Literature Review:

1. Rubinstein et al., (1993), prepared the matrix tablets of indomethacin with calcium pectinate and also with pectin. The releases of indomethacin from these matrixes were studied in presence of (a) Pectinolytic enzymes, (b) Bacteroides ovatus and (c) Rat cecal contents. He showed calcium salt of pectin as a promising colon drug targeting matrix since significant difference between indomethacin levels were observed in the presence of rat cecal content and control at each time.

2. Radai et al., (1995), studied that calcium pectinate-indomethacin tablets of both types, i.e. compression coated and matrix tablets give no release of indomethacin at a pH-1.5 for 2 hr. When these tablets were shaken at a pH-7.4 a drug leak was seen in plain matrix tablets but not in compression coated tablets. In the presence of pectinolytic enzymes, a sudden release of indomethacin was seen in both, the types of tablets but the rate and the percentage of release were lower (only 57.6 ± 2.5%) in compression coated tablets as compared to plain matrix tablets (74.2 ±4%) after 12 hr.

3. Turkoglu et al., (2002), evaluated the pectin–HPMC system for compression coated core tablets of 5-aminosalicylic acid (5-ASA) for colonic delivery. Drug dissolution/system erosion/degradation studies were carried out in pH 1.2 and 6.8 buffers using a pectinolytic enzyme. The system was designed based on the gastrointestinal transit time concept, under the assumption of colon arrival times of 6 h. It was found that pectin alone was not sufficient to protect the core tablets and HPMC addition was required to control the solubility of pectin.

4. Krishnaiah et al., (1998), evaluated the suitability of guar gum as a carrier in colonic drug delivery. In this study, matrix tablet of indomethacin with guar gum were prepared. These tablets were found to retain their integrity in 0.1 M HCl for 2 hr and in Sorensen’s phosphate buffer (pH-7.4) for 3 hr releasing only 21% of the drug in these 5 hr. However, in presence of 2% rat cecal contents the drug release increased and further increased with 4% concentration of cecal contents.

5. Satyanaryana et al., (1999), evaluated guar gum as a compression coating to protect the drug core of 5-ASA in upper GIT. Percent drug release from tablet
increased considerably from 11 hr and the tablets were completely disintegrated in 26 hr in the presence of the rat cecal medium. The results of drug release studies on compression coated tablets suggested that the thickness of guar gum coating in the range of 0.61–0.91 mm was sufficient to deliver the drugs selectively to the colon.

6. Bhaskar et al., (2002), studied to develop colon targeted drug delivery systems for metronidazole using guar gum as a carrier. Matrix, multilayer and compression coated tablets of metronidazole containing various proportions of guar gum were prepared. Matrix tablets and multilayer tablets of metronidazole failed to control the drug release within 5 h of the dissolution study in the physiological environment of stomach and small intestine.

7. Shinha et al., (2004), evaluated polysaccharide (combined xanthan gum and guar gum) matrices for microbially triggered drug delivery to the colon. Matrix tablets were prepared using xanthan gum and guar gum in varying proportions using indomethacin as model drug. The ability of the prepared matrices to retard drug release in the upper gastrointestinal tract and to undergo enzymatic hydrolysis by the colonic bacteria was evaluated in the presence of rat cecal content. Guar gum alone as a drug release retarding excipient in the matrices does not achieve the desired retardation.

8. Tominaga et al., (1998), evaluated chitosan as compression coated material for colon specific drug delivery system. Cores of acetaminophen were coated with chitosan as inner coating layer and gastric acid resistant material phytin as an outer coat. Phytin protected the core from gastric pH and dissolved in the small intestine. Chitosan protected the core in the small intestine and released the core upon biodegradation of chitosan in the colon.

9. Alonson et al., (1998), prepared and demonstrated the efficacy of a system, which combines specific biodegradability and pH dependent release behavior. The system consists of chitosan microcores entrapped within acrylic microspheres containing diclofenac sodium as model drug. The drug was efficiently entrapped within the chitosan microcores using spray drying and then microencapsulated into Eudragit® L100 and Eudragit® S100 using an oil-in-oil solvent evaporation
method. Release of the drug from chitosan multireservoir system was adjusted by changing the chitosan molecular weight or the type of chitosan salt.

10. **Brondsted et al., (1998)**, investigated the application of glutaraldehyde crosslinked dextran as a capsule material for colon-specific drug delivery. These capsules were loaded with hydrocortisone and drug release studies were conducted in vitro. Ten percent of drug was released in initial 3 h and only about 35% in 24 h at pH 5.4. Addition of dextranase enzyme after 24 h resulted in a rapid degradation of the capsule leading to fast and complete release of hydrocortisone. However, these results reflect only an experimental condition and not the in vivo situation.

