REVIEW OF LITERATURE

Kalu et al\textsuperscript{15} reported a new plant gum, Okra (extracted from the pods of \textit{Hibiscus esculentus}), has been evaluated as a controlled-release agent in modified release matrices, in comparison with Sodium carboxymethyl cellulose (NaCMC) and hydroxypropylmethyl cellulose (HPMC), using Paracetamol as a model drug. Tablets were produced by direct compression and the \textit{in vitro} drug release was assessed in conditions mimicking the gastro intestinal system for 6 h. Okra gum matrices provided a controlled-release of Paracetamol for more than 6 h and the release rates followed time-independent kinetics.

Umesh kumar et al\textsuperscript{16} reported gums and mucilages for conventional and novel dosage forms. With the increasing interest in polymers of natural origin, the pharmaceutical world has been compliance to use most of them in their formulations. Moreover, the tremendous orientations of pharmacy world towards these naturally derived polymers were become a subject of increasing interest to discover, extract and purify such compounds from the reported origin. These natural materials have advantages over synthetic ones since they are chemically inert, nontoxic, less expensive, biodegradable and widely available. They can also be modified in different ways to obtain tailor-made materials for drug delivery systems and thus can compete with the available synthetic excipients.

Tavakoli et al\textsuperscript{17} reported the effectiveness of a new binder extracted from \textit{Hibiscus esculentus} (Okra gum) in tabletting. Okra gum was extracted from the pods of Okra fruit by maceration in distilled water followed by filtration of viscous solution as well as precipitation of gum extract by using acetone. To evaluate the binder effectiveness, two models, including a placebo formulation (lactose) and a drug formulation (Acetaminophen, Ibuprofen, and/or Calcium acetate) were evaluated. Okra gum produces some tablet formulations with good hardness and friability. However, this binder prolongs the dissolution rate of some slightly soluble drugs and hence may be good candidate for sustained release formulations.
Kotadiya et al\textsuperscript{18} reported coated tablets using okra gum and guar gum followed by optimization using $2^3$ full factorial designs. Tablets were evaluated for \textit{in vitro} characterizations including detailed dissolution study, \textit{in vivo} pharmacokinetic study and stability study. Formulation of okra gum: guar gum was most likely to provide colonic delivery of Diclofenac sodium. \textit{In vivo} ingestion in rabbits showed controlled release pharmacokinetic profile of prepared formulation in comparison to marketed formulation.

Okoye et al\textsuperscript{19} reported at comparing the mechanical and release properties of Paracetamol tablets formulated with Okra gum, povidone, gelatin and hydroxypropylmethyl cellulose as wet binders. Relevant quality control tests were performed on the tablets and the results compared. Friedman’s test revealed Okra gum as the most effective binder while regression analysis proved Okra gum to be the most economical binder with respect to reduction of BFI values which is directly related to binders’ abilities to ameliorate capping and lamination in tablets. Okra gum reduced the BFI of Paracetamol tablets to an acceptable level. It has proved to be more effective and economical than PVP.

Ogaji et al\textsuperscript{20} reported on natural polymeric materials. This was attributable to a number of factors which include their relative abundance, low cost, and biodegradable and eco-friendly profiles. This article reviews the current applications of natural polymeric materials in pharmaceutical formulations. The pharmaceutical applications of some of the traditional and commercially available natural polymers were discussed. Emerging potential pharmaceutical excipients of natural origins were also discussed. The increasing research interests in this group of materials were indications of their increasing importance.

Amelia et al\textsuperscript{21} reported that all pharmaceutical dosage forms contain many additives besides the active ingredients to assist manufacturing and to obtain the desired effect of the pharmaceutical active ingredients. The advances in drug delivery had simultaneously urged the discovery of novel excipients which were safe and fulfill specific functions and directly or indirectly influence the rate and extent of
release and/or absorption. The plant derived gums and mucilages comply with many requirements of pharmaceutical excipients as they are non-toxic, stable, easily available, associated with less regulatory issues as compared to their synthetic counterpart and inexpensive. Most of these plant derived gums and mucilages were hydrophilic and gel-forming in nature. Recent trend towards the use of plant based and natural products demands the replacement of synthetic additives with natural ones.

