

## Research Article

# Preparation and Evaluation of Silymarin-Loaded Solid Eutectic for Enhanced Anti-Inflammatory, Hepatoprotective Effect: *In Vitro*–*In Vivo* Prospect

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Solubility of phytochemicals is a major concern for drug delivery, permeability, and their biological response. However, advancements in the novel formulation technologies have been helping to overcome these challenges. The applications of these newer technologies are easy for commercialization and high therapeutic outcomes compared to conventional formulations. Considering these facts, the present study is aimed to prepare a silymarin-loaded eutectic mixture with three different ratios of Polyvinylpyrrolidone K30 (PVP K30) and evaluating their anti-inflammatory, and hepatoprotective effects. The preliminary phytochemical and characterization of silymarin, physical mixture, and solid dispersions suggested and successfully confirmed the formation of solid dispersion of silymarin with PVP K30. It was found that the solubility of silymarin was increased by 5-fold compared to pure silymarin. Moreover, the *in vitro* dissolution displayed that 83% of silymarin released within 2 h with 2.8-fold increase in dissolution rate compared to pure silymarin. Also, the *in vivo* study suggested that the formulation significantly reduced the carbon tetrachloride- (0.8620±0.05034\*\* for 1:3 ratio), paracetamol- (0.7300±0.01517\*\* for 1:3 ratio), and ethanol- (0.8100±0.04037\*\* for 1:3 ratio) induced hepatotoxicity in rats. Silymarin solid dispersion was prepared using homogenization methods that have prominent anti-inflammatory effect (0.6520±0.008602\*\* with 8.33%) in carrageenan-induced rat paw model.

## 1. Introduction

Solid solution is an interchangeable solution state while solute interacting strongly in the form of eutectics. Solid dispersion method maximizes interaction with water and profoundly incorporates hydrogen bonds. Furthermore, it

allows the intercalation of the lipophilic substance centrally giving the odor of hydrophilic monolayer polymer. Solid dispersion is widely used and a well-explored technique for the enhancement of solubility at both laboratory and commercial scale [1]. But macerates of plants or animal displayed the limited solubility in aqueous environment, and recent

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