



اَبُو سَيِّدِي تَيْكُو لَوِي كِي مَارَا
UNIVERSITI
TEKNOLOGI
MARA

Cawangan Terengganu
Kampus Bukit Besi

TITLE:

A Study of Roselle-Based Dye as a Potential for Hybrid Dye Sensitized Solar Cells
Application

SUPERVISOR:

DR. NORAINI BINTI RAZALI
DR. NURUL HUDA KAMARULZAMAN

**SCHOOL OF CHEMICAL ENGINEERING
COLLEGE OF ENGINEERING**

2025

AUTHOR'S DECLARATION

“ I hereby declare that this report is the result my own work except for quotations and summaries which have been duly acknowledged.”

Name of Student : Wan Haikal Saffi Bin Jefris

Student I.D. No. : 2022474184

Programme : Diploma in Chemical Engineering

College/School : College of Engineering/School of Chemical Engineering

Signature of Student :

Date : 12/2/2025

ABSTRACT

For this research, two sources of dye were used which are dried roselle and fresh roselle to extract natural dye using methanol as a solvent. The main objective of this research is to find the optimum condition for natural dye to act as natural sensitizer for dye sensitized solar cell (DSSC) application. The parameter considered that could influence dye behaviours are leaven time for dye extraction, pH levels and doping with metal oxides. The dye extraction uses electrical conductivity meter to monitor dye efficiency on conducting electrical current. pH level alteration was conducted using 1.0 M HCL and 1.0 M NaOH as pH adjuster and the dye colours and conductivity were analysed. The doping process uses CaO as metal oxide and water as medium for the natural dye. The highest electrical conductivity is 9110 $\mu\text{S}/\text{cm}$ from dried roselle where the pH level has been altered to pH 8. From this study, it was found that dried roselle produce the best dye that has a potential to be used as natural sensitizer for DSSC application because of its overall characteristic.

TABLE OF CONTENTS

	Page
AUTHOR'S DECLARATION	2
ABSTRACT	3
TABLE OF CONTENTS	4
CHAPTER ONE BACKGROUND	6
1.1 Introduction	6
1.2 Literature Review	8
1.2.1 Natural Dye as a Sensitizer	10
1.2.2 pH Levels and Dye Performance	11
1.2.3 Role of CaO Doping in DSSC	12
1.3 Problem Statement	12
1.4 Objectives	13
1.5 Scope of Study	13
CHAPTER TWO METHODOLOGY	14
2.1 Introduction	14
2.1.1 Raw Material	15
2.1.2 Chemical	15
2.1.3 Apparatus and Equipment	16
2.2 Optimum Dye Extraction of Dried and Fresh Roselle Calyces	17
2.3 pH Level Alteration of Natural Dye Extracted from Roselle	17
2.4 Doping of CaO with Natural Dye extracted from Roselle	18

CHAPTER THREE RESULT AND DISCUSSION	20
3.1 Result of Dye Extraction Of Dried and Fresh Roselle Calyces	20
3.1.1 Dried Roselle Calyces	20
3.1.2 Fresh Roselle Calyces	21
3.1.3 Comparison Graph	22
3.1.4 Discussion	22
3.2 Result of pH Alteration of Natural Dye Extracted from Roselle	23
3.2.1 Dried Roselle Calyces	23
3.2.2 Fresh Roselle Calyces	25
3.2.3 Discussion	26
3.3 Result of Doping of CaO with Dried Roselle Dye with Water as Solvent	28
3.3.1 Discussion	28
 CHAPTER FOUR CONCLUSION AND RECOMMENDATION	 29
4.1 Conclusion	29
4.2 Recommendation	30
 REFERENCES	 31