Kotadiya et al\textsuperscript{22} reported Okra gum matrices of Theophylline to target the nocturnal peak symptoms of asthma. Dissolution studies revealed that Okra gum preparation was able to protect the drug from being released under conditions mimicking mouth to colon transit. \textit{In vivo} ingestion in rabbits showed controlled release pharmacokinetic profile of Theophylline from the formulation prepared.

Manavalan et al\textsuperscript{23} reported products from natural sources that had became an integral part of human health care system because of some side effects and toxicity of synthetic drugs. Applications of natural polymers in pharmacy were comparable to the synthetic polymers and they possess wide scope in food and cosmetic industries.

Edukondalu et al\textsuperscript{24} reported to optimize and evaluate the floating tablets of Atenolol that prolongs the gastric residence time. Semi-synthetic polymer, HPMC K100M and natural polymer i.e. Okra gum were used as release retarding agents by its swelling nature. Sodium bicarbonate was used as a gas-generating agent, Atenolol were prepared by direct compression method. The prepared tablets were evaluated for physicochemical parameters and found to be within range. The concentration of Okra gum with a gas-generating agent was optimized. The optimized formulation has better release rate.

Pranitha et al\textsuperscript{25} estimated the effectiveness of the edible gum of \textit{Abelmoschus esculentus} as a polymer in the development of a gastric floating dosage form of Metformin HCl. \textit{Abelmoschus esculentus}, popularly known as Okra, was shown to aid in the formulation of floating tablets. In the present study, it was used as a pharmaceutical excipient along with HPMC E15 in the formulation of Metformin HCl floating tablets. The prepared tablets were tested for physicochemical properties, drug content
uniformity, *in vitro* drug release patterns and FT-IR spectral analysis. From the study, it was evident that the formulations which included *Abelmoschus esculentus* gum (F1, F3, and F4) had lesser floating capacity but show a sustained release of drug whereas the formulation (F2) which contained only HPMC has higher floating capacity but poor sustained release of drug.

Prakash *et al*\(^26\) reported on existing and newly designed drugs and natural products, semisynthetic as well as synthetic excipients often need to be used for variety of purposes. Gums and mucilages were widely used materials for conventional and novel dosage forms. These natural materials had advantages over synthetic ones since they were chemically inert, nontoxic, less expensive, biodegradable and widely available. They can also be modified in different ways to obtain tailor-made materials for drug delivery systems and thus can compete with the available synthetic excipients. Based on the features of the retarding polymer, hydrophilic polymers were the most suitable for retarding drug release and there was growing interest in using these polymers in sustained drug delivery.

Rajamma *et al*\(^27\) reported the potential use of natural gums in the development of drug delivery systems. Therefore in this work gastro retentive tablet formulations of Ziprasidone HCl were developed using simplex lattice design considering concentration of Okra gum, locust bean gum and HPMC K4M as independent variables. A response surface plot and multiple regression equations were used to evaluate the effect of independent variables on hardness, flag time, floating time and drug release for 1 h, 2 h, and 8 h and for 24 h.

Bharghav *et al*\(^28\) reported to provide new sustained release excipient which, when incorporated into a final product, produces controlled release of active ingredient over an extended period of 12 hrs or more when the dosage form is exposed to G.I fluids in gastric environment. Okra gum, which is a natural polymer, has advantage over synthetic and semi-synthetic polymers, in that it is cheap and easily available, non-irritant, biodegradable, biocompatible, and eco-friendly. In the present investigation the
physicochemical, microbial and rheological properties of Okra gum powder are evaluated. Further Okra gum is subjected to accelerated stability studies according to ICH guidelines.

