

1. INTRODUCTION

The use of hazardous organic solvents such as methanol, chloroform, and dichloromethane in pharmaceutical formulations poses significant risks to human health and the environment. This study investigates eco-friendly solvents as sustainable alternatives in drug formulation.

Paracetamol was selected as a model drug and formulated using:

Conventional Solvent System

(Hazardous Solvents)

Methanol, Chloroform,
Dichloromethane



Green Solvent System

(Eco-friendly Solvents)

Ethanol + Water



This approach aims to enhance drug performance while minimizing chemical toxicity and environmental impact.

2. AIM



To evaluate and compare the solubility, dissolution, and stability of paracetamol formulations prepared using a conventional solvent system and a green solvent system.

3. MATERIALS

Model Drug



Paracetamol
(Acetaminophen)

Conventional Solvents



Methanol Chloroform
Dichloromethane

Green Solvents



Ethanol + Water

4. METHODOLOGY

1. Formulation Preparation (Solvent Evaporation Method)



Formulations were prepared through solvent evaporation under controlled temperature conditions.

2. Solubility Study (UV-Visible Spectrophotometer)



Solubility was measured using a UV-Visible spectrophotometer.

3. Dissolution Study (USP Dissolution Apparatus II)



Dissolution experiments were conducted at 37°C. Samples were withdrawn at fixed time intervals and analyzed.

4. Stability Study (2 Weeks, Room Temperature)



Formulations were stored under normal conditions for two weeks and analyzed for any change.

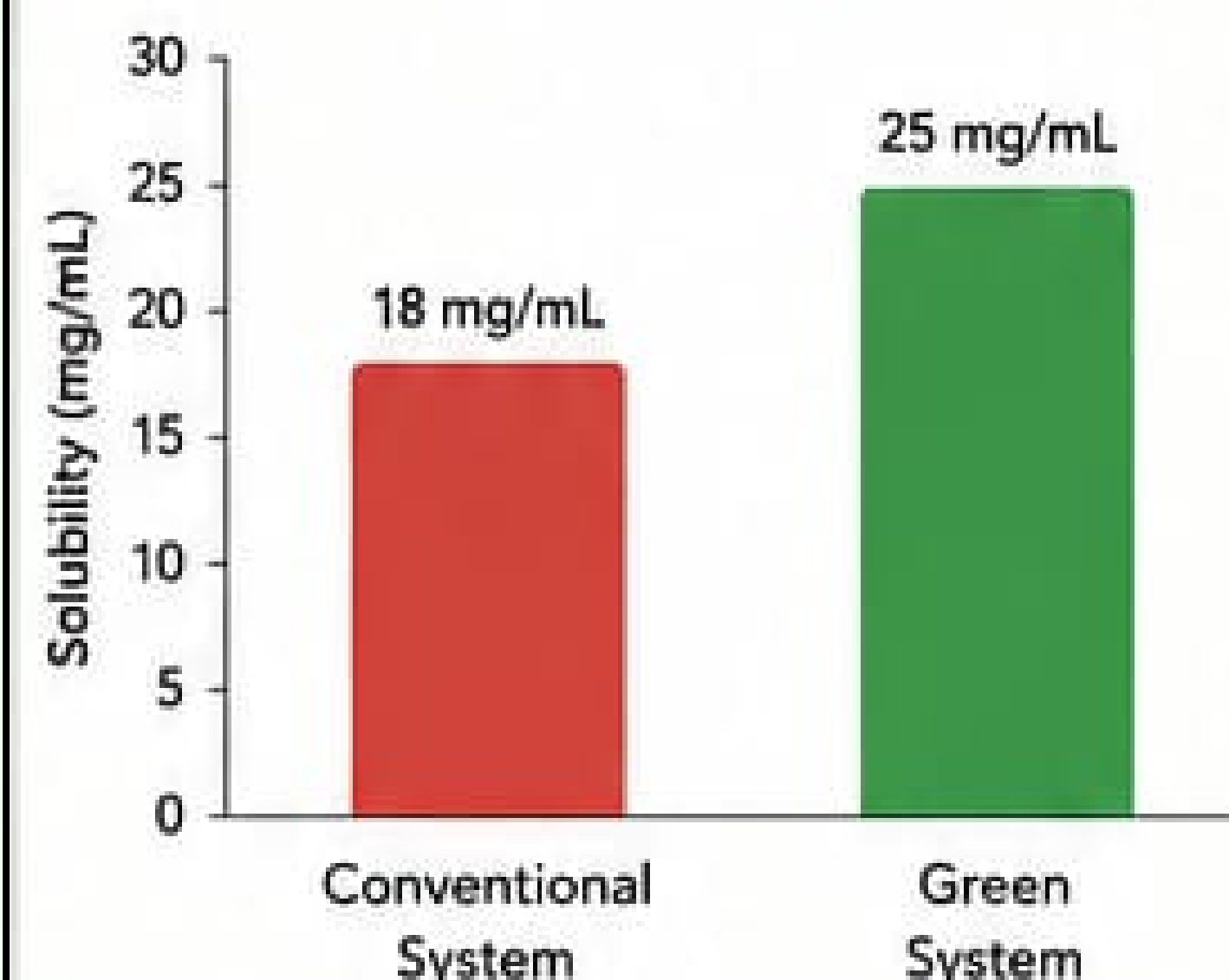
5. Replicates



All measurements were performed in triplicate to ensure accuracy.