11. **Vervoort et al., (1997; 1998a; 1998b; 1999)**, synthesized methacrylated inulin and aqueous solutions of methacrylated inulin upon free radical polymerisation, were converted to cross-linked hydrogels. Rheological studies and characterization of the hydrogels showed that higher substituted inulins had better network and higher mechanical strength. These hydrogels were then studied for their swelling properties and degradation in vitro. Degradation studies carried out in the presence of inulinase showed that increasing enzyme concentration and incubation time degraded inulin faster.

12. **Rubinstein et al., (1992a; 1992b)**, developed cross-linked chondroitin as a drug carrier for colon-specific delivery. Chondroitin sulphate was cross-linked with 1, 12-diaminododecane via dicyclohexylcarbodiimide activation. Cross-linked chondroitin sulphate was used to form a matrix tablet with indomethacin. Release of indomethacin from this tablet was studied in the presence of rat cecal contents as compared to release in phosphate buffer saline. A significant difference in drug release was observed after 14 hr in the two dissolution media.

13. **Milojevic et al., (1995; 1996a)**, evaluated Amylose-Ethocel® system for their potential as microbial degradable colon drug carrier. Amylose-Ethocel® coating system resistant to gastric acid and small intestinal enzymes, but degradable by colonic bacteria. Varying concentrations of Amylose and Ethocel® in the form of aqueous dispersions were used to coat 5-ASA pellets. A coating formulation
comprising Amylose and Ethocel® in the ratio of 1:4 w/w showed optimum drug release retarding properties in gastric and intestinal fluids.

14. **Hodson et al., (1995)**, have studied that the gel formed around alginate matrices in acidic condition is of a different structure to that formed at near neutral pH. At neutral pH sodium alginate was soluble and hydrates to form a viscous gel eventually and this gel may critically influence the drug release. However, at pH below 3, sodium alginate was converted to alginic acid rapidly, which has the ability to swell on hydration, but is virtually insoluble and therefore drug release depends on diffusion through polymer matrices and at alkaline solution, drug release from alginate matrices depends on erosion.

15. **Lee et al., (1999)**, have studied a drug delivery system made with gelatin and polysaccharide degraded by the colonic microflora, for example: soluble pectinate, pectate, alginate, chondroitin sulfate, polygalacturonic acid, tragacanth gum, and gum arabic and with an aldehyde and/or polyvalent metal and/or an additional polysaccharide (not degraded in upper gut, such as dextran, amylose, arabinogalactan, arabinoxylan, cellulose gum, pectin, starch, and xylan) also make it possible to deliver drugs to the colon.

16. **LiuXinga et al., (2003)**, developed a novel formulation for oral administration using coated calcium alginate gel beads-entrapped liposome and bee venom peptide as a model drug for colon-specific drug delivery in vitro. Drug release studies under conditions mimicking stomach to colon transit have shown that the drug was protected from being released completely in the physiological environment of the stomach and small intestine.

17. **Shun et al., (1992)**, evaluated calcium alginate beads incorporated with 5-ASA as colon specific drug delivery. Calcium alginate beads were made as cores and 5-ASA was spray coated on them. These beads were coated with different percentages of enteric coating polymer and/or sustained release polymer. A system was formulated by coating 5-ASA calcium alginate beads with aquacoat (4%w/w) followed by 6% w/w coat of Eudragit L-30D.
18. **Kiyoung et al., (1999)**, prepared alginate beads coated with dextran acetate. These beads showed minimal drug release in the absence of dextranase but significant drug release was seen in presence of dextranases in vitro.

19. **Pillay et al., (1999a; 1999b)**, studied that the dosage forms made using pectinate released a tracer more rapidly than the same dosage forms made with calcium alginate and a mixture of calcium pectinate-alginate. In vitro, the latter began to release the tracer from a pH-5.4 and released 100% of the tracer between 4 and 10 hr after ingestion. Studies on the degree of cross linking would also appear to be useful to target the release of the drug contained in the dosage forms.

20. **Mishra et al., (2003)**, developed and evaluated suitable chitosan-alginate microcapsules for colon-specific delivery of metronidazole for better treatment in amoebic colitis. Microcapsules were prepared by calcium chloride cross-linking method with different concentrations of sodium alginate and chitosan. Prepared microcapsules were treated for three different coatings with reduced molecular weight chitosan, guar gum and enteric coating with cellulose acetate phthalate.