**Prajapathi et al**\(^{29}\) reported on plant based pharmaceutical excipients. Gums and mucilages are the most commonly available plant ingredients with a wide range of applications in pharmaceutical and cosmetic industries. They are being used due to their abundance in nature, safety and economy. They have been extensively explored as pharmaceutical excipients. They are biocompatible, cheap and easily available. Natural materials have advantages over synthetic ones since they are chemically inert, nontoxic, less expensive, biodegradable and widely available. Recent trend towards the use of plant based and natural products demands the replacement of synthetic additives with natural ones.

**Sajid et al**\(^{30}\) reported to develop sustained release matrix tablets of Phenytoin sodium an antiepileptic drug. The tablets were fabricated by the wet granulation method using water as granulating agent along with matrix materials like Guar gum, Sodium alginate, Tragacanth and Xanthan gum with varying percentage. The swelling behavior of matrix was also investigated. The granules showed satisfactory flow properties, compressibility and drug content. The IR spectral analysis studies confirmed no interaction between Phenytoin with used natural gums. All the tablet formulations showed acceptable pharmacotechnical properties and complied with in-house specifications for tested parameters.

**Rasul et al**\(^{31}\) reported oral sustained release tablets of Metoprolol tartrate using natural hydrophilic matrix formers (Xanthan gum and Tragacanth). Sustained release matrix tablets of Metoprolol tartrate were prepared by using different ratios of drug, Xanthan gum and Tragacanth. The polymer was incorporated into a matrix system using direct compression technique. Increasing the amount of polymer (Xanthan gum) in the formulation led to slow release of drug and decreasing the amount of polymer gave enhanced release of Metoprolol tartrate. The kinetic treatment showed the best fitted different mathematical models (Zero order, First order, Higuchi and Hixson-Crowell). Most of the solid matrix formulations followed Higuchi or Zero order kinetics.
Sandeep et al\textsuperscript{32} reported a gastroretentive floating matrix tablets of Cefuroxime axetil were successfully prepared with hydrophilic polymers like HPMC K4M and HPMC K15M. From the preformulation studies for drug excipients compatibility it was observed that there was no compatibility problem with the excipients used in study. The drug release from most of the formulations follows Fickian diffusion.

Chandra Bose et al\textsuperscript{33} reported on floating tablets of Diltiazem HCl using Xanthan gum as carrier. The formulations were prepared by varying the concentrations of Xanthan gum and Sodium bicarbonate. The prepared floating tablets were evaluated for tablet properties such as hardness, thickness, friability, weight variation, floating property, compatibility using DSC and FTIR. It was noted that, all the prepared formulations had desired floating lag time and constantly floated on dissolution medium by maintaining the matrix integrity. The drug release from prepared tablets was found to vary with varying concentration of the polymer, Xanthan gum. From the study it was concluded that floating drug delivery system can be prepared by using Xanthan gum as a carrier.

Yeole et al\textsuperscript{34} reported on sustained release matrix tablets of Diclofenac sodium. Sustained release matrix tablets of Diclofenac sodium, were developed by using different drug: polymer ratios. Compressed tablets were evaluated for uniformity of weight, content of active ingredient, friability, hardness, thickness, \textit{in vitro} dissolution using basket method, and swelling index. The effect of other parameters like addition of release modifier (PEG 6000), gum concentration, pH of dissolution medium, rotation speed and dissolution by paddle method, were also studied. Selected formulation was subjected to stability studies and showed stability with respect to release pattern.

Kavitha et al\textsuperscript{35} reported floating tablets of Rosiglitazone maleate using gas forming agents and natural gums like Xanthan gum and Guar gum. The prepared tablets evaluated in terms of their precompression parameters, physical characteristics, \textit{in vitro} release, buoyancy, buoyancy lag-time. The formulations were optimized for the different concentrations of Xanthan gum and Guar gum. The results of the \textit{in
vitro release studies showed that the optimized formulation could sustain drug release and remain buoyant for 12 h.

