EVALUATION OF IN VITRO DISSOLUTION FOR SODIUM ALGINATE FLOATING PELLETS OF METRONIDAZOLE

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Metronidazole floating pellets were prepared by extrusion-spheronization method and drug release profiles of metronidazole were investigated. Different batches of pellets were prepared by using sodium alginate and HPMC K4M and HPMC K100LV as polymer. In vitro dissolution of pellets was carried out in USP apparatus XXIV (Paddle Method) at 50 rpm. The drug release was measured by using UV spectroscopy at 277 nm for acid buffer media. The dissolution data were treated with zero Order, first order and Higuchi model. Half of the formulations were fitted to Higuchi Model and to the first order model. Finally it can be concluded that increasing polymer concentration to an optimum level, the release rate (23.18%) of metronidazole was satisfactory but further increase causes decrease of metronidazole release.
Topical antimicrobials help in preventing entry of microorganism into wound, which leads to fast healing of wounds. In the present study histopathological evaluation of various plasters containing norfloxacin (NF) and metronidazole (MTZ) was carried out and compared with marketed silver sulfadiazine 1% cream USP. Transdermal plasters using polyvinylpyrrolidone, polyvinyl-alcohol and NF/MTZ in different concentrations were prepared. The dorsum of each rat was inflicted with the burn wounds. Selected NF/MTZ plaster and the marketed Silver Sulfadiazine 1% Cream USP were applied to the wound inflicted areas every day from the day 1 until day 12. After day 12, the rats were sacrificed and their skin harvested. The bits of tissue from skin were fixed, processed, sectioned and stained with Hemotoxylin and Eosin. By 4th day, the formation of granulation tissue occurred, which allowed the reepithelialization phase to take place, and epithelial cells migrated across the new tissue to form a barrier between the wound and environment. At 8th day after the wound occurred, fibroblasts began to enter the wound site, marking the onset of proliferative phase even before the inflammatory phase has ended. Angiogenesis, also called neovascularization, started concurrently with fibroblast proliferation. By 12th day, fibroblasts differentiated into myofibroblasts and the wound began to contract. This resulted in epithelialization of the wound. The burn wound healing activity of the prepared NF/MTZ plasters was comparable with the silver sulfadiazine 1% cream, USP.
Effect of Fruit Juice on the Dissolution of Diclofenac Sodium Sustained Release Matrix Tablets

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In vitro dissolution of ten brands of diclofenac sodium sustained release matrix tablets were studied to determine the effect of fruit juice on the dissolution of diclofenac. Significant reduction was observed in the release rate of all collected brands. The results suggested that except brands D7 and D8 others did not fulfil the USP in vitro dissolution specification when administered with fruit juice. Therefore to avoid drug therapeutic failures and of the drug in the systemic circulation, ingestion of the juice with diclofenac sodium should be discouraged.
THE INFLUENCE OF SPLITTING ON CONTENT UNIFORMITY, WEIGHT UNIFORMITY AND DISSOLUTION PROFILES OF SOME MARKETED TABLETS

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Splitted tablets provide dose flexibility, ease of swallowing and may reduce the costs of medication. However, many patients are confronted with splitted tablets that are broken unequally and with difficulty, reducing compliance and reliance on medicines. Possibilities to reduce breaking difficulties are breaking instructions, tablet-splitters and breaking in advance. Factors influencing the performance of splitting are shape, size, curvature and thickness of the tablet and the form and deepness of the score line. Here uniformity of mass of divided tablets and loss of mass was calculated. It was found that a substantial portion of weight loss occurred during splitting of a tablet which can make a standard preparation into substandard one. Weight loss was observed more in splitting by hand than splitting by knife. 30% weight variation was observed between two half of the tablets. In case of splitting, most of the tablets changed their drug release behavior. It was more observed in splitted fractioned by hand than fractioned by knife. The intact tablets of ciprofloxacin hydrochloride were dissolved within 30-45 min and most of the fractioned tablets were dissolved in 15-30 min. The intact tablets of verapamil hydrochloride were dissolved within 30-60 min and most of the fractioned tablets were dissolved in 20-40 min. The intact tablets of atenolol hydrochloride were dissolved within 30-60 min and most of the fractioned tablets were dissolved within 15-45 min. The intact tablets of metoprolol tartrate were dissolved within 30-50 min and most of the fractioned tablets were dissolved in 20-40 min.

ORAL PRESENTATION
FORMULATION AND EVALUATION OF EUDRAGIT FLOATING MICROSPHERES OF DICLOFENAC SODIUM BY SOLVENT EVAPORATION METHOD

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The main aim of the study was to formulate and evaluate floating microspheres of diclofenac sodium. Gastro retentive floating microspheres have emerged as an efficient means of enhancing the bioavailability and controlled delivery of many drugs. Floating microspheres of diclofenac sodium were formulated in order to achieve an extended retention time in upper G.I.T. which resulted in enhanced absorption and thereby improving the bioavailability. Floating microspheres were prepared by non aqueous solvent evaporation method by using Eudragit RS 100 and Eudragit RL 100. The pure drug, the polymers and the physical mixtures were evaluated for FTIR. The prepared diclofenac sodium microspheres were evaluated for surface topography, angle of repose, bulk density, tapped density, carr’s index, hausner’s ratio, yield of microspheres, particle size analysis, drug entrapment efficiency, in vitro floating ability, in vitro drug release and kinetic studies. Results showed that there were no drug incompatibilities and there was good floating ability. SEM revealed the size and surface morphology of microspheres. The preformulation parameters were found to be satisfactory. Drug entrapment efficiency was found to be 70-135% and yield was found to be 70-95%. The drug release profiles showed that microspheres prepared with Eudragit RS 100 showed less drug release when compared to Eudragit RL 100. When Eudragit RL 100 was used in combination with Eudragit RS 100, the release was found to be faster when compared to Eudragit RS 100 alone. The release data obtained were fitted to Higuchi and Korsemeyer-Peppas model and indicated that the mechanism of the drug release was non fickian type of diffusion.

