive polymeric constituents into in situ gelling formulations has also been explored to ensure that the therapeutic agents are retained at target site for extended period of time. The clinical properties of in situ gelling systems that have been studied for potential biomedical applications over the last ten years will be reviewed to highlight current knowledge in the performance of these systems.

In Vitro Gelation Study

In situ gelling systems are polymeric formulations that are in sol forms before entering in the body, but change to gel forms under the physiological conditions. The temperature sensitive in situ gel formulations, undergo phase transition from liquid to semisolid gel upon exposure to physiological eye temperature. These are free-flowing liquid at room temperature and easy to administer into the eye as drops. In situ gels are the solutions or suspensions that undergo gelation after reaching the particular site due to contact with body fluids or physicochemical changes such as pH, temperature, ionic concentration, UV radiation, presence of specific molecules, or ions, external triggers, etc.

Formulation	Floating lag time (min)	Floating time (hr)
F1	4.15	7.35
F2	3.40	8.10
F3	2.45	10.30

CONCLUSION:

Developing an efficient FDDS is a real challenge and the drug delivery system must remain for a sufficient time in the stomach. Various techniques

and approaches have been employed to develop FDDS has emerged as one of the most promising gastro-retentive drug delivery system. The FDDS has an additional advantage for drugs that are absorbed primarily in the upper part of the GIT, i.e., the stomach, duodenum, and jejunum. Recently many drugs have been formulated as floating drug delivery systems with an objective of sustained release and restricting the region of drug release to stomach. The principle of buoyant preparation offers a simple and practical approach to achieve increased gastric residence time for the dosage form and sustained drug release. The most important criteria which has to be looked into for the productions of a floating drug delivery system is that the density of the dosage form should be less than that of gastric fluid. And hence, it can be concluded that these dosage forms serve the best in the treatment of diseases related to the GIT and for extracting a prolonged action from a drug with a short half-life. In addition to being used to improve bioavailability, this gel is also used to make the drug increase the residence time in the area of use, so that it can provide maximum effectiveness via enhancing of per cent permeation. The use of in situ gel, usually used in ocular administration of drugs. Olanzapine demonstrated superior antipsychotic efficacy compared with haloperidol in the treatment of acute phase schizophrenia, and in the treatment of some patients with first-episode or treatment-resistant schizophrenia. Antipsychotic medications work by altering brain chemistry to help reduce psychotic symptoms like hallucinations, delusions and disordered thinking. They can also help prevent those symptoms from returning. Olanzapine helps to manage symptoms of mental health conditions such as: seeing, hearing, feeling or believing things that others do not, feeling unusually suspicious or having muddled thoughts (schizophrenia) feeling agitated or hyperactive, very excited, elated, or impulsive (mania symptoms of bipolar disorder). Excellent biodegradability and biocompatibility. All the in situ gel forming polymers sustain the release of drug from the delivery system with better bioavailability and more effectiveness. Synthetic polymers exhibit a problem of drug burst release effect. The main effect that olanzapine has is to block some dopamine receptors in the brain, correcting the overactivity of dopamine. Olanzapine also has effects on other neurotransmitters in the brain such as serotonin (5-HT), which may also contribute to its beneficial effects. It may take several weeks before you feel the full effect of olanzapine. Olanzapine tablets are usually taken 1 time per day with or without food. Typically, patients begin at a low dose of medication and the dose is increased slowly over several weeks. this medication works on several transmitters in the brain, so it can be helpful with a range of symptoms including sleep and agitation. Significant improvement was noted in 9 of 19 cognitive tests, including measures of selective attention, verbal learning and memory, and verbal fluency. These medications, includes all atypical antipsychotics are generally prescribed because they pose a lower risk of certain serious side effects than conventional antipsychotics. Olanzapine (sold under the trade name Zyprexa among others) is an atypical antipsychotic primarily used to treat schizophrenia and bipolar disorder. For schizophrenia, it can be used for both new-onset disease and long-term maintenance. It is taken by mouth or by injection into a muscle. Common side effects include weight gain, movement disorders, dizziness, feeling tired, constipation, and dry mouth. Other side effects include low blood pressure with standing, allergic reactions, neuroleptic malignant syndrome, high blood sugar, seizures, and tardive dyskinesia. In older people with dementia, its use increases the risk of death. Use in the later part of pregnancy may result in a movement disorder in the baby for

some time after birth. Although how it works is not entirely clear, it blocks dopamine and serotonin receptors. Olanzapine was patented in 1991 and approved for medical use in the United States in 1996. It is available as a generic medication. In 2020, it was the 164th most commonly prescribed medication in the United States, with more than 3 million prescriptions. Eli Lilly also markets olanzapine in a fixed-dose combination with fluoxetine as olanzapine/fluoxetine (Symbyax). It is on the World Health Organization's List of Essential Medicines. It is approved by FDA for the following indications:

