Colon Specific Drug Delivery Systems: The Importance

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Colon or large intestine is the last part of digestive systems from vertebrates. The anatomy of colon is divided into five main segments and has 1.5 meters long in human, which is about one-fifth of the whole length of the gastrointestinal tract [1]. Since, the colon located at the end of gastrointestinal tract, designing a colon specific drug delivery system is quite complicated. On the other hand, the colon is believed to be a suitable site for the following reasons, colon is a site where both local or systemic drug delivery could be achieved, an attractive site where poorly absorbed drug molecules may have an improved bioavailability, it has a longer retention time and appears highly responsive to agents that enhance the absorption of poorly absorbed drugs, can reduce gastric irritation caused by many drugs (e.g. NSAIDS), and colon has less peptidase activity so peptides, oral vaccines, insulin, growth hormones, can be administered through this route [2,3]. Therefore, colon specific drug delivery system (CDDS) should give advantages to treat several diseases.

In order to gain better effectiveness in developing CDDS, it is worthwhile to understand some factors of gastrointestinal conditions and formulation factor. Also, since there are differences between disease state and healthy state, it is important to know some of them. Consequently, various strategies have been developed (pH-, time-, microflora-, polymer-triggered, chemical modification/prodrug systems) to conquer the obstacles [4-7]. Furthermore, in terms of drug delivery research, intestinal modelling systems are needed. Whether *in vitro* dissolution test or absorption studies, as well as *in vivo* information of carrier is required to evaluate the effectiveness of the systems.

Why is Colon Targeting Important?

The oral route is acknowledged as a preferable administration of the drug. It is because of its well-established acceptability, cost-effective, and certain advantages such as higher compliance, greater convenience, and reduced risk of cross infection and needle-stick injuries [8]. Although it gives several advantages, there are also limitations for some drugs which can be degraded in the upper part of gastrointestinal tract (GIT), such as proteins, polypeptides, and vaccines. It is because they are highly vulnerable to digestive enzymes present in the GIT [9,10]. Moreover, there are also some other drugs which have low bioavailability, because they can be easily eliminated by first pass metabolism [11].

Concerning to this limitation, CDDS has considered as a useful way of delivering a variety of therapeutics agent via the oral route, both local and systemic delivery therapy. A lot of research is going on worldwide for designing an effective way by utilizing this method. Direct delivery of drugs at the site of action leads to an increase in the availability of drugs at the targeted region, such as to the inflamed colon tissue, pancreatectomy and cystic fibrosis, and colorectal cancer [11]. Also, protein and peptide drug is proposed by using this system to gain the effective therapy regarding the problems of limited bioavailability. The main hindrances which must be solved for obtaining efficacious delivery of drugs to the colonic region via oral route are the absorption and degradation of the drug in the upper part of the GIT [12].

Colon targeting has proven beneficial for local action in a variety of disease conditions, such as inflammatory bowel disease (Crohn's disease and ulcerative colitis), irritable bowel syndrome, and colonic cancer [4,6,7,13,14]. In site-specific (targeted) drug delivery, it is

potential to reduce the total amount of drug administered thus less adverse effects. In addition, targeted drug delivery also gives many advantages, such as more patient friendly, more cost-effective, and safer. Therefore, selective delivery to (inflamed) colon tissue for local action or systemic action for other diseases via colon absorption, are needed for alternative approaches. In the same way, colon targeting has also proven useful for the systemic action of protein-peptide drugs such as insulin, calcitonin, and met-enkephalin and even for other nonpeptide drugs such as cardiovascular, anti-asthmatic agents, steroids, and nonsteroidal anti-inflammatory drugs (NSAIDs) [10,11].

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