**Development and Evaluation of a Microemulsion-Based Gel for Enhanced Topical Delivery of Diclofenac Diethylamine**

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**Background and aims.** Diclofenac diethylamine (DDEA), a non-steroidal anti-inflammatory drug (NSAID), is commonly used to treat conditions like osteoarthritis and rheumatoid arthritis due to its analgesic and anti-inflammatory properties. However, oral administration of diclofenac is associated with gastrointestinal side effects and increased cardiovascular risks. This study aimed to develop a microemulsion-based gel containing DDEA to minimize systemic side effects and enhance topical drug delivery.

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**Methods.** Oils, surfactants, and co-surfactants were selected based on their solubilizing capacity and emulsification efficiency. Pseudo-ternary phase diagrams were constructed using the titration method to identify optimal microemulsion regions. Both blank and DDEA-loaded microemulsions were evaluated for appearance, transmittance, pH, conductivity, thermodynamic stability, droplet size, polydispersity index (PDI), zeta potential, drug content, and *in vitro* drug release using Franz diffusion cells. The optimized microemulsion was incorporated into a gel base using Poloxamer 407, and the resulting formulation was characterized for appearance, pH, spreadability, drug content, and in vitro drug release.

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**Results**. The optimized microemulsion formulation consisted of Capryol 90, Croduret 40, Transcutol HP, and water in a ratio of 5:10:10:75, incorporating 2.32% DDEA. This formulation was transparent, thermodynamically stable, with a droplet size of 10.77 ± 0.375 nm, PDI < 0.3, and zeta potential of −14.63 ± 1.28 mV. *In vitro* release studies demonstrated the highest drug release at 6 hours. The microemulsion-based gel containing 12% Poloxamer 407 met physicochemical requirements and exhibited an increased drug release rate compared to a commercial product within 6 hours.

**Conclusion/Discussion.** This study successfully developed a microemulsion-based gel incorporating diclofenac diethylamine with enhanced topical delivery performance and favorable physicochemical characteristics. This formulation offers a promising alternative to oral NSAIDs by minimizing systemic side effects, improving patient compliance, and representing a step forward in the development of accessible, effective, and patient-friendly dosage forms.

**References:**

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