Ramesh et al\textsuperscript{36} reported floating matrix tablets of Norfloxacin using polymers such as Hydroxypropyl methylcellulose (HPMC K4M, HPMC K100M) and Xanthan gum. Tablets were evaluated for their physical characteristics, in vitro drug release characteristics. The tablets exhibited controlled and prolonged drug release profiles while floating over the dissolution medium. The best formulation was selected based on in vitro characteristics and was used in vivo radiographic studies.

Prasad et al\textsuperscript{37} reported on low density dosage form containing high concentration of active pharmaceutical ingredient. In the present work, the in vitro sustained release of Stavudine from matrix of tablet containing HPMC K100M and Xanthan gum as release retardant polymers has been studied. Optimized formulation of Stavudine floating tablet shows no significant change in hardness, drug content, floating lag time and drug release pattern after the stability period.

Sanjay et al\textsuperscript{38} reported gastro-retentive delivery system of Atenolol which, after oral administration should have the ability to prolong gastric residence time with desired in vitro release profile. Atenolol was chosen as a model drug because it was poorly absorbed from the lower gastrointestinal tract. The tablets were prepared by direct compression technique, using natural gum such as Xanthan gum and Guar gum, alone or in combination. Tablets were evaluated for in vitro release characteristics. Among all the formulations, tablets containing combination of Xanthan gum and Guar gum showed better floating capacity as well as sustained release of Atenolol.

Swati et al\textsuperscript{39} reported the effect of Xanthan gum and Chitosan in combination on effervescent floating matrix tablet of water soluble analgesic drug, Tapentadol HCl. To reduce the frequency of administration and to improve patient compliance, a sustained-release formulation of Tapentadol is desirable. Combination of polymers Xanthan gum and Chitosan was used to retard drug release. The
concentration of polymers was varied and their effect on floating time, drug content, % drug release, swelling index of the tablets was studied. The formulation was evaluated using Infrared-red spectroscopy and Differential Scanning Calorimetry to study drug-excipient compatibility.

Shah et al\textsuperscript{40} reported an effective Fluvastatin buccal adhesive tablet with excellent bioadhesive force and good drug stability in human saliva. The study also focuses on the mucoadhesive potential of some natural gums like Tamrind gum, Xanthan gum and Gellan gum. Physicochemical properties of tablets like bioadhesive strength, swelling rate, surface pH, permeation rate and \textit{in vitro} drug release rate were studied. Release studies revealed that the sustained release of Fluvastatin over several hours may be obtained by combining the chitosan with natural gums.

Vinny et al\textsuperscript{41} reported Xanthan gum as a matrix former for the preparation of sustained release tablets. Based on single surface experiments and tablet erosion studies, it was concluded that release of a soluble drug (Chlorpheniramine maleate) and an insoluble drug (Theophylline) from tablets containing low concentrations of Xanthan gum was mainly via diffusion and erosion, respectively. Drug release from tablets containing Xanthan gum was slightly faster in acidic media due to more rapid initial surface erosion than at higher pH.

Kajale et al\textsuperscript{42} reported at targeting drugs to the colon by the oral route could be achieved by different approaches including matrix and coated systems, for which the drug release is controlled by the gastrointestinal pH, transit times or intestinal flora. A number of synthetic azo polymers and natural or modified polysaccharides (Guar gum, Xanthan gum, Locust gum, Inulin, Dextran, Starch, Amylose, Pectins) degraded by the human colonic flora were investigated as colonic drug delivery carriers.

