Technology Offer

Thermally Stable Insulin with Preserved Biological Activity

A breakthrough enabling cold-chain–free insulin for global healthcare markets

Potential use cases and/or markets (applications):
thermally-stable insulin for broader and easier diabetes treatment; biopharmaceutical (biologics) development

Current state of technology:
TRL

Intellectual property:
International Patent Application No. PCT/EP2025/078804 (PCT application based on LU508453), »Polypeptides having NH-triazole functionalizations«.

Developed by
University of Ljubljana (Faculty of Chemistry and Chemical Technology, Faculty of Medicine) and Jozef Stefan Institute

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Background

About **830 million people** currently live with diabetes, projected to reach **1.3 billion by 2050**. Insulin is essential but often inaccessible in low- and middle-income regions due to strict **cold-chain requirements**. Because current insulin must be stored at **~4 °C**, distribution is costly and prone to failures.
A **heat-stable, cold-chain-independent insulin** would greatly expand access, reduce supply-chain losses, and lower costs. The **WHO** has identified this need as urgent. Insulin's instability also reflects broader challenges in biologics, where many protein-based therapeutics degrade easily. Incorporating **non-canonical building blocks** offers a promising strategy to enhance protein stability across medicine and biotechnology.

Description of the solution

Researchers introduced a novel non-canonical histidne analogue, having NH-triazole building block, into specific positions of human insulin, enhancing intramolecular and intermolecular interactions that stabilize the molecule.
Key Advantages

- Thermal stability up to 95 °C
- Retains full biological activity after extreme heat exposure
- Increased resistance to enzymatic degradation
- Higher affinity for metal ions, enabling alternative stabilization and purification pathways
- Simplified production and distribution, potentially eliminating cold-chain requirements

This creates a high-value, next-generation insulin that could reshape the competitive landscape.

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Opportunity

The diabetes therapeutics market is one of the world's largest pharmaceutical segments, dominated by a few players. A thermally stable insulin could unlock massive new markets:

- Emerging economies where cold-chain infrastructure is limited
- Remote regions and humanitarian/NGO settings
- Pharmacological formulations requiring improved stability
- Temperature-resilient supply chains for global distribution
- Ultra-convenient consumer products (travel-friendly, room-temperature stable)

Value Proposition for Industry

- Significant reduction in storage and transport costs
- Lower spoilage rates = improved margins
- Ability to penetrate untapped high-population markets
- Competitive differentiation through superior formulation stability
- Potential for premium temperature-stable insulin products