Schizophrenia

Acute treatment of manic or mixed episodes associated with bipolar I disorder and maintenance treatment of bipolar I disorder. Adjunct to valproate, carbamazepine or lithium in the treatment of manic or mixed episodes associated with bipolar I disorder. Combination olanzapine/fluoxetine for the treatment of depressive episodes associated with bipolar I disorder. In United Kingdom and Australia it is approved for schizophrenia, moderate to severe manic episodes, alone, or in combination with lithium or valproate and the short-term treatment of acute manic episodes associated with Bipolar I Disorder. The first-line psychiatric treatment for schizophrenia is antipsychotic medication. Olanzapine appears to be effective in reducing symptoms of schizophrenia, treating acute exacerbations, and treating early-onset schizophrenia. The usefulness of maintenance therapy, however, is difficult to determine, as more than half of people in trials quit before the 6-week completion date. Treatment with olanzapine (like clozapine) may result in increased weight gain and increased glucose and cholesterol levels when compared to most other second-generation antipsychotic drugs used to treat schizophrenia.

Bipolar disorder

Olanzapine is recommended by the National Institute for Health and Care Excellence as a first-line therapy for the treatment of acute mania in bipolar disorder. Other recommended first-line treatments are aripiprazole, haloperidol, quetiapine, and risperidone. It is recommended in combination with fluoxetine as a first-line therapy for acute bipolar depression, and as a second-line treatment by itself for the maintenance treatment of bipolar disorder. The Network for Mood and Anxiety Treatments recommends olanzapine as a first-line maintenance treatment in bipolar disorder and the combination of olanzapine with fluoxetine as second-line treatment for bipolar depression. A review on the efficacy of olanzapine as maintenance therapy in patients with bipolar disorder was published by Dando & Tohen in 2006. A 2014 meta-analysis concluded that olanzapine with fluoxetine was the most effective among nine treatments for bipolar depression included in the analysis. Olanzapine may be useful in promoting weight gain in underweight adult outpatients with anorexia nervosa. However, no improvement of psychological symptoms was noted. Olanzapine has been shown to be helpful in addressing a range of anxiety and depressive symptoms in individuals with schizophrenia and schizoaffective disorders, and has since been used in the treatment of a range of mood and anxiety disorders. Olanzapine is no less effective than lithium or valproate and more effective than placebo in treating bipolar disorder. It has also been used for Tourette syndrome and stuttering. Olanzapine has been studied for the treatment of hyperactivity, aggressive behavior, and repetitive behaviors in autism. Olanzapine is frequently prescribed off-label for the treatment of insomnia, including difficulty falling asleep and staying asleep, even though such use is not recommended. The daytime sedation experienced with olanzapine is generally comparable to quetiapine and lurasidone, which is a frequent complaint in

clinical trials. In some cases, the sedation due to olanzapine impaired the ability of people to wake up at a consistent time every day. Some evidence of efficacy for treating insomnia is seen; however, side effects such as dyslipidemia and neutropenia, which may possibly be observed even at low doses, outweigh any potential benefits for insomnia that is not due to an underlying mental health condition. Olanzapine has been recommended to be used in antiemetic regimens in people receiving chemotherapy that has a high risk for vomiting**.**

REFERENCES:

