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A Systematic Review of Polymer Matrices and Manufacturing Approaches in Solid Dispersion Systems for Enhancing Andrographolide Solubility and Bioavailability

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Introduction

Andrographolide, a bioactive compound derived from Andrographis paniculata, has long been recognized for its potent pharmacological properties, including anti-inflammatory, antioxidant, anticancer, and antimicrobial activities. However, the clinical application of andrographolide is limited by its poor water solubility, which consequently results in low bioavailability. This is a common challenge for many drug compounds, particularly those derived from natural products, which may have promising therapeutic effects but fail to exhibit sufficient systemic absorption due to their insolubility in aqueous environments. To overcome this issue, solid dispersion systems have gained attention as a potential strategy to enhance the solubility and bioavailability of poorly soluble drugs. By dispersing the active pharmaceutical ingredient in a solid matrix, SDS can increase the surface area of the drug, enhance its dissolution rate, and facilitate its absorption. The success of SDS depends on the choice of polymer matrix and the method of preparation. This article presents a systematic review of polymer matrices and manufacturing approaches used in solid dispersion systems for enhancing the solubility and bioavailability of andrographolide [1-3].

Description

A solid dispersion system is a formulation where the poorly soluble drug is dispersed in a solid polymer or matrix, typically in an amorphous state. This dispersal increases the surface area of the drug, improving its dissolution rate, and often results in higher drug absorption after administration. Solid dispersions can be classified into two types: first-generation systems, which are simple physical mixtures of the drug and the polymer, and second-generation systems, which are more complex and may involve the formation of a drug-polymer complex or solid solution. The solid dispersion approach has become a popular strategy for improving the solubility and bioavailability of drugs, especially those with poor aqueous solubility, such as andrographolide. The selection of the appropriate polymer matrix is critical to the success of a solid dispersion system. Polymers not only influence the drug's solubility but also affect its stability, release rate, and the overall performance of the formulation. Several polymers have been explored for use in solid dispersion systems for andrographolide, including both hydrophilic and hydrophobic types. Hydrophilic polymers are commonly used in solid dispersion systems because they can improve the solubility of the drug by enhancing the wettability and dissolution rate. Various grades of HPMC is another hydrophilic polymer that is widely used for improving the solubility and release profiles of poorly soluble drugs. It is known for its ability to form a gel-like network in aqueous solutions, which can help in the sustained release of drugs like andrographolide [4,5].

Conclusion

Solid dispersion systems represent a promising approach to improve the solubility and bioavailability of andrographolide, a compound with significant therapeutic potential. By using suitable polymer matrices and employing effective manufacturing methods such as solvent evaporation, melt extrusion, and spray drying, the solubility of andrographolide can be significantly enhanced, facilitating its clinical application. However, challenges such as stability, polymer selection, and scalability must be addressed to ensure the widespread use of solid dispersion formulations. Further research and development in this area could lead to the successful commercialization of andrographolide-based therapies for various therapeutic indications.

Acknowledgement

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Conflict of Interest

None.

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