

**SUBMISSION FOR EVALUATION
FINAL YEAR PROJECT 2 - RESEARCH PROJECT**

**PHYSICOCHEMICAL PROPERTIES OF POTASSIUM CARBONATE-GLYCEROL
MIXTURE: EFFECT OF MOLAR RATIOS AND TEMPERATURE VARIATIONS**

Name : KHAIRUNADIA BINTI BADRUL HIZAM
Student ID : 2022611546
Program : AS245
Course code : FSG671
Mobile Phone : 016-9093532
E-mail : 2022611546@student.uitm.edu.my

Approval by Main Supervisor :

I certify that the work conducted by the above student is completed and approve this report to be submitted for evaluation.

Supervisor's name : MADAM SYARIFAH NURSYIMI AZLINA BINTI SYED ISMAIL
Date : 1/8/2025
Turnitin Similarity % : 5%
Signature :

SYARIFAH NURSYIMI AZLINA SYED ISMAIL
Pensyarah Kanan
Universiti Teknologi MARA
Cawangan Perlis
02600 Arau, Perlis
syarifah_nursyimi@uitm.edu.my

**PHYSICOCHEMICAL PROPERTIES OF POTASSIUM CARBONATE
AND GLYCEROL MIXTURES AT DIFFERENT MOLAR RATIOS AND
TEMPERATURE**

KHAIRUNADIA BINTI BADRUL HIZAM

**Final Year Project Proposal Submitted in
Partial Fulfilment of the Requirements for the Degree of Bachelor of Science
(Hons.) Applied Chemistry in the Faculty of Applied Sciences
University Teknologi MARA**

AUGUST 2025

ABSTRACT

PHYSICOCHEMICAL PROPERTIES OF POTASSIUM CARBONATE AND GLYCEROL MIXTURES AT DIFFERENT MOLAR RATIOS AND TEMPERATURE

This study was conducted to explore the development of Deep Eutectic Solvents (DES) based on a mixture of Potassium Carbonate and Glycerol as an alternative to conventional organic solvents, which are hazardous, non-biodegradable, and release volatile organic compounds (VOCs). Conventional solvents face issues such as limited solubility for ionic compounds and pose serious environmental and health risks. Therefore, DES is proposed as a more environmentally friendly and safer solution. The objective of this study is to identify the optimum molar ratio and evaluate the effect of temperature on the physicochemical properties of the potassium carbonate-glycerol mixture, namely pH, density, viscosity, and ionic conductivity. In this study, Potassium Carbonate and Glycerol were mixed at molar ratios of 1:10 and 1:16 and stirred at 50°C until a homogeneous solution was formed. The mixtures were analyzed within a temperature range of 30°C to 70°C. The tests conducted included pH measurement using the Hanna Hi2020 pH meter, hydrogen bonding using FTIR, density using the Attention Force Tensiometer, viscosity using a rotational viscometer, and ionic conductivity using the Eutech CON 2700 conductivity meter. The results showed that both molar ratios of 1:10 and 1:16 formed stable DES solutions. The FTIR spectra confirmed the presence of hydrogen bonding between Glycerol (hydrogen bond donor) and carbonate ions (hydrogen bond acceptor). The pH values for both mixtures remained consistent (~11.5), indicating strong chemical stability. Density and viscosity decreased with increasing temperature due to reduced intermolecular forces, while ionic conductivity increased with temperature, reaching 33.80 mS/cm at 70°C for the 1:10 ratio. The 1:10 ratio demonstrated higher ionic conductivity and thermal stability, while the 1:16 ratio was more fluid and suitable for applications requiring low viscosity. In conclusion, DES based on Potassium Carbonate and Glycerol has potential as a tunable green solvent, suitable for applications such as CO₂ absorption, catalysis, and electrochemical systems. This study contributes to the development of sustainable solvents that are environmentally friendly and safer, aligning with green chemistry principles for research and industrial use.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF SYMBOLS	vii
LIST OF ABBREVIATIONS	viii
ABSTRACT	ix
ABSTRAK	
CHAPTER 1 INTRODUCTION	
1.1 Research Background	1
1.2 Problem Statement	2
1.3 Significance of study	3
1.4 Objectives of study	5
CHAPTER 2 LITERATURE REVIEW	
2.1 Deep Eutectic Solvent (DES).	6
2.1.1 HBA HBD	8
2.2 Factors Affecting DES Performance	10
2.2.1 Molar ratio	10
2.2.2 Temperature	11
2.3 Physicochemical properties	13
2.3.1 Phase behaviour	13
2.3.2 Functional group changes	14
2.3.3 Viscosity	15
2.3.4 Density	17
2.3.5 Ionic conductivity	20
2.3.6 pH	22
CHAPTER 3 METHODOLOGY	
3.1 Materials and chemicals	25
3.2 Preparation of Potassium Carbonate-Glycerol Mixture	25
3.3 Instrumentation	27
3.3.1 pH meter	27
3.3.2 FTIR	27
3.3.3 Density meter	28
3.3.4 Viscometer	29
3.3.5 Ionic conductivity meter	31

3.4 Experimental designs/ Flow chart	32
CHAPTER 4 RESULTS AND DISCUSSION	
4.1 Mixture solubility at different molar ratios	34
4.2 pH analysis	36
4.3 Fourier Transform Infrared Spectroscopy	39
4.4 Density Meter Analysis	42
4.5 Viscosity Meter Analysis	46
4.6 Ionic Conductivity Analysis	50
CHAPTER 5 CONCLUSION AND RECOMMENDATIONS	54
CITED REFERENCES	59
APPENDICES	63