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OPTIMIZING PHYSICOCHEMICAL PROPERTIES OF POTASSIUM CARBONATE AND 1,2-PROPANEDIOL MIXTURE AT DIFFERENT MOLAR RATIOS AND TEMPERATURES TO ENHANCE SOLVENT EFFICIENCY

Name	:	FATIN NAZURAH BINTI ABD LATIFF
Student ID	:	2022868326
Program	:	AS245
Course code	:	FSG671
Mobile Phone	:	
E-mail	:	fatinnazurah68@gmail.com

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	:	PUAN SYARIFAH NURSYIMI AZLINA BINTI SYED ISMAIL
Date	:	31/7/2025
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Signature	:	

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

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FATIN NAZURAH BINTI ABD LATIFF

BACHELOR OF SCIENCE (HONS.) APPLIED CHEMISTRY IN THE FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA

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ABSTRACT

OPTIMIZING PHYSICOCHEMICAL PROPERTIES OF POTASSIUM CARBONATE AND 1,2-PROPANEDIOL MIXTURE AT DIFFERENT MOLAR RATIOS AND TEMPERATURES TO ENHANCE SOLVENT EFFICIENCY

Conventional organic solvents are widely used in chemical processes, but they suffer from critical drawbacks such as toxicity, flammability, and volatility, posing risks to human health and the environment. As the demand for safer, greener alternatives grows, deep eutectic solvents (DESs) have emerged as promising eco-friendly options due to their tunable physicochemical properties. This research focused on the potassium carbonate (PC) and 1,2-propanediol (PG) deep eutectic solvents (DESs) physicochemical properties at two different molar ratios, 1:12 and 1:16. The purpose of the study was to measure the solubility, pH, and intermolecular hydrogen bonding of PC-PG in 1:12 and 1:16 ratios, as well as to analyse the impact of these ratios and temperatures on density, viscosity, and ionic conductivity of the prepared DES. Both DESs were fully characterized comprising solubility tests, pH measurement, FTIR spectroscopy, and evaluation of density, viscosity, and ionic conductivity in the range of 30 °C to 70 °C. 1:12 and 1:16 DESs resulted in stable homogeneous liquids. The 1:12 DES showed higher pH and viscosity but lower density and ionic conductivity compared to 1:16 DES. FTIR analysis confirmed the formation of DESs through the presence of broad O–H and C–O stretching bands, with the 1:16 DES showing stronger hydrogen bonding and more significant spectral shifts. Changes in molecular structure influenced transport properties of the DES systems. The 1:16 DES showed better performance in terms of conductivity and flow behaviour, making it more suitable for applications that require enhanced ion mobility and reduced resistance. This study provides fundamental insight into the relationship between DES composition and temperature on hydrogen bonding, and physical properties, contributing to the design of greener and more tunable solvent systems.

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