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Innovative Formulation Strategies for Solid Dispersions: Overcoming Challenges in Enhancing Solubility of BCS Class 2 Compounds

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Abstract: *Controlled release tablets play a pivotal role in pharmaceutical formulations, offering targeted drug delivery and improved patient compliance. This review explores innovative approaches for modulating gastrointestinal absorption to achieve controlled and sustained release from tablets. The introduction provides a brief overview of controlled release tablets, emphasizing the significance of influencing drug absorption for achieving therapeutic efficacy. The objective is to highlight the need for innovative approaches in modulating gastrointestinal absorption, addressing current challenges in achieving controlled release. Physiological considerations in gastrointestinal absorption are examined, including the structure and function of the stomach and intestines, along with factors influencing drug absorption in different regions. Challenges in achieving controlled release, such as variability in gastric emptying times and pH-dependent solubility issues, are discussed. Conventional methods, such as enteric coatings and modified-release formulations, are explored alongside their limitations, emphasizing the incomplete control over drug release and the lack of adaptability to individual patient variations. The review then delves into novel strategies, including bioresponsive materials, carrier systems, and prodrug approaches, showcasing their potential in overcoming challenges associated with conventional methods. Technological advances, such as microfabrication techniques and 3D printing in gastrointestinal drug delivery, are examined, offering insights into customized tablets for controlled release. In vitro and in vivo assessment methods are detailed, covering simulated gastric and intestinal conditions, tools for predicting in vivo performance, and the use of animal models and clinical trials. The review concludes with an exploration of challenges and future perspectives, addressing biopharmaceutical variability and regulatory considerations. The findings provide a structured approach for formulators, researchers, and pharmaceutical scientists in advancing controlled release tablet development, paving the way for personalized and effective drug delivery.*

Keywords: controlled release tablets, gastrointestinal absorption, innovative approaches, drug delivery, sustained release, novel strategies, technological advances, personalized.

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