ORAL PRESENTATION

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[7th April, 2012 – Bhopal, MP]
INFLUENCE OF THE PROCESS PARAMETERS ON FORMULATION OF POLY-D,L-LACTIDE NANOPARTICLES OF LOMUSTINE

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The present research work describes a formulation of a poly-D,L-lactide based biodegradable nanoparticulate carrier system of lomustine. Lomustine is a cell-cycle phase nonspecific antineoplastic drug. It is highly toxic with low therapeutic index. About 60% of cyclohexyl moiety of this drug is found to be bound to plasma proteins. Change of dissolution rate and site specific delivery of lomustine was tried with nanoparticles formulation. The nanoparticles were prepared by modified nanoprecipitation method and parameters tested were polymer and drug content, cosolvent addition and organic solvent evaporation rate, surfactant amount and incorporation mode, aqueous to organic phase volume ratio, homogenization speed and time. Nanoparticles were characterized in terms of dynamic light scattering for particle size and size distribution, transmission electron microscopy (TEM), scanning electron microscopy (SEM), percent entrapment efficiency, in vitro drug release and cell viability testing. The average particle size and size distribution varied substantially with different preparation conditions from 68 nm to 437 nm with polydispersibility index (PDI) from 0.066 to 0.3. The entrapment efficiency varied from 47% to 95%. There was significant control of drug release over 24 h. Cell viability assay showed that the drug loaded nanoparticles reduced the tumor cell proliferation significantly in L132 human lung cancer cell line with optimized formulations.

[6]
Preparation and Characterization of Vesicles Containing Lipoamino Acids Prepared from Aspartic Acid and Glutamic Acid

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Vesicles containing long chain alkyl esters of aspartic acid and glutamic acid (Lipoamino acids) were prepared by using lipoamino acids (LAA) and cholesterol in 1:1 weight ratio. The vesicles were prepared by film hydration method followed by sonication in which aqueous azidothymidine (AZT) solution was encapsulated. Formation of vesicles was confirmed by optical microscope. The vesicles after sonication were characterized for size and size distribution, charge and zeta potential (ZP), percent entrapment and in vitro release. Vesicle size increased with increasing the chain length of LAA. The ZP of all the vesicles was negative. The altered zeta potential in vesicles containing LAA compared to control vesicles indicates surface orientation of LAA on to the vesicles. Percent drug entrapment was calculated. Preparations containing LAAs prepared with aspartic acid showed higher entrapment compared to those prepared with LAAs of glutamic acid. Entrapment efficiency decreased with increase in the alkyl chain length. The percent release was lower in LAA containing preparations when compared with control vesicular preparation. Chain length did not have any significant effect on drug release.
FORMULATION OF CONTROLLED RELEASE LAYERED MATRIX SYSTEM OF HIGHLY WATER SOLUBLE DRUG

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Multilayered matrix tablets for controlled drug delivery wherein one or two layers of release retardant polymer may be applied on the both sides matrix tablet such that the swollen hydrophilic polymer controls the drug release after oral administration. These formulations designed to deliver the drug at predetermined rate, maintain therapeutically effective concentrations in systemic circulation for prolonged period of time. In the present study, guar gum was used as hydrophilic matrix carrier for designing oral controlled drug delivery systems of a highly water soluble drug. Three layered matrix tablets of a model drug was prepared by wet granulation technique were optimized to release the drug at the desired first order release rate constant.
DEVELOPMENT AND CHARACTERIZATION OF CYCLODEXTRIN NANOSPONGES: A NOVEL DRUG DELIVERY SYSTEM FOR DELIVERY OF POORLY SOLUBLE DRUG

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Cefadroxil is a first generation cephalosporin anti-bacterial drug used in skin, throat, and urinary tract infections. The poor aqueous solubility of cefadroxil limits its therapeutic utility. Cyclodextrin nanosponges are a novel class of cross-linked derivatives of cyclodextrins. They have been used to increase the solubility of poorly soluble actives and control the release. The purpose of the present study was to develop β-cyclodextrin nanosponges loaded with poorly soluble model drug cefadroxil for oral drug delivery. The complexes of cefadroxil with three types of β-cyclodextrin nanosponges having different cross-linking ratio (1:2, 1:4 and 1:8 on molar basis with the cross-linker diphenylcarbonate) were developed with a view to increase its solubility. The particle sizes of the nanosponge complex were found between 690 to 800 nm with low polydispersity indices. The crosslinking and interactions of drug with cyclodextrin nanosponge was confirmed by FTIR. The DSC studies further confirmed the complexation. The loading of cefadroxil in prepared nanosponges formulations was found to be 58%, 70% and 66% w/w in N1, N2 and N3, respectively. The phase solubility study was done in rationale to evaluate the solubilization efficiency of nanosponges. Phase-solubility profile indicated that the solubility of cefadroxil was significantly increased in the presence of β-cyclodextrin and was classified as A1-type. It was found that the solubility of cefadroxil was enhanced more than 5-folds with nanosponges. The nanosponges were found capable of improving the solubility of poorly water-soluble molecules.

ORAL PRESENTATION

[9]
FORMULATION DEVELOPMENT AND EVALUATION OF ACYCLOVIR LOADED CHITOSAN MUCOADHESIVE MICROSPHERES

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Chitosan is a natural polycationic copolymer consisting of glucosamine and N-acetyl glucosamine units. Chitosan has a very good potential as a drug carrier in pharmaceutical field due to its biodegradability, high charge density, non-toxicity and mucoadhesive properties. In order to minimize the local side effects of acyclovir in GIT, it was loaded in chitosan microspheres. Microspheres were formulated by single emulsification phase separation method. They were characterized for morphology by optical microscope and were found to be small and spherical in shape. The particle size of microspheres were determined by sieving and found to be 150-200 µm in size. FTIR studies showed that there was no interaction between chitosan and acyclovir. The formulations were mucoadhesive and showed sustained release for at least 8 h.
TRANSDERMAL THERAPEUTIC SYSTEM AND ITS REGULATORY ASPECTS