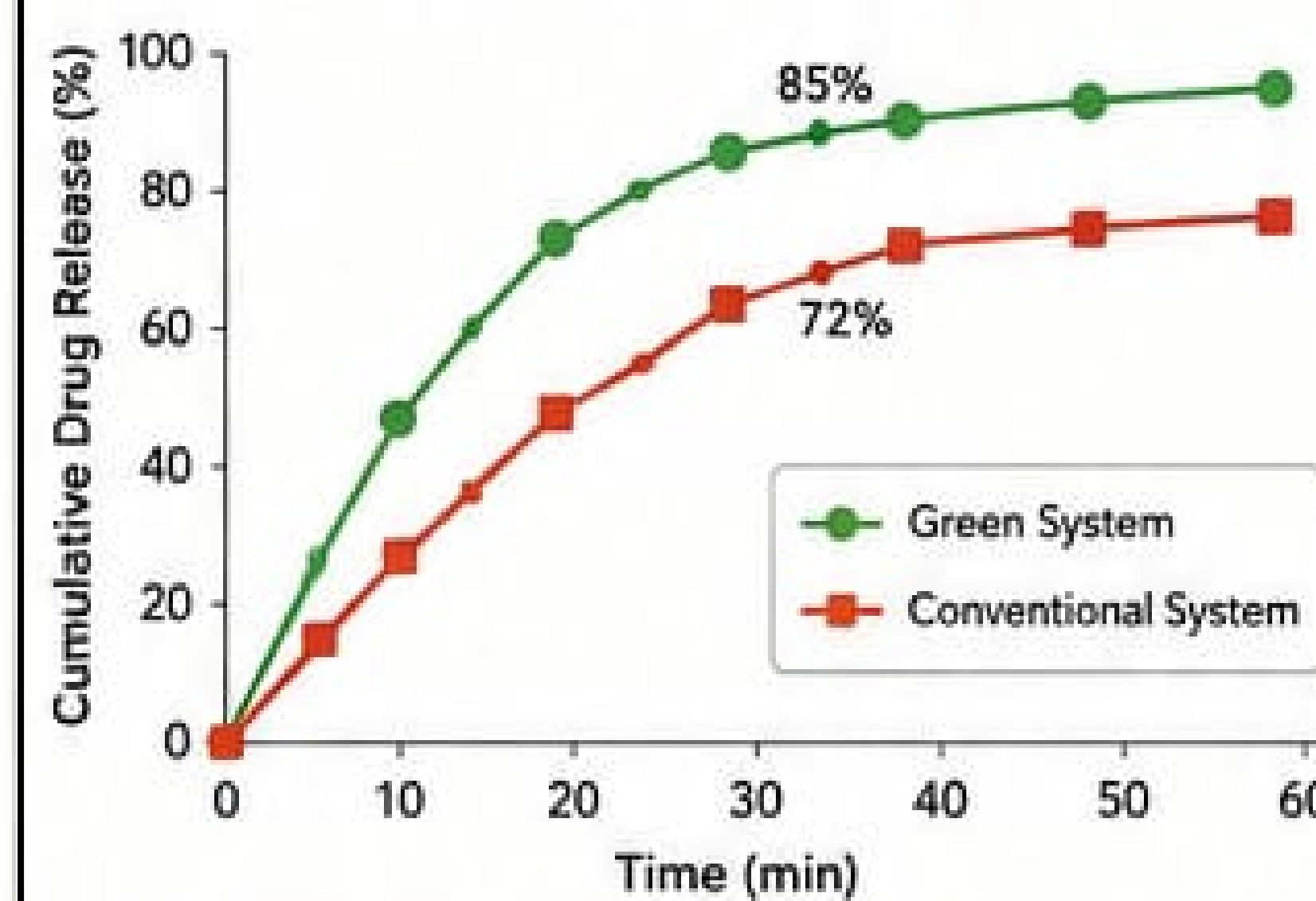
5. RESULTS

5.1 Solubility



The solubility of the green formulation increased from 18 mg/mL to 25 mg/mL.

5.2 Dissolution Study



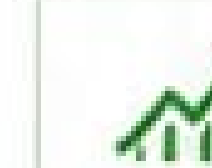
85% of the drug was released in 30 minutes in the green system as opposed to 72% in the conventional formulation.

5.3 Stability Study (2 Weeks)

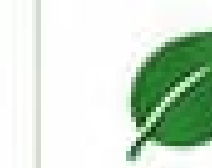
Parameter	Conventional System		Green System	
	Initial	2 Weeks	Initial	2 Weeks
Appearance	White powder	White powder	White powder	White powder
Drug Content (%)	99.2	98.7	99.4	98.9
% Degradation	–	0.5%	–	0.5%
Solubility (mg/mL)	18.1	17.8	25.2	24.6

No significant degradation was observed in both formulations over two weeks.

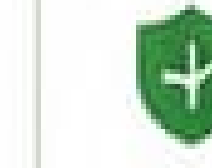
6. DISCUSSION



The green solvent system significantly improved solubility and dissolution rate compared to the conventional system.



Ethanol and water, being less toxic and environmentally benign, offer a safer alternative without compromising drug performance.



The similar stability profile of both formulations indicates that green solvents are suitable for stable drug formulations.



These findings support the integration of green chemistry principles in pharmaceutical development for sustainable and responsible production.

7. CONCLUSION



Eco-friendly solvents (ethanol and water) enhanced the solubility and dissolution performance of paracetamol without affecting stability. This study demonstrates that green solvents can minimize chemical toxicity while improving drug delivery efficiency. Adopting green solvents in pharmaceutical formulation is a sustainable, safer, and globally responsible strategy that aligns with environmental protection and public health goals.

REFERENCES

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KEY TAKEAWAY

Green solvents provide a more sustainable and safer approach to pharmaceutical formulation, supporting both human health and global sustainability goals.