1. Nishikawa T, Tanaka M, and Tsuda A. et al. Clonidine therapy for tardive dyskinesia and related syndromes. Clin Neuropharmacol. 1984 7:239–245.
2. Delwaide PJ, Desseilles M. Spontaneous buccolinguofacial dyskinesia in the elderly. Acta Neurol Scand. 1977;56:256–262.
3. Brandon S, McClelland HA, Protheroe C. A study of facial dyskinesia in a mental hospital population. Br J Psychiatry. 1971;118:171–184.
4. World Health O. World Health Organization; Geneva: 2019. General Meeting of the WHO Global Coordination Mechanism on the Prevention and Control of Noncommunicable Diseases: Meeting Report: International Conference Centre. Geneva, Switzerland, 5-6 November 2018.
5. Dessy N Siahaan R., et al. In vitro and in vivo evaluation of floating gastroretentive drug delivery system of cimetidine using hard alginate capsules. Asian J. Pharmaceut. Clin. Res. 2018;11:162–168. doi: 10.22159/ajpcr.2018.v11i6.24731.
6. Gharti K., et al. Formulation and in vitro evaluation of floating tablets of hydroxypropyl methylcellulose and polyethylene oxide using ranitidine hydrochloride as a model drug. J. Young Pharm. 2012;4:201–208. doi: 10.4103/0975-1483.104363.
7. Vigani B., et al. Recent advances in the development of in situ gelling drug delivery systems for non-parenteral administration routes. Pharmaceutics. 2020;12 doi: 10.3390/pharmaceutics12090859.
8. Lewis GA. Optimization methods. In: Swarbrick J, Boylan JC, editors. Encyclopaedia of Pharmaceutical Technology. New York, NY, USA: Marcel Dekker; 1996. pp. 2458–2468.
9. Higuchi T. Mechanism of sustained action mediation, theoretical analysis of rate of release of solid drugs dispersed in solid matrices. Journal of Pharmaceutical Sciences. 1963;52:1145–1149.
10. Hixon AW, Crowell JH. Dependence of reaction velocity upon surface and agitation. Industrial & Engineering Chemistry Research. 1931;23:923–931.
11. Korsmeyer RW, Gurny R, Doelker E, Buri P, Peppas NA. Mechanisms of solute release from porous hydrophilic polymers. International Journal of Pharmaceutics. 1983;15(1):25–35. 26. Coasta P, Manuel J, Labao S. Modelling and comparision of dissolution profiles. European Journal of Pharmaceutical Sciences. 2002;13:123–133.
12. Mendenhall W, Sincich T. A second Course in Business Statistics, Regression Analysis. San Francisco, Calif, USA: Dellen Publishing; 1989. Multiple regression; pp. 141–226.
13. Siepmann J, Peppas NA. Modeling of drug release from delivery systems based on hydroxypropyl methylcellulose (HPMC) Advanced Drug Delivery Reviews. 2001;48(2-3):139–157.
14. Ritger PL, Peppas NA. A simple equation for description of solute release II. Fickian and anomalous release from swellable devices.

Journal of Controlled Release. 1987;5(1):37–42.
15. Raghuram Reddy K, Srinivas M, Srinivas R. Once-daily sustained-release matrix tablets of nicorandil: Formulation and in vitro evaluation. AAPS PharmSciTech. 2003;4:480–8.
16. Ramakrishna BS. Helicobacter pylori infection in India: the case against eradication. Indian Journal of Gastroenterology. 2006;25(1):25–28.
17. Joel GH, Lee EL. Agents for control of gastric acidity and treatment of peptic ulcers. In: Gilman AG, Hardman JG, Limbird LE, editors. The Pharmacological Basis of Therapeutics. New York, NY, USA: The MC Graw Hill; 2001. pp. 909–910.
18. Manuel TA, Leopoldo VR. Assay of amoxicillin sustained release from matrix tablets containing different proportions of Carbopol 971P NF. International Journal of Pharmaceutics. 2004;273(1-2):121–127.
19. Hilton AK, Deasy PB. In vitro and in vivo evaluation of an oral sustainedrelease floating dosage form of amoxycillin trihydrate. International Journal of Pharmaceutics. 1992;86(1):79–88.
20. Sonani NG, Hiremath SP, Sreenivas SA. Design and evaluation of gastroretentive mucoadhesive cephalexin tablets. Pharmaceutical Development and Technology. 2010;15(2):178–183.
21. Nagahara NH, Yohko AM, Masafumi N, Mayumi T. Mucoadhesive microspheres containing amoxicillin for clearance of H. pylori . American Society for Microbiology. 1998;42(10):2492–2494.
22. Miyazaki S, Kawasaki N, Kubo M. Comparison of in situ gelling formulations for the oral delivery of cimetidine. International Journal of Pharmaceutics. 2001;220(1-2):161–168.
23. Ali NK, Anish T. In situ cross-linking of sodium alginate with calcium and aluminum ions to sustain the release of theophylline from polymeric matrices. Farmaco. 2004;59(12):999–1004.
24. Harish NM, Prabhu P, Charyulu N. Formulation and evaluation of in situ gels containing clotrimazole for oral candidiasis. Indian Journal of Pharmaceutical Sciences. 2009;71(4):421–427.
25. Melo NR, Taguchi H, Culhari VP, Kamei K, Mikami Y, Smith SN, et al. Oral candidiasis of HIV-infected children undergoing sequential HIV therapies. Med Mycol. 2009;47:1–8.
26. Gallardo JM. Xerostomia: Etiology, diagnosis and treatment. Rev Med Inst Mex Seguro Soc. 2008;46:109–16.
27. Chang JY, Oh YK, Kong HS, Kim EJ, Jang DD, Nam KT, et al. Prolonged antifungal effects of Clotrimazole-containing mucoadhesive thermosensitive gels on vaginitis. J Control Release. 2002;82:39–50.
28. Ning MY, Guo YZ, Pan HZ, Yu HM, Gu ZW. Preparation and evaluation of proliposomes containing clotrimazole. Chem Pharm Bull (Tokyo) 2005;53:620–4.
29. Wu C, Qi H, Chen W, Huang C, Su C, Li W, et al. Preparation and evaluation of a Carbopol/HPMC-based in situ gelling ophthalmic system for puerarin. Yakugaku Zasshi. 2007;127:183–91. Ikanth PS, Mishra B. Floating in situ gelling system for stomach site-specific delivery of clarithromycin to eradicate H. pylori. J Control Release. 2008;125:33– 41.
30. Mitra J, Mohammad RR, Hedayte S. Mucoadhesive and drug release properties of benzocaine gel. Iranian J Pharm Sci. 2006;2:185–94. .
31. El laithy HM, El-Shaboury KM. The development of cutina lipogels and gel