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A transdermal patch or skin patch is a medicated adhesive patch that is placed on the skin to deliver a specific dose of medication through the skin and into the bloodstream. Often, this promotes healing to an injured area of the body. The main components to a transdermal patch are: liner, drug, adhesive, membrane, backing. A wide variety of pharmaceuticals can be delivered by transdermal patches. For example: Transdermal therapeutic system-fentanyl (TTS-F) has been extensively studied in cancer pain management. Nitroglycerin patches for angina are available. Lidocaine patches, marketed as Lidoderm, relieve the peripheral pain of shingles. A transdermal patch is classified by the U.S. Food and Drug Administration as a combination product consisting of a medical device combined with a drug or biological product that the device is designed to deliver. Prior to sale in the United States, any transdermal patch product must apply for and receive approval from the Food and Drug Administration, demonstrating safety and efficacy for its intended use. Sensitization to drugs in transdermal therapeutic systems is a common unwanted event. Skin irritation is judged on clinical aspects, histopathologic and immunofluorescence findings, and changes in the Langerhans cell systems. The most frequent treatment-related adverse events were nausea, constipation, and somnolence and opioid specific adverse events. Moreover, throughout the past two decades, the transdermal patches have become a proven technology that offers variety of significant clinical benefits over other dosage forms.
FORMULATION AND EVALUATION OF BILAYER TABLETS HAVING METFORMIN AS SUSTAINED RELEASE LAYER AND GLIMEPIRIDE AS IMMEDIATE RELEASE LAYER

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In diabetes, patients have to take several medicines in combination at the same time which reduces patients’ compliance and aesthetic value. Metformin and glimepiride are used as oral hypoglycemic agents in combination therapy to treat diabetes. In order to reduce dosing frequency and improve patient compliance bilayer tablet was designed. In this bilayer tablet metformin acted as the sustained release layer which was prepared by wet granulation method using HPMC and glimepiride acted as the immediate release layer which was prepared by using sodium starch glycolate as a superdisintegrant. The bilayer tablet passed the weight variation and friability tests. The tablets showed an average hardness of 5 Kg and thickness of 9 mm. The immediate layer disintegrated in 11 min. In-vitro drug release studies showed that immediate layer released the entire glimepiride within 15 minutes whereas the sustained release layer sustained the release of metformin up to 8 h.

POSTER PRESENTATION
AN OVERVIEW OF ISO

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The ISO 9000 series of quality management systems standards, introduced in 1986, has been adopted at over 5,60,000 locations worldwide. Anecdotal evidence suggests that firms can achieve internal benefits such as quality or productivity improvements or that certification can help firms maintain or increase their market share, or both. Others argue that the standard is too generic to cause performance improvement but can be seen as a signal of good management. This article highlighted on the global adoption of ISO and ISO certification for maintaining the quality of the product. An introduction of ISO families including 14000 series and some of the series of ISO used in medical fields and also include the procedure to get industry ISO certified. Benefits of ISO certification and ISO 9001 includes the various benefits like better products, improved profit levels results as productivity improves, customer satisfaction, superior design etc. This article focus on how ISO is beneficial for pharmacy field in various aspects such as pharmacy accreditation services, patient safety, pharmacy quality, unifying base for industry, transfer of goods to developing countries, increase efficiency and effectiveness.

POSTER PRESENTATION

PT-13
PREPARATION, CHARACTERIZATION AND IN VIVO EVALUATION OF DOCETAXEL SOLID DISPERSIONS

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Docetaxel is a poorly water-soluble drug with low oral bioavailability of 8%±6%. The main use of docetaxel is the treatment of a variety of cancers after the failure of anthracycline-based chemotherapy. The aim of the present work was to investigate the effect of various carriers like urea, mannitol, PVP K30 and PVPP/VA 64 on in vitro dissolution characteristics of docetaxel. Docetaxel solid dispersions were prepared by fusion method. All the prepared solid dispersions exhibited appropriate yield, average particle size, drug content, wetting time and moisture content. Scanning electron microscopy supported the amorphous nature of the drug in the prepared formulation. The carriers did not show any incompatibility when tested using Fourier transform infrared spectroscopy and differential scanning calorimetry. A higher release in both, 0.1 N HCl, pH 1.2 and phosphate buffer pH 7.4 was observed as compared to pure drug and their corresponding physical mixtures. With perspective of the dissolution media, the phosphate buffer pH 7.4 showed higher dissolution as compared to 0.1 N HCl pH 1.2. The highest improvement in dissolution was found with PVP K30 as carrier. The in vitro release from all the formulations was best described by first order kinetics (R²= 0.9132 and 0.9346 in 0.1 N HCl and phosphate buffer, respectively) followed by Higuchi release model (R² = 0.9068 and 0.9458 in 0.1 N HCl and phosphate buffer, respectively) with better intestinal absorption. The intestinal absorption followed the first order kinetics (R² = 0.9321). With enhanced solubility and dissolution, it is expected that docetaxel in solid dispersions will demonstrate improved bioavailability.
FORMULATION, DEVELOPMENT AND EVALUATION OF MOUTH DISSOLVING FILM OF CARVEDILOL BASED ON MALTODEXTRIN

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Carvedilol is a nonselective β-adrenergic blocking agent with α1-blocking activity. It is widely used to treat essential hypertension and angina pectoris. It is rapidly absorbed after oral administration, the bioavailability of carvedilol is 25-35% as it undergoes stereo selective first pass metabolism. In order to reduce these side effects of carvedilol, it was formulated as mouth dissolving film to get immediate release of the drug. Mouth dissolving film based on maltodextrin was formulated by solvent casting method. Maltodextrin provided flexibility and reduce the cracking of film and increase viscosity allowing for faster drying times. The film was evaluated for thickness, FTIR, XRD, in-vitro disintegration time and in-vitro drug release. By FTIR studies, it was found that there was no interaction between drug and polymer. Thickness of the films were found to be less than 1 mm, it was transparent and flexible film. The in-vitro disintegration time of film was found to be less than 1 min.
FORMULATION AND COMPARATIVE DISSOLUTION EVALUATION OF METFORMIN HYDROCHLORIDE TABLETS USING VARIOUS BINDERS