21. **Kasture et al., (2002)**, evaluated the anticonvulsive activity of S. grandiflora leaves using a variety of animal models of convulsions. The triterpene-containing fraction of S. grandiflora exhibits a wide spectrum of anticonvulsant profile and anxiolytic activity. The leaves of S. grandiflora are used in ayurveda for the treatment of epileptic fits.

22. **Lakshminarayana et al., (2005)**, determined the major carotenoids in a sesbania grandiflora leaf by high-performance liquid chromatography. Among the carotenoids identified, lutein and beta-carotene levels were found to be higher in this leaf.

23. **Pari et al., (2003)**, evaluated the protective effect of Sesbania grandiflora against erythromycin estolate-induced hepatotoxicity. The sesbania extract also restored the depressed levels of antioxidants to near normal. The results of this study revealed that sesbania could afford a significant protective effect against erythromycin estolate-induced hepatotoxicity by compared with that of silymarin, a reference hepatoprotective drug.
24. Gayathri et al., (2006), evaluated in vitro haemolytic effect of Sesbania grandiflora leaves. Aqueous extract of the leaves of Sesbania grandiflora produced haemolysis of human and sheep erythrocytes even at very low concentrations. The liberation of phospholipids and sterols into the supernatant as a result of haemolysis indicated possible damage to the erythrocyte membrane.

25. Hossain et al., (2002), studied the use of seed of the leguminous plant Sesbania grandiflora as a partial replacement for fish meal in diets for tilapia (Oreochromis niloticus). The seed contains non-thermolabile toxins that produce high mortality and severely reduce fish growth and feed utilization.

26. Anderson et al., (1990), made an analytical study of gum exudates from sesbania grandiflora. Gum exudates are strongly dextrorotatory, acidic arabinogalactans and give strongly colored solution of low viscosity comparable to gum talha (Acacia seyal).

27. Heineman et al., (1997), evaluated the suitability of sesbania grandiflora for a range of agroforestry products and services and also found their effect on maize yields and soil properties (fertility).


29. Pollard et al., (2011), isolated a galactomannan, having $[\alpha] D^{-50^\circ}$ and a D-galactose-D-mannose ratio of 1:2 from the seed tegmen (inner seed coat) of Sesbania grandiflora. Periodate oxidation of the polysaccharide, followed by reduction and hydrolysis, gives glycerol (1 mole) and erythritol (1.8 mole). The specific rotation and the galactose- mannose ratio of sesbania galactomannan correspond very closely similar to data from guar galactomannan, the two polysaccharides may have the same chemical structure with ratio of 1:2.

30. Murthy et al., (1997), evaluated the structure of Sesbania mosaic virus (SMV), an isometric, ss-RNA plant virus found infecting Sesbania grandiflora plants at 3 Å resolution. The 3D structure of SMV was determined by molecular replacement techniques using SBMV structure as the initial phasing model.
31. **Momin et al., (2011)**, studied the extracellular invertase of *Rhizobia japonicum* and its role in free sugar metabolism in the developing root nodules of *sesbania grandiflora*. The enzyme hydrolyzed sucrose extracellularly, and its release was substrate inducible. In the developing nodules sucrose was the major sugar. The content of fructose was low in comparison with that of glucose, suggesting that in the nodules the fructose is converted to glucose prior to its entry into the bacterial cell.

32. **Giri et al., (2004)**, determined the influence of two tropical isolates of *Glomus fasciculatum* and *Glomus mosseae* on the nutrient uptake and growth of *Sesbania grandiflora*. Inoculation of sterile soil with the fungi significantly improved growth and nutrient uptake by *S. grandiflora*. Nutrient uptake and growth of *S. grandiflora* in nonsterile soil was also significantly stimulated by inoculation.

33. **Ash et al., (1990)**, evaluated the effect of supplementation with leaves from the fodder tree *sesbania grandiflora* on the intake and digestibility of guinea grass hay (1.08% nitrogen (N)) by goats. The varying ability of the fodder tree leaves to improve intake and digestion of guinea grass hay, particularly in relation to condensed tannin content.