Ahmed et al\textsuperscript{43} reported to modulate the release rate by varying concentration of rate controlling materials and by restricting the surface area available for drug release. The tablets were evaluated for
weight variation, hardness, thickness, friability, drug content uniformity and \textit{in vitro} drug release studies. All the physical parameters were within the limits as per IP for the formulations. \textit{In vitro} dissolution study revealed that the drug release from matrix tablet was more than 90\%, where as drug release from three layer matrix tablets decreased depends on the quantity of polymer used in retardant layers. Different dissolution models were applied to drug release data in order to evaluate release mechanisms and kinetics.

\textbf{Varhosaz et al}\textsuperscript{44} reported to prepare sustained release (SR) tablets of Terbutalin sulfate to decrease the number of doses frequency and to promote the patient compliances. It was also desirable to evaluate the capability of natural gums for preparation of SR oral dosage forms in comparison with the cellulosic polymers. After evaluation of physical characteristics of tablets, release rate were compared with the standard. All tablets met the official physical properties. It was concluded that formulation containing Guar and Xanthan released the drug with zero-order kinetics.

\textbf{Diwakar et al}\textsuperscript{45} reported the effect of formulation variables on drug release and floating properties of Ofloxacin drug delivery system was investigated. In formulating gastric floating drug delivery System Hydroxypropyl methylcellulose of different viscosity grades and Carbopol were used. It was concluded that both Hydroxy propyl methylcellulose viscosity and the presence of Carbopol and their interaction had significant impact on the release and floating properties if the delivery system.

\textbf{Hemanth et al}\textsuperscript{46} were reported to prolong the gastric residence time after oral administration at particular site and controlling the release of drug especially useful for achieving controlled plasma level as well as improving bioavailability. Ofloxacin is used as model drug. All formulations were evaluated for various tests like thickness, hardness, friability, weight variation, floating lag time, swelling characteristics and \textit{in vitro} dissolution.

\textbf{Mona et al}\textsuperscript{47} reported that Ofloxacin was absorbed from the upper part of the gastrointestinal tract
and was readily soluble in the acidic environment of the stomach; the floating microspheres of Ofloxacin were formulated to develop gastroretentive formulation. These floating microspheres release the drug in the stomach and upper gastrointestinal tract and thereby improve the bioavailability.

Pramod et al\textsuperscript{48} reported on floating tablets of Ofloxacin which were designed to prolong the gastric residence time after oral administration. Ofloxacin was a fluoroquinolone antibacterial agent which was highly effective against gram positive and gram negative bacteria. Ofloxacin floating tablets were prepared by wet granulation method incorporating natural polymer like Guar gum, Locust bean gum, either alone or in combination with HPMC K100M as swelling polymers, with sodium bicarbonate as gas generating agent and were evaluated for parameters such as Weight variation, Hardness, Friability, Drug content, Swelling index, \textit{in vitro} buoyancy study, \textit{in vitro} drug release study.

Garg et al\textsuperscript{49} reported on Controlled release (CR) dosage forms had been extensively used to improve therapy with several important drugs. However, the development processes were faced with several physiological difficulties such as the inability to restrain and localize the system within the desired region of the gastrointestinal tract and the highly variable nature of the gastric emptying process. This variability may lead to unpredictable bioavailability and times to achieve peak plasma levels. On the other hand, incorporation of the drug in a controlled release gastroretentive dosage forms (CR-GRDF) which can remain in the gastric region for several hours would significantly prolong the gastric residence time of drugs and improve bioavailability, reduce drug waste, and enhance the solubility of drugs that are less soluble in high pH environment.

Shah et al\textsuperscript{50} reported on controlled release dosage forms, tablets that allow an improved absorption and release profiles of Ofloxacin. The fact that drugs with fine particles size can be compressed well after wetting. Studies on Ofloxacin controlled release matrix tablets were prepared by wet granulation
technique. In order to investigate the potential of Ethyl cellulose ether derivatives as a matrix material, Ofloxacin formulations with different types and grades of Ethyl cellulose were prepared at several drug-to-polymer ratios. A comparative study was performed between the tested Ofloxacin-Ethocel formulations and a standard reference obtained from the local market.

