Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
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Advanced Liquid Drug Encapsulation Technique

Novel drug encapsulation method enables high drug loading while maintaining thermodynamic stability and rapid dissolution

Overview

This invention addresses the critical challenge of poor bioavailability in oral solid dosage forms caused by the low solubility of crystalline active pharmaceutical ingredients (APIs). The technology combines ionic liquids (salts melting below 100°C) of APIs with polymers to create stable solid compositions. By encapsulating the ionic liquid within a polymer matrix (e.g., ethyl cellulose or maltodextrin), the solution enables high drug loading while maintaining thermodynamic stability and rapid dissolution.

The breakthrough lies in overcoming recrystallisation risks associated with amorphous solid dispersions, achieving >90% dissolution in aqueous media without precipitation.

Advantages

Enhanced solubility and bioavailability: Ionic liquids eliminate lattice energy barriers, enabling near-complete API dissolution in water and simulated intestinal fluid (pH 6.8) within 10 minutes.

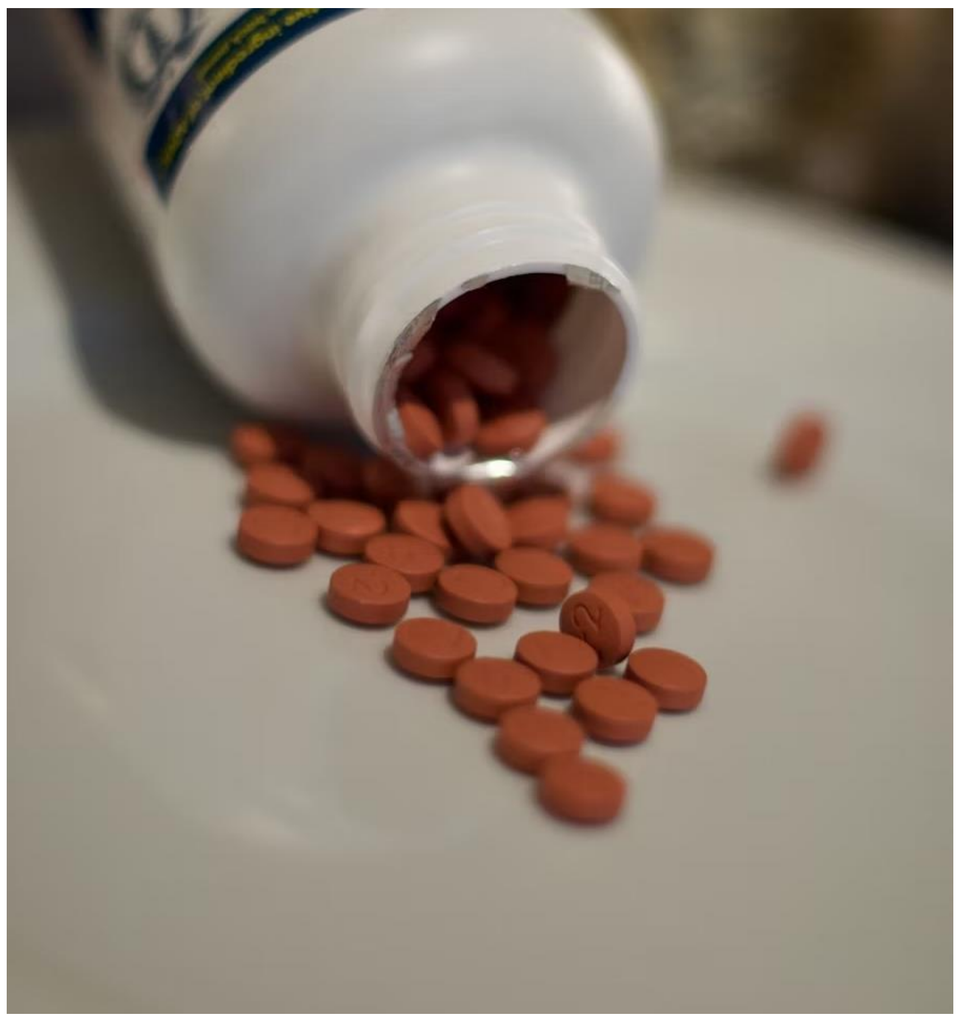
High drug loading: Supports up to 75% w/w API content, surpassing amorphous solid dispersions (typically ≤40%).

Thermodynamic stability: No crystallisation observed in dissolution media over two years, ensuring consistent performance.

Simplified manufacturing: Solvent-free spray drying process avoids capsule encapsulation limitations and organic solvent residues.

Versatile polymer compatibility: Functions with water-soluble (maltodextrin) and insoluble (ethyl cellulose) polymers, enabling tailored release profiles.

Compared to existing amorphous dispersions, which risk recrystallisation and have low API capacity, this technology ensures long-term stability and higher payloads.



Applications

Primary: Pharmaceutical Formulation Technology / Oral Solid Dosage Systems.

Secondary: Drug Delivery Platforms, Solubility Enhancement Solutions.

Technology Status

Development stage: Lab-validated prototypes (TRL 4–5); spray-dried powders characterised for dissolution, stability, and phase behaviour.

Validation: In vitro dissolution testing in deionised water and simulated intestinal fluid (0.05M phosphate buffer, pH 6.8) confirms >90% release within 10 minutes.

Key milestones: UK patent filed (Application No. 2012897.1, priority date 18 August 2020); ionic liquid synthesis scaled to 47.96g batches (90% yield).

Gaps: No clinical or animal trial data; further in vivo testing required.

Market Opportunity

Target applications: Oral solid dosage forms for poorly soluble drugs, including common medications like ibuprofen and warfarin. This approach is relevant to about 63% of small-molecule drugs with ionisable groups.

Prevalence: Ibuprofen is used daily by over 30 million people in the US for pain relief. Warfarin is prescribed to more than 2 million US patients for anticoagulation.

Market size: The global oral solid dosage market exceeds $490 billion (2024). The solubility enhancement segment is projected to reach over $40 billion by 2028.

Unmet needs: Many BCS Class 2 and 4 drugs suffer from low bioavailability and instability. This technology offers a stable, high-loading solution to improve therapeutic outcomes and patient compliance.

Technology Sector
Med Tech, Pharmacy

Patent Details
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Opportunity
Research collaboration
Available to License

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