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# Abstract

***This study investigates the use of polycaprolactone (PCL) mesophases for controlled drug delivery of three compounds: dolutegravir (DTG), meloxicam (MLX), and dexamethasone (DEX). Statistical analysis revealed significant correlations (p < 0.05) between mesophase content and release kinetics at both 25°C and 50°C.*** *[Dr. Smith: Consider adding more details about the mechanism of mesophase formation.]*

# Introduction

**Polycaprolactone has emerged as a promising biodegradable polymer for pharmaceutical applications. The crystallinity of PCL can be modulated through thermomechanical processing to create mesophase structures that influence drug release profiles.**

## Drug Compounds

**Three model drugs were selected: dolutegravir for HIV treatment, meloxicam as an anti-inflammatory agent, and dexamethasone as a corticosteroid. Each compound exhibits different solubility characteristics affecting release kinetics.**

# Methods

*Samples were processed using compression molding at temperatures of 25°C and 50°C. X-ray diffraction analysis was performed to quantify crystallinity changes. Release studies were conducted in phosphate-buffered saline with ANOVA statistical analysis.*

# Results

***Significant differences were observed between treatment groups. The correlation between mesophase content and drug release was highly significant with r² values exceeding 0.85 for all compounds tested.***

|  |  |  |
| --- | --- | --- |
| Compound | Mesophase % | Release Rate (μg/mL/h) |
| **DTG** | **23.5 ± 2.1** | **15.2 ± 1.8** |
| **MLX** | **31.7 ± 3.4** | **22.1 ± 2.5** |
| **DEX** | **18.9 ± 1.9** | **12.7 ± 1.4** |

# Conclusion

***This research demonstrates the potential of PCL mesophase engineering for precise control of drug release kinetics. The significant correlations observed support the hypothesis that processing-induced mesophases can be leveraged for pharmaceutical applications.***