

**DETERMINATION OF TANNIN CONTENT, PHENOLIC CONTENT, AND  
ANTIOXIDANT ACTIVITY OF RED ROOIBOS TEA, BLACK TEA, AND  
GREEN TEA FROM COMMERCIAL TEA BAG**

**AZZA FAIZA BINTI MOHAMMAD TAIB**

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

**AUGUST 2023**

This Final Year Project Report entitled "**Determination of tannin content, phenolic content and antioxidant activity of Rooibos tea, green tea and black tea from commercial tea bag**" was submitted by Azza Faiza binti Mohammad Taib in partial fulfillment of the requirements for the Degree of Bachelor of Science (Hons.) Applied Chemistry, in the Faculty of Applied Sciences, and was approved by

---

Dr. Nurul Zawani binti Alias  
Supervisor  
B. Sc. (Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
02600 Arau  
Perlis

---

Dr. Siti Nurlia Ali  
Project Coordinator  
B. Sc. (Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
02600 Arau  
Perlis

---

Dr. Nur Nasulhah Kasim  
Head of Programme  
B. Sc. (Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
02600 Arau  
Perlis

Date: 4 August 2023

## ABSTRACT

### **DETERMINATION OF TANNIN CONTENT, PHENOLIC CONTENT, AND ANTIOXIDANT ACTIVITY OF RED ROOIBOS TEA, BLACK TEA, AND GREEN TEA FROM COMMERCIAL TEA BAG**

People worldwide consume a variety of teas, including Rooibos tea (red Rooibos tea), black tea, and green tea. Various teas offer unique benefits through antioxidants that protect cells from free radicals. Tannin, an antioxidant in tea, has health advantages but may hinder iron absorption, reducing nutritional value from food. Thus, the objective of this study is to determine the tannin content, phenolic content, and antioxidant activity of different tea types (Rooibos tea, green tea, and black tea). This study also aims to determine the correlation between TPC and TTC with antioxidant activity by DPPH. The total tannin content and total phenolic content were measured using Folin-Ciocalteu method. Additionally, the antioxidant activity of the teas was evaluated using DPPH radical scavenging assay. Green tea exhibited a low IC<sub>50</sub> value for DPPH (15.01 µg/mL), high phenolic content (56.57 mg GAE/g), and high tannin content (101.75 mg TAE/g). Rooibos tea had the lowest tannin content (38.75 mg TAE/g), and low phenolic content (36.95 mg GAE/g) but exhibit a higher IC<sub>50</sub> value for DPPH (25.11 µg/mL). Black tea exhibited moderate amount of phenolic content (46.18 mg GAE/g), tannin content (41.37 mg TAE/g), and IC<sub>50</sub> value for DPPH (18.93 µg/mL). Hence, the antioxidant activities of the teas ranked as follows: Rooibos tea < black tea < green tea. By using Pearson's correlation coefficient, total phenolic content was found closely associated with antioxidant activity with  $r = 0.984$  while total tannin content was weakly associated with antioxidant activity with  $r = 0.178$ . Consequently, the study's findings suggest that a higher total phenolic content corresponds to stronger antioxidant activity, whereas elevated total tannin content does not necessarily indicate higher antioxidant activity. Therefore, according to tannin content, phenolic content and antioxidant activity value, Rooibos tea is considered the best compared to green tea and black tea.

## TABLE OF CONTENTS

	<b>Page</b>
<b>ABSTRACT</b>	<b>iii</b>
<b>ABSTRAK</b>	<b>iv</b>
<b>ACKNOWLEDGEMENTS</b>	<b>v</b>
<b>TABLE OF CONTENTS</b>	<b>vi</b>
<b>LIST OF TABLES</b>	<b>viii</b>
<b>LIST OF FIGURES</b>	<b>ix</b>
<b>LIST OF SYMBOLS</b>	<b>x</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xi</b>
<b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Background of the study	1
1.2 Problem statement	3
1.3 Objectives of the study	4
1.4 Significance of study	4
<b>CHAPTER 2 LITERATURE REVIEW</b>	<b>5</b>
2.1 Rooibos tea, green tea, and black tea	5
2.2 Chemical composition of tea	9
2.3 Health benefits of tea	13
2.4 Tannin	15
2.5 Biological activities of tannin	16
2.5.1 Anti-oxidant	16
2.5.2 Anti-microbial	17
2.5.3 Anti-inflammatory	18
2.5.4 Anti-obesity	20
2.6 Limitation of tannin	21

2.6.1 Tannin as anti-nutrient	21
2.6.2 Tannin as carcinogen and mutagen	22
2.7 Application of tannin	23
2.8 Antioxidant activity	25
<b>CHAPTER 3 METHODOLOGY</b>	<b>27</b>
3.1 Materials	27
3.2 Chemicals and Reagents	27
3.3 Preparation of tea extract	27
3.4 Total tannin content (TTC) assay	28
3.5 Total phenolic content (TPC) assay	29
3.6 Determination of antioxidant activity by DPPH assay	30
3.7 Statistical Analysis	31
<b>CHAPTER 4 RESULT AND DISCUSSION</b>	<b>32</b>
4.1 Extraction yield of Rooibos tea, green tea, and black tea	32
4.2 Total tannin content assay (TTC)	33
4.3 Total phenolic content assay (TPC)	37
4.4 Antioxidant activity by DPPH	41
4.5 Correlation Analysis of TPC and TTC with DPPH	44
<b>CHAPTER 5 CONCLUSION AND DISCUSSION</b>	<b>46</b>
<b>CITED REFERENCES</b>	<b>48</b>
<b>APPENDICES</b>	<b>58</b>
<b>CURRICULUM VITAE</b>	<b>59</b>