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The major objective of this work is to systematically compare and explain the effect of various binders at four different levels (2%, 3%, 5%, and 7%) using a model drug as metformin hydrochloride. Metformin hydrochloride is a high-dose drug widely used as an oral anti-hyperglycemic agent. As it is highly crystalline and has poor compaction properties, it is difficult to form tablets by direct compression. The aim of this study was to develop adequate metformin tablets, pharmaceutically equivalent to the reference product, metformin 500 mg tablets, by wet granulation prepared by high shear granulation technique with various binders (different Povidone like PVP K29/32, PVP K30, PVP K90) and cellulose binders HPMC, HPC, MC) at different concentrations and different compression forces like 20, 30, 40, 50 KN. The tablets were analyzed for their hardness, friability, disintegration, dissolution, content uniformity and dissolution profile (basket apparatus at 50 rpm, pH 6.8 phosphate buffer). The four formulations, (2%, 3%, 5%, and 7%) demonstrated adequate uniformity of content, hardness, friability, disintegration and total drug dissolution after 30 minutes and after 60 minutes. The dissolution efficiency for all the formulations was about 75%. These results suggested that optimum concentration of Povidone in the formulation at 3% level of PVP K29/32 was the most effective binder evaluated based on compression and dissolution results.

POSTER PRESENTATION

[16]
Dendrimers are a new class of polymeric materials. They are highly branched, monodisperse macromolecules. The structure of these materials has a great impact on their physical and chemical properties. As a result of their unique behavior dendrimers are suitable for a wide range of biomedical and industrial applications. They possess empty internal cavities and many functional end groups which are responsible for high solubility and reactivity. They are produced in an interactive sequence of reaction steps, in which each additional interaction leads to a higher generation dendrimer. Dendrimers possess three distinguished architectural components namely Initiator core, Interior layers & Exterior. Polyamido amine (PAMAM) dendrimers has received much attention for their ability to solubilize water-insoluble drugs and their ability to promote the transport of drugs across biomembranes. In one study an efficient transdermal drug delivery system (TDDS) consisting of a polyhydroxyalkanoate (PHA)-based system with a polyamidoamine dendrimer was examined for the transdermal delivery of tamsulosin. By adding the dendrimer, the dendrimer-containing PHA matrix achieved the clinically required amount of tamsulosin permeating through the skin model.
FORMULATION AND EVALUATION OF BUCCOADHESIVE TABLET OF ATENOLOL

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The present study was aimed to formulate the buccoadhesive tablet of atenolol by adopting Box Behnken factorial design and using chitosan, carbopol 937P and CMC Na. The formulations were evaluated for drug content, hardness, thickness, friability, weight variation, in vitro dissolution study and ex vivo bioadhesive strength and time. The in vitro dissolution study showed higher and controlled drug release. The ex vivo bioadhesion studies of formulations on sheep buccal mucosa showed better bioadhesion with high bioadhesion time. The oral cavity is being increasingly used for the administration of drugs which are mainly designed for the contained drugs through the oral mucosa into systemic circulation. Buccal mucosa consisting of stratified squamous epithelium, was investigated as a site for drug delivery several decades ago and the interest in this area for the transmucosal drug administration is still growing. Buccal mucosa makes a more appropriate choice of site if prolonged drug delivery is desired because buccal site is less permeable than the sublingual site. Buccal bioadhesive drug devices designed to remain in contact with buccal mucosa and release the drug over a long period of time in controlled manner. Such a delivery of drug through buccal mucosa overcomes premature drug degradation within the GI tract as well as active drug loss due to first pass metabolism. In addition there is excellent acceptability and the drug can be applied, localized and may be removed easily at any time during the treatment period. Atenolol, a β-blocker, prescribed widely in diverse cardiovascular diseases. e.g. hypertension, angina pectoris, arrhythmias and myocardial infarction. Administration of conventional tablets of atenolol has been reported to exhibit fluctuations in the plasma drug levels.

POSTER PRESENTATION

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NOVEL OPHTHALMIC HYDROGEL: A BOON FOR GLAUCOMA

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Glaucoma currently constitutes second most common cause of treatable blindness worldwide. The reduced therapeutic response and the poor bioavailability exhibited by the conventional ophthalmic dosage form are due to the rapid pre corneal elimination of the drug. This problem can be solved by using the stimuli sensitive hydrogels that are instilled as drops in the eye and shows increase in viscosity after instillation due to stimuli. The present work describes the formulation and evaluation of hydrogel system of the anti glaucoma agent, based on the concept of stimuli sensitivity i.e. pH of instiu gelation. Poly acrylic acid (carbapol 934p) was used as a gelling agent in the combination with the viscolizers i.e. hydroxylpropyl methylcellulose. Rheological studies were performed by using Brookfield viscometer. In vitro drug release studies were carried out by dynamic dialysis technique.
INTRANASAL DRUG DELIVERY TO BRAIN

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Intranasal drug delivery provides a practical, non-invasive method by bypassing the blood brain barrier (BBB) to deliver therapeutic agents to the brain and spinal cord. The blood brain barrier represents one of the strictest barriers in the human body. The barrier is defined by restricted exchange of hydrophilic compounds, small proteins and charged molecules between the plasma and CNS. For decades, the BBB has prevented the use of many therapeutic agents for treating Alzheimer disease, strokes, brain tumor, spinal cord injury, depression, anxiety and other CNS disorders. This technology allows drugs that do not cross the BBB to be delivered to the CNS within minutes. It also directly deliver drugs that do not cross the BBB to the brain, eliminating the need for systemic administration and its potential side effects as there is a direct connection to brain via olfactory lobe which is responsible for olfaction, it is easy to deliver drugs to CNS. Intranasal delivery does not necessarily require any modification to therapeutic agents and does not require drug to be coupled with carrier. A wide variety of therapeutics, including both small molecules and macromolecules can be rapidly delivered to CNS using this method. This new method of delivery of drugs can revolutionize the treatment of Alzheimer’s diseases and other brain disorders.
Nutraceuticals - The Ultimate Health Promoters

