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REVIEW

Microparticles as controlled drug delivery carrier for the treatment of ulcerative colitis: A brief review

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Abstract Ulcerative colitis is the chronic relapsing multifactorial gastrointestinal inflammatory bowel disease, which is characterized by bloody or mucus diarrhea, tenesmus, bowel dystension, anemia. The annual incidence of ulcerative colitis in Asia, North America and Europe was found to be 6.3, 19.2 and 24.3 per 100,000 person-years. The major challenge in the treatment of ulcerative colitis is appropriate local targeting and drug related side-effects. To overcome these challenges, microparticulate systems seem to be a promising approach for controlled and sustained drug release after oral administration. The main goal of this article is to explore the role of microparticles in ulcerative colitis for the appropriate targeting of drugs to colon. There are different approaches which have been studied over the last decade, including prodrugs, polymeric approach, time released system, pH sensitive system, which show the site specific drug delivery to colon. Among these approaches, microparticulate drug delivery system has been gaining an immense importance for local targeting of drug to colon at a controlled and sustained rate. Combined approaches such as pH dependent and time dependent system provide the maximum release of drug into colon via oral route. This article embraces briefly about pathophysiology, challenges and polymeric approaches mainly multiparticulate systems for site specific drug delivery to colon in sustained and controlled manner so that drug related side-effects by reducing dosage frequency can be minimized.

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Contents

1. Introduction

Inflammatory bowel diseases are the idiopathic chronic multifactorial inflammatory diseases of gastrointestinal tract, which mainly include ulcerative colitis and Crohn's disease (Talaei et al., 2013). Small intestine and large intestine or colon are the main regions involved in inflammatory bowel diseases, which are marked by the chronic inflammation in specific mucosal or transmural locations (Friend, 2005). Appropriate local targeting is the main challenge in the treatment of ulcerative colitis. For improved localization, a well designed drug delivery system is beneficial to enhance therapeutic efficacy. There are many approaches used for appropriate targeting like pro drug approach, conjugate approach, and time released system, pH dependent system, multiparticulate system, nanoparticulate system, probiotic approach. Among all, microparticulate system is one of the best approaches for controlled drug delivery in specific site of inflammation. Microparticles are small free flowing particles consisting of natural or synthetic polymers having particle diameter ranging from 1 to 1000 μm. With the advancement in biotechnology, genomics, lots of potent and specific therapeutics have been formed. Due to various problems such as low solubility, poor stability, narrow therapeutic index of many new drugs, there is a corresponding need for safer drug delivery. The delivery should be designed in such a way to provide active agent in right amount, at right time, to proper location in the body to increase patient compliance and minimize side-effects. There is wide range of particulate carrier system used for targeted drug delivery to colon, which mainly includes microparticles, microcapsules, nanoparticles, nanocapsules to overcome the disadvantages of conventional drug delivery systems like increased risk of systemic adverse drug reactions. To target drugs only to their desired gastro-intestinal regions is really a great challenge. Therefore, there is the need to design such a delivery system, with a more effective drug targeting. Micro particulate carriers like polymeric micro particles are found to have lots of applications in ulcerative colitis patients (Collnot et al., 2012). Advances in the understanding of pathogenesis of ulcerative colitis and mechanism of action of drug brought novel ideas for drug targeting to specific site of action.

At present, the etiology of disease is not fully understood but it has been hypothesized that various factors such as genetic, Gut/environmental, psychosomatic, autoimmune, epidemiological are responsible for the development of ulcerative colitis (Molodecky and Kaplan, 2010). Gut/environmental factors include immune/epithelial interactions, bacterial infections, and epithelial barrier functions. Epidemiological studies include dietary habits, smoking habits, intake of drugs, hormonal status, variations due to different climates, and changes due to social circumstances. The inflammatory factors can be examined through different cell signaling pathways,