microemulsion for topical administration of fluconazole. AAPS PharmSciTech. 2002;3:77–85.
32. Walewijk A, Cooper White JJ, Dunstan DE. Adhesion measurements between alginate gel surfaces via texture analysis. Food Hydrocolloids. 2008;22:91–6.
33. Srividya B, Cardoza RM, Amin PD. Sustained ophthalmic delivery of ofloxacin from a pH triggered in situ gelling system. J Control Release. 2001;73:205–11. Hongyi Q, Wenwen C, Chunyan H, Chuming C, Wenmin L, Chunjie W. Development of a poloxamer analogs/carbopol based in situ gelling and mucoadhesive ophthalmic delivery system for puerarin. Int J Pharm. 2007;337:178–8.
34. 4. Oyeneyin B. In: Developments in Petroleum Science. Oyeneyin B., editor. Elsevier; 2015. Chapter 2 - introduction to the hydrocarbon composite production system; pp. 11–128.
35. Bai Y., Bai Q. In: Subsea Engineering Handbook. second ed. Bai Y., Bai Q., editors. Gulf Professional Publishing; Boston: 2019. 17 - subsea corrosion and scale; pp. 455–487. . Ropp R.C. In: Encyclopedia of the Alkaline Earth Compounds. Ropp R.C., editor. Elsevier; Amsterdam: 2013. Chapter 2 - group 17 (H, F, Cl, Br, I) alkaline earth compounds; pp. 25–104.
36. Rj R., et al. Development of a novel floating in-situ gelling system for stomach specific drug delivery of the narrow absorption window drug baclofen. Iran. J. Pharm. Res. (IJPR) 2010;9:359–368.
37. Mandel, et al. Review article: alginate-raft formulations in the treatment of heartburn and acid reflux. Aliment. Pharmacol. Ther. 2000;14:669–690. doi: 10.1046/j.1365-2036.2000.00759.x.
38. Gołębiowski A., et al. Molecular parameters of low methoxylated pectin affected by gelation with copper and cadmium cations. Bioact Carbohydr. 2020;21 doi: 10.1016/j.bcdf.2020.100211.
39. Chaudhary B., Verma S. Preparation and evaluation of novel in situ gels containing acyclovir for the treatment of oral herpes simplex virus infections. Sci. World J. 2014;2014 doi: 10.1155/2014/280928.
40. Shen T., Yang Z. In vivo and in vitro evaluation of in situ gel formulation of pemirolast potassium in allergic conjunctivitis. Drug Des. Dev. Ther. 2021;15:2099–2107. doi: 10.2147/DDDT.S308448.

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