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Nutraceutical, a portmanteau of the words “nutrition” and “pharmaceutical”, is a food or food product that reportedly provides health and medical benefits, including the prevention and treatment of disease. Health Canada defines the term as a product isolated or purified from foods that is generally sold in medicinal forms not usually associated with food. A nutraceutical is demonstrated to have a physiological benefit or provide protection against chronic disease. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered foods, herbal products, and processed foods such as cereals, soups, and beverages. Examples are beta-carotene and lycopene. The FDA provides a list of dietary supplement companies receiving warning letters about their products. Many botanical and herbal extracts such as ginseng, garlic oil, etc. have been developed as nutraceuticals. Nutraceuticals are often used in nutrient premixes or nutrient systems in the food and pharmaceutical industries. 

Poster Presentation

[21]
NANO DRUG DELIVERY SYSTEM

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Nanotechnology received a lot of attention with the never-seen-before enthusiasm because of its future potential that can literally revolutionize each field in which it is being exploited. In drug delivery, nanotechnology is just beginning to make an impact, because materials reduced to nanoscale can show different properties compared to what they exhibit on a macro scale. Drug delivery nanosystems constitute a significant portion of nanomedicine. Many of the current “nano” drug delivery systems, however, are remnants of conventional drug delivery systems that happen to be in the nanometer range, such as liposomes, polymeric micelles, nanoparticles, dendrimers, and nanocrystals. Liposomes and polymer micelles were first prepared in 1960s, and nanoparticles and dendrimers in 1970s. The importance of nanotechnology in drug delivery is in the concept and ability to manipulate molecules and supramolecular structures for producing devices with programmed functions. Conventional liposomes, polymeric micelles, and nanoparticles are now called “nanovehicles”. Due to nano particles, modern chemistry has reached the point where it is possible to prepare small molecules to almost any structure, which are very useful in manufacturing variety of useful pharmaceuticals. Nanotechnology may be able to create many new materials with a vast range of applications in medicine and energy production.
FLOATING MICROSPHERES OF CURCUMIN: FORMULATION, CHARACTERIZATION AND IN VITRO EVALUATION

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The objective of the present study was to develop floating microspheres of curcumin in order to achieve an extended retention in the upper GIT, which may result in enhanced absorption and thereby improved bioavailability. The microspheres were prepared by solvent evaporation method using polymers such as hydroxylpropyl methylcellulose (HPMC K15 M), ethyl cellulose (EC) in different ratios and curcumin in each formulation. In vitro drug release studies were performed using USP apparatus type I and the microspheres were characterized by polymer compatibility by using FTIR. The yield, particle size, buoyancy, drug entrapment efficiency, and in vitro drug release were studied. The results showed that microspheres yielded 63.81-64.36%. The particle size was distributed between 14.60-20.76 µm, drug entrapment efficiency was 57.4-63.8%, and buoyancy percentage was 48.3-68.3%. The best drug release profile was seen with formulation 5 at the ratio of drug to polymer 1:6.
DESIGN AND EVALUATION OF MICONAZOLE TOPICAL NANOEMULSION GEL FOR THE TREATMENT OF SUBUNGUAL ONYCHOMYCOSIS

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Onychomycosis is a common infection of nails caused majorly by Trichophyton rubrum. Although various antifungal agents are available for the treatment of the disease, but their oral and i.v. administration is associated with serious side effects and toxicity. Topical drug delivery systems can provide the suitable answer for this problem. In the present research work, an attempt was made for effective delivery of miconazole across human nail plates by enhancing the penetration and retention time in skin layers. For this purpose nanoemulsion gel, composed of oil, surfactant, co-surfactant, and carbopol was developed by aqueous phase titration method and was evaluated for various in-vitro attributes. Oleic acid, tween 80, and PEG 400 were selected as oil, surfactant and co-surfactant respectively. Pseudoternary phase diagrams were plotted to get the range of nano-emulsion area. The selected formulations were subjected to thermodynamic studies. Among thermodynamically stable formulation, MIE4 had shown lowest permeation across skin (46.17 µg/cm²/h). MIE4 formulation has been further evaluated for skin retention study by fluorescent microscopy. Fluorescence microscopy studies done over a period of 6 h clearly gave an indication of longer retention capability of the nano-gel formulation, for the desired topical action.

POSTER PRESENTATION [24]
SKIN PERMEATION STUDY OF ONDANSETRON NANOEMULSION GEL

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Chemotherapy induced nausea vomiting (CINV) is a major dose limiting side effect of cancer treatment. Treatment of CINV may vary from 1-7 days. In this perspective, o/w nanoemulsion was developed as a tool for the transdermal delivery of ondansetron. Pseudo ternary phase diagrams were constructed by aqueous titration technique and various nanoemulsion formulations were developed. The developed formulations were subjected to thermodynamic stability tests. In order to evaluate the effect of nanoemulsion on skin permeation, ex vivo skin permeation studies across rat skin were performed using a vertical type Keshary-Chien diffusion cell and permeation profile was compared with drug solution in oil, S{sub mix} and aqueous suspension. The flux of nanoemulsion formulations were in the range from 103.8 -188.3 µg/cm²/h, significantly higher (p<0.01) than the oil solution (control, 33.08 µg/cm²/h), S{sub mix} (11.78 µg/cm²/h) and aqueous suspension (10.75 µg/cm²/h). Mechanism of skin permeation enhancement was also studied by subjecting nanoemulsion treated skin to DSC, FTIR and histopathological examination. Reduction in characteristic height and area of peak of FTIR band, shifting of DSC to lower melting and disruption of skin indicated the extraction of lipid and fluidization of skin due to presence of surfactant could be the possible reasons of permeation enhancement.