Janardhan et al\textsuperscript{51} reported a gastroretentive drug delivery system of Ofloxacin. Different formulations were formulated using various concentrations of hydroxy propyl methylcellulose, sodiumcarboxymethylcellulose, sodium bicarbonate and citric acid. All the formulations were subjected to \textit{in vitro} dissolution studies and compared with the marketed formulation. The floating lag time was below 15 seconds for all the formulations. The floating duration was found to be more than 24 hours. Drug release kinetics was studied for prepared formulations and optimized formulation was found to follow zero order kinetics.

Anilkumar et al\textsuperscript{52} reported on oral floating tablets of Cephalexin using the hydrophilic polymer hydroxy propyl methyl cellulose (HPMC), gas generating agent sodium bicarbonate and citric acid. A 3 factorial design was applied systematically. The amount of citric acid and amount of HPMC K100M were selected as independent variables. The time required for 50\% drug release, percentage drug release at 12hr and percentage drug release at 6 hr were selected as dependent variables. The results of factorial design indicated that high level of HPMC K100M and citric acid favors preparation of floating sustained release tablet of Cephalexin. Tablets were compressed by KBr press and evaluated with different parameters like diameter, thickness, average weight, hardness, friability, drug content, \textit{in vitro} buoyancy study, swelling characteristics, scanning electron microscopy, kinetic release data.

Padmavathi et al\textsuperscript{53} reported a systematic approach for designing and development of Ofloxacin floating tablets to enhance the bioavailability and therapeutic efficacy of the drug. Floating tablets of Ofloxacin have shown controlled release thereby proper duration of action at a particular site were
designed to prolong the gastric residence time after oral administration. Different formulations were formulated by wet granulation technique using HPMC K4M, HPMC K15M and HPMC K100M (floating agent) as polymers along with sodium bicarbonate as gas generating agent. The formulations were evaluated for their physicochemical properties, buoyancy lag time, total floating time, swelling index and \textit{in vitro} drug release. All six formulations possessed good floating properties with total floating time between 8-12 hrs.

\textbf{Mahesh et al}\textsuperscript{54} reported many advantages for drugs having absorption from upper gastrointestinal tract and improve the bioavailability of medications that were characterized by a narrow absorption window. A new gastroretentive sustained release delivery system was developed with floating, swellable and bioadhesive properties. All these properties were optimized and evaluated. Various release retarding polymers like psyllium husk, HPMC K100M and a swelling agent, crosspovidone in combinations were tried and optimized to get the release profile for 24 h. Formulations were evaluated for \textit{in vitro} drug release profile, swelling characteristics and \textit{in vitro} bioadhesion property.

\textbf{Patel et al}\textsuperscript{55} explored the use of Xanthan gum and guar gum for development of floating drug delivery system of dipyridamole using factorial design approach. The content of polymer blends (X(1)) and ratio of xanthan gum to guar gum (X(2)) were selected as independent variables. The diffusion exponent (n), release rate constant (k), percentage drug release at 1 hr (Q(1)) and 6 hr (Q(6)) were selected as dependent variables. Tablets of all batches had desired buoyancy characteristics. Multiple regression analysis with two way ANOVA revealed that both the factors had statistically significant influence on the response studied (p<0.05).

\textbf{Bhattacharya et al}\textsuperscript{56} studied Interpenetrating polymer network (IPN) hydrogel microspheres of xanthan gum (XG) based superabsorbent polymer (SAP) and poly(vinyl alcohol) (PVA) were prepared by water-in-oil (w/o) emulsion crosslinking method for sustained release of ciprofloxacin
hydrochloride (CIPRO). The microspheres were prepared with various ratios of hydrolyzed SAP to PVA and extent of crosslinking density. The prepared microspheres with loose and rigid surfaces were evidenced by scanning electron microscope (SEM).

