**PCL** Drug Delivery Research

# Abstract

This study investigates the use of polycaprolactone (**PCL**) s for controlled drug delivery of three compounds: **dolutegravir** (**DTG**), **meloxicam** (**MLX**), and **dexamethasone** (**DEX**). Statistical analysis revealed *significant* correlations (***p < 0.05***) between content and release kinetics at both 25°C and 50°C.

# Introduction

Polycaprolactone has emerged as a promising biodegradable polymer for pharmaceutical applications. The crystallinity of **PCL** can be modulated through thermomechanical processing to create 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 content and drug release was highly *significant* with **r²** values exceeding 0.85 for all compounds tested.

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| Compound | % | 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** engineering for precise control of drug release kinetics. The *significant* correlations observed support the hypothesis that processing-induced s can be leveraged for pharmaceutical applications.