[25]
FORMULATION AND CHARACTERIZATION OF ALPRAZOLAM BILAYERED BUCCOADHESIVE PATCHES

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The buccal region of oral cavity is an attractive target for administration of drug of choice. The oral transmucosal drug delivery bypasses liver and avoid pre-systemic elimination. Alprazolam is an antianxiety drug commonly used in panic disorder and insomnia. It has high protein binding and extensive first pass metabolism. The objective of this study was to develop formulations and systematically evaluate in vitro performances of bilayered buccoadhesive patches of alprazolam using hydrophilic polymer hydroxypropyl methylcellulose (HPMC) as primary layer and hydrophobic polymer Eudragit RLPO as secondary layer using solvent casting method. The patches were evaluated for thickness, folding endurance, swelling behavior, mucoadhesive strength and surface pH. In vitro release studies were conducted for alprazolam loaded patches in phosphate buffer pH 6.8 solution. The patches exhibited drug release in the range of 75.7 to 97% in 12 hours. Data of in vitro release studies were fitted into kinetic model (Higuchi and Korsmeyer- Peppas models) to explain release profiles.
DEVELOPMENT OF NOVEL DRUG DELIVERY SYSTEM FOR ORAL MALE CONTRACEPTIVE FROM PLANT SOURCE

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The study represents a new approach for the development of oral male contraceptive formulation based on the plant content. Nanoemulsions are submicron sized emulsions that are under extensive investigation as drug carriers for improving the delivery of therapeutic agents. They are by far the most advanced nanoparticle systems for the systemic delivery of biologically active agents for controlled drug delivery and targeting. Nanoemulsions are the thermodynamically stable isotropic system in which two immiscible liquids (water and oil) are mixed to form a single phase by means of appropriate surfactants or its mix with a droplet diameter approximately in the range of 0.5-100 µm. In present time, no effective male contraceptive formulation is available in the market. Literature shows that various plants possess spermicidal and contraceptive potential. Papaya is commonly known for its food and nutritional values throughout the world. The medicinal properties of papaya fruit and other parts of the plant are also well known in the traditional system of medicine. Carica papaya is the plant source which content highly oral male contraceptive potential. This work will represent nanoemulsion formulation of chloroform extract of Carica papaya plant and in-vivo, in-vitro, stability, evaluation study of nanoemulsion formulation.

POSTER PRESENTATION

[27]
EFFECT OF POLYMER AND DIFFERENT CROSS LINKING AGENTS ON IN-VITRO RELEASE OF QUERCETIN FROM MICROBEADS

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The present exploration depicts the effect of polymer and cross linking agent on in-vitro release of quercetin from alginate beads. The formulations were prepared by utilizing 2³ factorial design. Hydrophilic polymer hydroxypropyl methylcellulose (15-24 cps) was used for its gel forming and release controlling properties. The effect of different concentrations of cross linking agent (calcium chloride) on entrapment efficiency and drug release profile were investigated. The beads were prepared by changing the experimental variables such as concentration of polymer and cross linking agent in order to optimize independent variables. The bead formulations were prepared by ionotropic gelation method. Quercetin was used as model drug. The formulated beads were evaluated for particle size, drug entrapment efficiency and in-vitro release. The entrapment efficiency and particle size was between the range of 16.62% to 72.47% and 0.726±0.0088 mm to 1.179±0.0547 mm respectively. Results revealed that on increasing polymer concentration and cross linking agent, entrapment efficiency of drug increased with decrease in its release rate. The results suggested the possibility of getting controlled release system by varying the concentrations of polymer and cross linking agent.
DESIGN, DEVELOPMENT AND IN VITRO EVALUATION OF CAFFEINE LOADED HYDROPHILIC GUM MATRIX TABLETS

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The present study was carried out to develop sustained release tablets of caffeine using natural hydrophilic matrix formers (tragacanth) and different filling polymers like hydroxypropyl methylcellulose (HPMC), cellulose acetate phthalate (CAP), and ethyl cellulose (EC). Sustained release matrix tablets of caffeine were prepared by using different ratios of different polymers and tragacanth. The polymer was incorporated into a matrix system using wet granulation technique. All the lubricated formulations were compressed into tablets and evaluated for diameter, hardness, friability, weight variation and in vitro dissolution using USP Paddle dissolution apparatus. Increasing the amount of polymer (tragacanth) in the formulation led to reduced friability, increased hardness and slow release of drug. Different filling polymers also sustain the drug release. Most of the solid matrix formulations followed Higuchi kinetics. The results showed that the formulation F3 containing gum tragacanth sustained the drug release up to 8 h.
ROLE OF NDDS IN BRAIN TARGETING OF PROTEINS AND PEPTIDES

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Brain is a delicate organ, isolated from general circulation and characterized by the presence of relatively impermeable endothelial cells with tight junctions, enzymatic activity and the presence of active efflux transporter mechanisms. These formidable obstacles often impede drug delivery to the brain. As a result, several promising molecules are lost from the market for a mere consequence of lack of in vivo response probably because the molecule cannot reach the brain in a sufficient concentration. Brain delivery of nanoparticles after oral administration had been limited due to reduced bioavailability of nanoparticles and extensive degradation of the peptide and/or nanoparticles by gastrointestinal enzymes. The premedial existing approaches for brain delivery like superficial and ventricular application of chemical or the application of chemicals to brain parenchyma are invasive and hence are less patient friendly, more laborious and require skill and could also damage the brain permanently. Nanoparticles could be polymeric or lipidic (SLNs) and are taken up readily by the brain because of lipidic nature. The bioacceptable and biodegradable nature of SLNs makes them less toxic as compared to polymeric nanoparticles. Supplemented with small size which prolongs the circulation time in blood, feasible scale up for large scale production and absence of burst effect makes them interesting candidates for study. The polymers used for preparation of NDDS for brain targeting include glyceryl monostearate, precirol ATOs (PRE), glyceryl tristearate (GTs), witepsol E85 (WE 5), poloxamer 407, hydrogenated soya, phosphatidylcholine as stabilizers. With advanced CADD technology or molecular modelling new sides, combinations of drugs and polymers CNS drug delivery system can be improved.

