

**REFINING OF INDUSTRIAL SPENT-FUEL OIL
BY REMOVAL OF METALS IMPURITIES USING
NANOPARTICLE ADDITIVES.**

MUHAMMAD IRSYAD BIN ROSLAN

**BACHELOR OF CHEMICAL ENGINEERING
(ENVIRONMENT) WITH HONOURS**

UNIVERSITI TEKNOLOGI MARA

2022

**REFINING OF INDUSTRIAL SPENT FUEL OIL BY REMOVAL
OF METAL IMPURITIES USING NANOPARTICLE ADDITIVES.**

By

MUHAMMAD IRSYAD BIN ROSLAN

This report is submitted in partial fulfillment of the requirements
needed for the award of
Bachelor of Chemical Engineering (Environment) with Honours

**CENTRE FOR CHEMICAL ENGINEERING STUDIES
UNIVERSITI TEKNOLOGI MARA**

AUG 2022

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim.

First and foremost, I praise to Allah S.W.T for all his guidance and blessings for the opportunity to embark on my bachelor and for completing this final year project. Additionally, I want to give my special thanks and express my deepest appreciation to my supervisor, PM Dr. Abdul Hadi for his patience and willingness in teaching and monitoring this research. Besides that, I am thankful for the guidance from all lecturers in completing this research work.

I would also like to express my gratitude to my colleague friends for being a source of great inspiration and giving full supports throughout this research work. Lastly, my gratitude goes to everyone who involved either directly or indirectly on this journey. Thank you and may He bless us all.

TABLE OF CONTENTS

AUTHOR'S DECLARATION	i
SUPERVISOR'S CERTIFICATION	ii
COORDINATOR'S CERTIFICATION	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF SYMBOLS	ix
LIST OF ABBREVIATIONS	x
ABSTRACT	xi
CHAPTER ONE	1
1.0 Introduction	1
1.1 Problem Statement	2
1.2 Research Objective.....	4
1.3 Scope Of Work.....	4
CHAPTER TWO	5
2.1 Waste Engine Oil	5
2.2 Pyrolysis Process On Waste Fuel Oil	6
2.3 Metal Impurities In Pyrolysis Oil.....	6
2.4 Metal Removal On Pyrolysis Oil	7
2.5 Nanoparticles Technology	8
2.6 Nanoparticle As Additives	9
2.7 Metallic Nanoparticles	10
2.7.1 Zinc Oxide (ZnO) Nanoparticles	12
2.8 Nanoparticle Synthesis.....	13

ABSTRACT

Energy plays a vital role in economic growth around the globe. As the demand and usage of fuels increases, primary sources of energy mainly fossil fuel and natural gas are getting depleted day by day. This is circumvented by implementing chemical recycling practices, which shows that worn out fuel can still be used as a source of energy after undergoing thorough process specifically pyrolysis which turns the fuel into pyrolytic oil. Recently, nanoparticles have garnered a lot of attractions as a potential additive for pyrolytic oil. It has been suggested that these additives are able to improve pyrolytic oil properties and quality by removing metal impurities. Therefore, in this research study, zinc oxide (ZnO) nanoparticle is synthesized in laboratory scale by using sol-gel method. Zinc acetate dihydrate and NaOH was used as precursor for this synthesis. The solution was then mixed, heated under constant stirring and dried at 100°C to produce ZnO nanoparticle sample. This sample is further analyzed by usage XRD, FTIR and TGA. The analysis of XRD shows the different peaks are located at 31.84°, 32.34°, and 33.50° which indicates presence of zinc and peak at 38.02° which indicates some presence of zinc acetate. The FTIR shows absorption peaks at 533.71 cm⁻¹ which corresponds to ZnO stretching vibrations but less O-H stretching in 3398.56 cm⁻¹ and 2912.09 cm⁻¹ peaks. Analysis of TGA further confirm the presence of zinc acetate by huge weight loss at 200°C to 300°C.