34. **Paradkar et al., (2004)**, have prepared solid dispersions of Curcumin with PVP-K 30 in different drug to carrier ratios (1:1, 1:3, 1:5, 1:7 and 1:10) by spray drying technique. In vitro dissolution studies were conducted for all the solid dispersion as well as physical mixtures of the same ratios and pure drug in 0.1 N HCl, which infers the improved release with increase in concentration of PVP-K-30 when compared with physical mixture and pure drug. Physical characterization by SEM, DSC, IR and XRPD studies in comparison with corresponding physical mixtures revealed the changes in the solid state during the formation of dispersion and justified the formation of high energy amorphous phase.

35. **Maurice et al., (2004)**, studied that solubility of the Curcumin can be enhanced by micellar systems using Cetyltrimethylammonium bromide (CTAB). The micellized Curcumin showed it to be isotropically clear for an extended period of time.
36. **Wang et al., (1997)**, investigated the degradation kinetics of Curcumin under various pH conditions and the stability of Curcumin in physiological matrices was investigated. They had showed 90% of Curcumin degraded within 30 min at 37°C and also showed that the degradation is pH dependent and occurs faster at neutral – basic conditions. It is more stable in cell culture medium containing 10% fetal calf serum and in human blood; less then 20% Curcumin decomposed within 1 h and after incubation for 8 h, about 50% of Curcumin is still remained.

37. **Ansari et al., (2005)**, has developed a simple, selective, precise and stability indicating HPTLC method of analysis of Curcumin both as a bulk drug and in formulation was developed and validated. The method employed TLC aluminium plates precoated with silica gel 60F-254 as a stationary phase. The solvent system consisted of chloroform: methanol (9.25:0.75 v/v). Densitometric analysis of Curcumin was carried out in the absorbance mode at 430 nm.

38. **Maheshwari et al., (2006)**, has discussed about the pharmacological actions of Curcumin. They reviewed briefly actions of Curcumin on various organs including stomach, intestine, liver, bile, pancreas, cardiovascular system and blood. They have, further, given incite on hormonal system and metabolism including antifertility action, lipid metabolism, antimicrobial action.

39. **Kawamori et al., (1999)**, investigated the chemopreventive effect Curcumin when administered during the promotion /progression stage of colon carcinogenesis in male rats. The result proved that administration of 0.2% Curcumin through diet during both initiation and postinitiation period. Significantly inhibit the colon carcinogenesis. Effect of synthetic Curcumin also showed the inhibition effect over invasive adenocarcinomas of the colon. 0.6% Curcumin in administration during the promotion/progression stage significantly inhibited the incidence of non invasive (85% inhibition) and invasive (45% inhibition) adenocarcinogenesis of colon.

40. **Sharma et al., (2001)**, investigated the effect of Curcumin extract on 15 patients with advanced colorectal cancer refractory to standard chemotherapies received curcuma extract daily for up to 4 months. Activity of glutathione S-transferase and levels of DNA adduct formed by malondialdehyde (a product of lipid
peroxidation and prostaglandin biosynthesis) were measured in patients blood cells. Ingestion of 440 mg of Curcumin curcuma extract for 29 days was accomplished by a 59% decrease in lymphocytic glutathione S transferase activity.

41. Ireson et al., (2001), compared Curcumin metabolism in human and rat hepatocytes. The major metabolites identified in the suspension of human and rat hepatocytes were HexahydroCurcumin, hexahydroCurcuminol. The major products of Curcumin biotransformation in rat plasma were Curcumin glucoronide, Curcumin sulfate. HexahydroCurcumin hexahydroCurcuminol and HexahydroCurcumin glucoronide were identified in little concentration.

42. Tønnesen et al., (2002), have prepared cyclodextrin complexes in order to improve the water solubility, hydrolytic and photo chemical stability of the Curcumin. The complexes showed the improvement in solubility to the factor $10^4$. Hydrolytic stability was improved strongly by complex formation in alkaline conditions and photodecomposition rate was increased in organic solution.

43. Sowbhagya et al., (2005), prepared water soluble form of Curcumin by the use of diluents called propylene glycol and tween and has been applied onto an expanded extruded balls, made from corn and defatted soybean flours. The stability of this natural turmeric colorant has been examined and compared with artificial that of permitted synthetic colour like tartrazine. The products were stored at ambient temperature ($27^0$ C, 65% Relative humidity) and are tested for moisture content and colour and pigment retention.

44. Kholi et al., (2005), discussed well about the antiinflammatory activity of the Curcumin as it inhibits the arachidonic acid metabolism, cyclooxygenase, lipoxigenase, cytokines (interleukins and tumors necrosis factor) nuclear factor κB and release of steroidal hormones. They reviewed that the dose of 100mg to 200mg showed good antiinflammatory action and seems to have negligible adverse effect on human system.