POSTER PRESENTATION

[30]
DESIGN AND DEVELOPMENT OF MUCOADHESIVE DOSAGE FORM FOR NDDS

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Today, a pharmaceutical scientist is well versed with the fact that the overall action of a drug molecule is not merely dependent on its inherent therapeutic activity, rather on the efficiency of its delivery at the site of action. Many drug delivery systems (DDS) are aimed to sustain drug blood concentration and controlling the rate of drug delivery to the target tissue, but mucoadhesion is one of the most prominent and latest systems in the design of gastro retentive drug delivery systems. It prolongs the residence time of the dosage form at the site of application or absorption and facilitates an intimate contact of the dosage form with the underline absorption surface and thus contributes to improved and better therapeutic performance of the drug. Mucoadhesive is the type of dosage form which having gastroretentive property and smaller particle size facilitate advantages over other dosage forms and help to overcome these problems. Tacrine, clonazepam, sumatriptan, cyclosporine are successfully discovered and already existing in market as mucoadhesive microemulsion for treatment of alzheimer disease, epilepsy, migraine respectively. Many characterization parameters are there to evaluate like globule size distribution, zeta potential, drug content, biodistribution of drug in brain etc. Recently, intranasal mucoadhesive of clonazepam was prepared and indicated more effective targeting of brain with intranasal CMME. With the advent of molecular modeling and computer aided drug delivery system it is possible to acknowledge the molecular level of drug and help in targeting of drug to know about drug biochemistry and suitable dosage form to formulate and dispense the drug in the form of mucoadhesive.
Present work represents disadvantages of conventionally utilized drugs and their dosage in cancer therapy and the recent advancement as well as various novel delivery systems; their advantages and utility in various cancer therapy. The main disadvantage with conventionally utilized cancer drugs is that the targets on tumor cell resemble the normal cells very much thus it is difficult to target that specific difference between the two, and target them. Thus, various novel targets or strategies are represented diagrammatically which are to provide benefits like reduction in dose, side effects, more site specific, minimal damage to normal cell, identification of abnormal changes or abnormal sites of tumor cells. The various novel targets are passive targeting via RES predominant organs (liver, lungs, spleen) pegyllation i.e. covering the carrier system by PEG, potiosis, targeting GLUT (glucose receptors) present in abnormally high concentration in tumor cells. A general outline of the benefits of these systems and future aspects in cancer therapy will be indicated.
FORMULATION AND DEVELOPMENT OF THERMO REVERSIBLE MUCOADHESIVE INTRANASAL IN SITU HYDROGEL BY USING A COMBINATION OF POLYMERS

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The prolonged residence of drug formulation in the nasal cavity is of utmost importance for intranasal drug delivery. To improve the nasal retention time of Metoclopramide hydrochloride (MCP HCl), it has been formulated as in situ mucoadhesive gel by using blend of Poloxamer 407, Poloxamer 188 and Carbopol 934P. The objective of this work was to improve the nasal bioavailability of antiemetic drug, MCP HCl by increasing its nasal retention time as well as by means of nasal permeation. Increase in the concentration of mucoadhesive agent enhanced the mucoadhesive force significantly. In vitro release of Metoclopramide HCl from the mucoadhesive system in simulated nasal fluid was influenced significantly by the properties and concentration of carbopol 934P showed to enhance bioavailability through its longer nasal residence time and ability to sustain the release of the drug. The formulations showed favorable sol-gel transition temperatures (28-33°C). The in vitro tests performed for mucoadhesive strength and drug diffusion showed that nasal in situ gelling formulations prepared are having good mucoadhesive strength with nearly 100% drug diffusion. The formulations were evaluated for physiochemical parameter, gelation temperature, viscosity, gel strength, content uniformity, mucoadhesive force, FTIR and DSC. So, this study pointed to the potential of mucoadhesive in situ nasal gel in terms of ease of administration, accuracy of dosing, prolonged nasal residence and improved nasal bioavailability.

POSTER PRESENTATION

[33]
Drug delivery is the method or process of administering a pharmaceutical compound to achieve a therapeutic effect in humans or animals. The concept of FDDS was described in the literature as early as 1962. Floating drug delivery systems (FDDS) have a bulk density less than gastric fluids and so remain buoyant in the stomach without affecting the gastric emptying rate for a prolonged period of time. When microspheres come in contact with gastric fluid, gel formers polysaccharides and polymers hydrate to form colloidal gel barrier that controls the rate of fluid penetration into the device and consequently controls the rate of fluid penetration into the device and hence the drug releases. While the system is floating on the gastric contents the drug is released slowly at the desired rate from the system. After release of drug, the residual system is emptied from the stomach. This results in an increase in GRT and a better control of fluctuations in plasma drug concentrations. Gastro-retentive floating micro spheres are low-density systems that have sufficient buoyancy to float over gastric contents and remain in stomach for prolonged period, as the system floats over gastric contents, the drug is released slowly at desired rate resulting in increased gastric retention with reduced fluctuations in plasma drug concentration.
Resveratrol is a phytoalexin that is found in a few edible food materials such as grape skins, peanuts and red wine. Numerous reports existed in the literature suggested that dietary resveratrol may act as an antioxidant, promotes nitric oxide production, inhibits platelet aggregation and increases high-density lipoprotein cholesterol, and subsequently may serve as a cardio-protective agent. Recent reports demonstrated that resveratrol can function as cancer chemo preventive agents, exhibiting anti-inflammatory, neuroprotective, anti-ageing and antiviral properties. However, most of these effects are yet to be confirmed in humans. In the only clinical trial, high doses of special proprietary formulation has demonstrated blood sugar-lowering effects of resveratrol in type 2 diabetes mellitus. As with many polyphenols, resveratrol is reasonably well absorbed but has low bioavailability. It is metabolized by hydroxylation, glucuronidation, sulfation and hydrogenation. We reviewed the published literature and reported to consolidate information available on the biological activity of resveratrol using electronic databases as well as hand-picked articles to summarize the biological effects of resveratrol and its clinical benefits against human diseases.
Generally, the drug approval process comprised mainly the two steps, application to conduct clinical trial and application to the regulatory authority for marketing authorization of drug. The new drug approval process of various countries is similar in some of the aspects whereas it differs in some other aspects. In most of the counties, sponsor firstly files an application to conduct clinical trial, and only after the approval by the regulatory authority, the applicant conducts the clinical studies and further submits an application to the regulatory authority for marketing authorization of drug. In all countries, information submitted to regulatory authorities regarding the quality, safety and efficacy of drug is similar; however, the time, fee and review process of clinical trials and marketing authorization application differs. For the purpose of harmonization, the International Conference on Harmonization (ICH) has taken major steps for recommendations in the uniform interpretation and application of technical guidelines and requirements. This step will ultimately reduce the need to duplicate work carried out during the research and development of new drugs. Therefore, harmonization of drug approval processes either by ICH or WHO may be initiated at global level.
PROMISING AND EMINENT STRATEGY WITH ADVANCEMENT: SOLID DISPERSION