Mamata et al\textsuperscript{57} reported extensively in volunteers, very limited animal data was reported in the literature and parameters such as bioavailability in rodents are unknown. Hence, the present study aims to investigate the pharmacokinetics parameters of Ofloxacin in Oryctolagus Cuniculus rabbits after intravenous (10 mg/kg) and oral (20 mg/kg) administration. The experimental data was adequately fitted to a two-compartment model after intravenous and a one compartment model with first order absorption after oral dosing. The total clearance, terminal half-life and apparent volume of distribution were statistically similar after intravenous and oral administration, by both model independent and compartmental approaches.

Nirav et al\textsuperscript{58} reported floating tablets of Glipizide employing different polymers like Xanthan gum, Guar gum, Carbopol 940, and PVP K30 by effervescent technique. Sodium bicarbonate and citric acid were incorporated as a gas generating agent. The Floating tablets were evaluated for uniformity of weight, hardness, friability, drug content, and in vitro buoyancy, swelling study, dissolution studies and stability studies. The drug release profile and floating properties was investigated. The prepared tablets exhibited satisfactory physico-chemical characteristics. All the prepared batches showed good in vitro buoyancy.

Jayavadan et al\textsuperscript{59} reported floating-bioadhesive tablets to lengthen the stay of Glipizide in its absorption area. Effervescent tablets were made using chitosan (CH), hydroxypropylmethylcellulose (HPMC), carbopolP934 (CP), polymethacrylic acid (PMA), citric acid, and sodium bicarbonate. Tablets with 5% effervescent base had longer lag time than 10%. The type of polymer had no significant effect on the floating lag time. All tablets floated atop the medium for 23-24 hr. Increasing carbopolP934 caused higher bioadhesion than chitosan (p < 0.05).
Sivabalan et al\textsuperscript{60} reported hydrodynamically balanced controlled drug delivery system of Glipizide. The formulation was designed by adopting optimization technique, which helps in setting up experiments in such a manner that the information was obtained as efficiently and precisely as possible. Initially, considering buoyancy as the main criteria, blank tablets were compressed for different formulae with various polymers like HPMC, MC and EC. The formula selected for design had a combination of Glipizide, HPMC, EC and MC. The tablets were prepared by direct compression method and evaluated for Glipizide content, in vitro release profile and buoyancy. Duration of buoyancy was observed simultaneously when the dissolution has carried out. The variation in weight was within the range of ±3\% complying with pharmacopoeial specifications (±7.5\%). The \textit{in-vitro} release was found to be in the range of 59.25\% to 79.50\%. The Glipizide content in the formulation varied between 91–100\%.

Basavaraj et al\textsuperscript{61} reported a novel gastroretentive drug delivery system based on effervescent technology for controlled delivery of active agent. Glipizide, a poorly soluble drug was used as a model drug and an attempt was made to improve the solubility of drug by the incorporation of accelerating agents, such as dispersant, alkalisising agent in conjunction with hydrophilic swellable polymer such as hydroxypropylmethylcellulose and present it in the form of gastroretentive floating tablets, which were designed to provide the desired controlled and complete release of drug for prolonged period of time. Floating tablets were prepared by direct compression method. Hydroxypropylmethylcellulose (HPMC K15M, HPMC K100M), Carbopol 940P, were incorporated for gel forming properties. Buoyancy was achieved by adding an effervescent mixture of sodium bicarbonate and anhydrous citric acid.

Saumya et al\textsuperscript{62} reported floating tablets of Glipizide employing Eudragit and two different grades of Hydroxy propyl methyl cellulose (HPMCK4M) and (HPMCK100M) polymers by effervescent technique. Sodium bicarbonate was incorporated as a gas-generating agent. The floating tablets were evaluated for uniformity of weight, hardness, friability, drug content, \textit{in vitro} buoyancy and dissolution studies. The drug release profile and floating properties was investigated. The prepared tablets exhibited
satisfactory physico-chemical characteristics. All the prepared batches showed good in vitro buoyancy. The tablets showed good results for in vitro buoyancy studies and floating time. It was observed that the tablets remained buoyant for 18-20 hours.

