of delivery systems via the most common non-invasive routes of drug administration.

1. ORAL DRUG DELIVERY

Oral administration of drugs by conventional or novel pharmaceutical formulations is the most convenient and effective delivery system and is preferred over parenteral delivery of medication. However, not all drugs can be administered orally, mainly because of their instability in gastric acid, vulnerability to gastrointestinal enzymes, first pass metabolism, and low oral permeability. The site-specific delivery of a drug to its target receptor site has the potential to reduce side effects and to increase pharmacological response. In addition, there are a number of local pathologies where direct release of drug in a specific site along the gastrointestinal (GI) tract would not only improve pharmacotherapy but also would reduce potential toxicity and side effects. The treatment of disorders of the GI tract, such as irritable bowel syndrome, colitis, Crohn's disease, colon cancer and local infectious diseases where a high concentration of active agent is needed, can be markedly improved using site-specific delivery systems employing various designs.

1.1. Anatomy and Physiology of the GI Tract

A brief review of GI anatomy and physiology should provide some insight into the design of oral drug delivery systems. The GI tract can be divided into four sections based on the organs of digestion along the alimentary canal.

1.1.1. Oral Cavity

The first section of the alimentary canal that a drug comes in contact with is the oral cavity. Seldom does the dosage form remain in this cavity long enough for drug absorption to take place, unless the drug is administered bucally or sublingually. The use of a buccal bioadhesive device in targeting controlled drug delivery to the gastrointestinal tract has been investigated (1).

Usually, an orally administered dosage form (i.e., tablet, capsule, solution, or suspension) quickly reaches the stomach after traveling down the esophagus. Drug absorption does not normally occur in the esophagus because the transport rate of the dosage form through the esophagus into the stomach far exceeds the rate of drug liberation from the dosage form or absorption of drug across the esophagus. However, an exception to this rule is the engineered formulation of magnetic granules consisting of bleomycin (an anticancer drug), bioadhesive polymers and ultrafine ferrite were prepared and evaluated for targeted drug delivery to the esophagus in an animal model of esophageal cancer (2).