UNIVERSITI TEKNOLOGI MARA

FUNCTIONAL PROPERTIES OF HERBAL TEA PREPARED FROM *Cosmos caudatus* LEAVES AT DIFFERENT MATURITY STAGES

DIAN NASHIELA BTE FATANAH

Thesis submitted in the fulfillment
of the requirements for the degree of
Master of Science

Faculty of Applied Sciences

September 2016

ABSTRACT

Nowadays, supplementation of human diet with herbal tea is a worldwide trend because it is believed to offer positive potential health effects, giving negligible side effects, refreshing taste, relaxation and rejuvenation, besides, cheaper in price, abundant in resources and convenience to be consumed. However, different maturity stages of plants being used as raw materials constitute an important factor in influencing their antioxidant activity, phenolic compounds, mineral content, colour, mutagenic activity and sensorial properties. Hence, this study was designed to investigate the antioxidant content, antioxidant activity, mineral content, colour, mutagenic activity and sensorial properties of herbal tea prepared from *Cosmos caudatus* leaves at different maturity stages namely young, mature, old and mixed leaves. Comparison of these *C. caudatus* herbal teas with *C. caudatus* herbal tea from commercial brand was also conducted. All prepared *C. caudatus* herbal teas were analysed for total phenolic content (TPC), total flavonoid content (TFC), ferric reducing antioxidant power (FRAP), 2-2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, β-carotene bleaching assay, oxygen radical absorbance capacity (ORAC), high performance liquid chromatography (HPLC) analysis of phenolic compounds, mineral content, colour, Ames test as well as quantitative descriptive analysis (QDA). The results demonstrated that, *C. caudatus* herbal tea prepared from young leaves had significantly strong ($p<0.05$) antioxidant activity compared to other *C. caudatus* herbal teas for all assays tested. Pearson's correlation coefficient also revealed that, TPC and TFC exhibited a strong correlation with all antioxidant activity assays, indicating that these compounds are the major contributors to the antioxidant activity in *C. caudatus* herbal teas. Out of fourteen phenolic compounds analysed, twelve phenolic compounds were detected in all *C. caudatus* herbal teas with the amount reduced significantly ($p<0.05$) as maturity increased. Nevertheless, the mineral content in *C. caudatus* herbal teas increased as maturity increased. Corresponded to the results of antioxidant activity and mineral content, *C. caudatus* herbal tea prepared from young leaves had significantly darker colour compared to other *C. caudatus* herbal teas. The Ames test showed that, none of *C. caudatus* herbal teas induced any increased in the number of revertants, demonstrating the absence of mutagenic activity. In terms of overall acceptability, *C. caudatus* herbal tea from commercial brand was the most preferred by the panelists. Hence, due to the beneficial constituents presence in all *C. caudatus* herbal teas prepared from leaves at different maturity stages, further investigation should be conducted to improve on the taste of these herbal teas as well as to study on their the antimutagenic activity.

ACKNOWLEDGEMENTS

Assalamualaikum w.b.t.

In the name of Allah, The Most Gracious and The Most Merciful. Peace and blessing of Allah al Mighty to our beloved, Prophet Muhammad S.A.W and his relatives, all his companions and those who have followed. Alhamdulillah, all praise and thankfulness to Allah S.W.T., the one and only, with His willingness has allowed and given me strength and patience for completing this project.

First and foremost, I would like to express my sincere gratitude to my beloved supervisor, Prof. Dr. Noriham Abdullah for her supervision, tolerance, encouragement and thoughtful guidance towards the completion of this thesis. My special appreciation also goes to my co-supervisors, Dr. Nooraain Hashim and Prof. Dr. Azizah Abd. Hamid for their experienced, advices, kindness and support throughout this research.

I would like to extend my thanks to School of Postgraduate Studies, Faculty of Applied Sciences and Institute of Graduate Studies (IPSis), UiTM for their financial and technical support. A lots of thanks also to Department of Food Science and Technology as well as Postgraduate Laboratory, Faculty of Applied Sciences, UiTM for all the laboratory facilities. This study could never be possible without the scholarship from Jabatan Perkhidmatan Awam (JPA), Malaysia in which I appreciate so much.

I am deeply indebted to all laboratory staffs, En. Ahmad Kambali, Pn. Siti Mahani Mardi, Cik Nor Shuhada Mohammad Samri, Pn. Norahiza Mohd. Soheh and Cik Hariyah Hasyim for their assistances and kindness. I also want to express my appreciation to my friends, Siti Hafsah Mohd. Shah, Azzura Abdullah, Siti Azima Abdul Mutalib, Wan Saidatul Syida Wan Kamarudin, Nurain Aziman, Noorul Farhana Md Ariff and Hassuna Johari for their advices, ideas and support upon completing this research.

My heartfelt appreciation is given to my family, especially my parents, Datuk Fatanah Datuk Hj. Ahmad and Ɗeros, all my siblings, Mohd. Faiz, Esma Nur, Dian Shafiqa, Raimi, Dian Syakınah, Mohd Danial, Dian Nur Elleina, Dian Nur Izzaty and Dian Nur Azreena as well as my nephews and niece, Muhammad Aqil Ashraf, Marissa Nur Zahra and Adam Mikail because of their endless love, support, moral advice, patience and prayers that they always have for me. I love them very much and I dedicated this work for them.

Lastly, my special thanks are dedicated to every single person who are directly or indirectly involved and contribute to the completion of this thesis.

May Allah bless all of them.

Wassalam.

TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

In recent years, as a results of the current frantic pace of modern lifestyle in developed and developing countries, there have been drastic changes in the ways of food consumption habits, in which the ingestion of varied and balanced food in the correct amount as well as sufficient intake of nutritive substances for the human body has been reduced (Krejčova, Ludvíková, Černohorský and Pouzar, 2012). For this reason, it attracts the number of food and beverages industries to grow dramatically, especially herbal industry to penetrate the herbal-based product market in order to compensate the lack of important nutrients (Zakaria, Masnan, Zakaria and Shakaff, 2014). It is well-known fact that plant-based diets offer nutritional benefits and therapeutic values which are connected with the presence of phytochemicals such as flavonoids, isoflavones, lignans, cinnamic acids derivatives, steroids, carotenoids and terpenoids, vitamins, polysaccharides, proteins and minerals contained in the plants (Shuib *et al.*, 2011). Herbal tea, is one of the most trending herbal-based products selected by consumers nowadays due to its lower price, convenience to take, easy to prepare, richer in resources, mild in action and most important it give negligible side effects (Tschiggerl and Bucar, 2012). According to Zhao, Deng, Chen and Li (2013), herbal tea such as herbal infusion or tisane has been used for health care, health promotion and disease prevention particularly, chronic disease for a thousand of years in many countries. Numerous epidemiological studies also link herbal tea consumption to a reduction of cardiovascular diseases, cholesterol level, diabetes, arthritis, osteoporosis and dental carries due to its antioxidant, antimicrobial, anticarcinogenic, cardiaprotective, chemopreventive and hepatoprotective properties (Horžić *et al.*, 2009). Generally, herbal tea can be prepared by pouring boiling water over the plant parts such as leaves, flowers, seeds, fruits, stems or roots of plant species other than *Camellia sinesis* L. and letting them to steep for a few minutes (Kara, 2009).