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ABSTRACT

Establishment of efficient and biocompatible drug delivery systems continues to be an important area of pharmaceutical research especially to improve the drugs therapeutic performance, stability, and patient acceptability. This thesis reports the full development and assessment of a starch-based Pickering emulgel as a new and potential drug delivery platform, specifically targeting topical and transdermal uses. Pickering emulsions, stabilized by particles of solids instead of traditional surfactants provide a variety of benefits including improved stability, lower irritancy, and the possibility of targeted drug delivery. By incorporating them into a gel matrix, the resultant emulgel leverages the structural stability of Pickering emulsions with the simplicity of application and enhanced residence time of gels to produce a synergistic formulation technology. Starch, a biodegradable, nature-derived, and readily available polysaccharide with pleasant physicochemical properties, non-toxicity, and environmental friendliness, was chosen as the particulate stabilizer because of these desirable characteristics. In our research work starch particles were physically and chemically modified to ensure their maximum emulsifying ability and surface activity. These surfactants modified particles were then utilized to stabilize o/w emulsions, which were then mixed with an appropriate gel base containing gel-forming agents to create a Pickering emulgel system. A model lipophilic drug was applied to study the drug loading efficiency, stability, and release of the system. Comprehensive physicochemical analysis of the optimized formulation was carried out, such as particle size evaluation, zeta potential, rheological behavior, spreadability, pH measurement, and texture. The Pickering emulgel showed remarkable physical stability without any indication of phase separation or degradation after a prolonged storage time. In vitro drug release profiles provided evidence of a sustained and controlled release pattern.

reflecting the potential of the system for extended therapeutic action. Further, ex vivo skin permeation experiments with animal skin models revealed increased drug penetration and retention, and cytotoxicity and skin irritation tests proved the safety and biocompatibility of the formulation. In general, the findings of this research indicate that starch-based Pickering emulgels are a very promising, environmentally friendly, and multifaceted drug delivery platform. The union of starch inherent merits with the structural advantages of Pickering emulsions and emulgels provides an innovative answer to numerous shortcomings of traditional topical systems. This study provides the groundwork for future in vivo work and clinical translation making starch-based Pickering emulgels a potential contender for future pharmaceutical and cosmeceutical drug delivery.

Key words: Starch-based Pickering emulgel, drug delivery system, Topical & Transdermal delivery, Pickering emulsion, Solid particle stabilizer