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The main reason for poor oral bioavailability and permeability of about 40% chemical entities is their poor aqueous solubility which presents greatest challenge to prepare formulations. Solid dispersion is found to be the promising and eminent strategy to enhance bioavailability and dissolution rate of poorly soluble drugs with high and low dose discussed in detail. This review compiles various approaches of solid dispersion with their advancement, carriers with their advantageous properties, new formulations to modify its release, future challenges, chracterization, solubility parameters for determining immisibility between drug and carrier and in brief about novel and promising technique liquisolid compacts. Recent use of various carriers such as surface active, self emulsifying and carrier for stability of solid dispersion formulations have been discussed. This article emphasizes some industrially feasible alternate approaches of solid dispersion such as supercritical fluid, sugar bead coating, hot melt extrusion to encompass the limitations of scale-up.
BUCCAL PATCHES: AN OVERVIEW

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Over past few decades mucoadhesive patches in oral cavity have been of profound curiosity as this delivery system offers distinct reward over traditional dosage forms like tablets, gels and solutions, mainly in case of peptides, proteins, polysaccharides and nucleic acids. Buccal adhesive drug delivery prolongs the residence time of the formulation at the site of application and facilitates an intimate contact of dosage form with absorption surface thus contribute to improved and/or better performance. This review highlights the composition, types, method of preparation and evaluation methods of buccal patches, starting with a brief review on oral mucosa and different buccal dosage forms by which first pass hepatic metabolism can be avoided. Active ingredient, polymer (adhesive layer), diluents, sweetening agent, flavoring agent, backing layer, penetration enhancer, plasticizer are the components of system. Mucoadhesive buccal patches can be set by several methods as solvent casting method, semisolid casting, hot melt extrusion, solid extrusion, solid dispersion and rolling method. Review proceeds with the phase of evaluation including weight variation, patch thickness, % volume entrapment efficiency, measurement of the % elongation at break, surface pH, folding endurance and stability study. Additionally the review covers a brief of reported work on buccal patches, methods to improve buccal absorption, recent advances in the field and future prospective of buccal drug delivery.
MULTIUNIT FLOATING DRUG DELIVERY SYSTEM OF
DILTIAZEM HYDROCHLORIDE: DEVELOPMENT AND CHARACTERIZATION

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Gastroretentive drug delivery systems are designed to prolong the gastric residence time in the stomach which significantly improves the bioavailability and control delivery of therapeutic molecules. In the present study, diltiazem hydrochloride loaded floating microspheres were prepared by non aqueous emulsification solvent evaporation technique using ethylcellulose as a rate controlling polymer in the mixture of dichloromethane and ethanol at the ratio of 1:1 with span 80 as the surfactant. The prepared microspheres were evaluated for their flow properties, particle size, percentage yield, drug entrapment efficiency, buoyancy studies and in vitro drug release profile. The shape and surface morphology of the microspheres were characterized by optical and scanning electron microscopy. The mean particle size of microspheres significantly increased with an increase in the polymer concentration and found in the size range of 113.712 µm to 255.377 µm. Percentage yield of floating microspheres varied from 75.4±0.205% to 92.2 ±0.205%. Entrapment efficiency of all the formulation was varied from 61.3±0.294% to 88.3%±0.249%. Results demonstrated that an increase in the concentration of ethyl cellulose increased the entrapment efficiency of floating microspheres. All the formulations exhibited prolonged drug release profile and remained buoyant for 12 h. Scanning electron microscopy revealed that ethyl cellulose microspheres were spherical with smooth surface; distinct pores were also evident on the surface of microspheres. It may be concluded that floating microspheres of diltiazem hydrochloride can be formulated as an approach to increase gastric residence time and improving its bioavailability.

POSTER PRESENTATION
FORMULATION AND EVALUATION OF ORAL BUOYANT EFFERVESCENT TABLETS OF SALBUTAMOL SULPHATE

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The objective of present study was to develop an optimized gastric floating drug delivery system containing salbutamol sulphate as a model drug. Oral buoyant effervescent tablets were formulated to prolong gastric residence time in order to enhance drug bioavailability. Tablets were prepared by direct compression technique employing polymers, hydroxypropyl methylcellulose (HPMC K4M) and Polyox WSR 1105. Sodium bicarbonate was incorporated as a gas generating agent. Prepared tablets were evaluated for weight variation, thickness, hardness, friability, drug content, swelling index, floating properties and in vitro drug release characteristics. Tablets exhibited sustained and prolonged drug release profile while floating over the dissolution medium. The release pattern followed was anomalous non-fickian type, indicating that water diffusion and polymer rearrangement played an essential role in drug release. From the results, it has been observed that effervescent based floating drug delivery system is a promising approach to achieve controlled release behavior and in vitro buoyancy ability. Moreover, it is anticipated that further research with a variety of gas-forming agents and new preparation methods will lead to the development of a more effective effervescent floating drug delivery system.