Senthil et al\textsuperscript{63} reported a gastric oral floating tablets of Glipizide ten formulations containing hydrophilic polymers, that are hydroxy propyl methyl cellulose K15 and eudragit RS100, gas generating agent, sodium bicarbonate and other release promoters such as sodium lauryl sulphate and polyvinyl pyrrolidone were used. The tablet were compressed and evaluated with different parameters like angle of repose, carr’s index diameter thickness, average weight, hardness, friability, drug content, in vitro buoyancy study and kinetic drug release data. The tablets remained buoyant over 8 hours in the release medium.

Pandya et al\textsuperscript{64} reported a controlled-release system designed to increase residence time in the stomach without contact with the mucosa was achieved through the preparation of floating microspheres by the emulsion solvent diffusion technique, using (i) Calcium silicate (CS) as porous carrier; (ii) Glipizide, an oral hypoglycemic agent; and (iii) Eudragit S as polymer. The effects of various formulations and process variables on the internal and external particle morphology, micromeritic properties, in vitro floating behavior, drug loading, and in vitro drug release were studied. The microspheres were found to be regular in shape and highly porous.

V.Mallikarjun et al\textsuperscript{65} reported floating tablets of Glipizide employing two different grades of HPMC and HPMC K15 polymers by effervescent technique. Sodium bicarbonate was incorporated as a gas-generating agent. The Floating tablets were evaluated for uniformity of weight, hardness, friability, drug content, in vitro buoyancy and dissolution studies. The drug release profile and floating properties was investigated. The prepared tablets exhibited satisfactory physico-chemical characteristics. All the prepared batches showed good in vitro buoyancy.
Uttam et al\textsuperscript{66} reported fixed dose combination of Metformin HCl as sustained release and Glipizide as immediate release were formulated as a bilayer matrix tablet using hydroxy propyl methyl cellulose (HPMC) as the matrix-forming polymer, and the tablets were evaluated via in vitro studies. Three different grades of HPMC (HPMC K 4M, HPMC K 15M, and HPMC K 100M) were used. All tablet formulations yielded quality matrix preparations with satisfactory tabletting properties. \textit{In vitro} release studies were carried out at a phosphate buffer of pH 6.8 with 0.75\% sodium lauryl sulphate w/v using the apparatus I (basket) as described in the United States Pharmacopeia.

Shahla et al\textsuperscript{67} reported a new monolithic matrix system to completely deliver Glipizide, a Biopharmaceutics Classification System (BCS) Class II drug in a zero order manner over an extended time period. Two approaches were examined using drug in formulations that contain swellable hydroxypropylmethylcellulose (HPMC) or erodible polyethylene oxide (PEO). The matrices were prepared by dry blending selected ratios of polymers and ingredients using direct compression technique. Dissolution was assessed using modified USP apparatus II. The inter relationship between matrix hydration, erosion and textural properties were determined and analyzed under the dissolution test conditions.

Phuntane et al\textsuperscript{68} reported by designing and systematically evaluating sustained release microspheres of Glipizide. Microspheres were developed by the emulsion solvent diffusion-evaporation technique by using the modified ethanol-dichloromethane co-solvent system. The resulting microspheres were evaluated for particle size, densities, flow properties, morphology, recovery yield, drug content, and \textit{in vitro} drug release behavior. The formulated microspheres were discrete, spherical with relatively smooth surface, and with good flow properties. Release pattern of Glipizide from microspheres of batch F3 followed Korsmeyer -peppas model and zero-order release kinetic model. The value of ‘n’ was found to be 0.960, which indicates that the drug release was followed by anomalous (non-fickian) diffusion.