EXTRACTION OF ESSENTIAL OILS FROM JASMINE FLOWER USING SOLVENT EXTRACTION BASED ON PETAL CONDITION

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A thesis submitted in fulfillment of the requirements for the award of the degree of Bachelor of Chemical Engineering

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MAY 2008

I declare that this thesis entitled "*Extraction of essential oils from Jasmine flower using solvent extraction based on petal condition*" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 15 May 2008

DEDICATION

Special dedication to the memory of my beloved mother and father, Miah bt Bidin and Idris bin Sharif, my aunty and uncle and all my family members that always inspire, love and stand besides me, my supervisors, my beloved friends, my fellow colleagues, and all faculty members

For all your love, care, support, and believe in me.Thank you so much.

ACKNOWLEDGEMENT

Praise be to God for His help and guidance that finally I'll able to complete this final year project as one of my requirement to complete my study.

First and foremost I would like to extend my deepest gratitude to all the parties involved in this research. First of all, a special thank to my supervisor Mr. Syaiful Nizam bin Hassan for willingness in overseeing the progress of my research work from its initial phases till the completion of it. I do believe that all their advice and comments are for the benefit of producing the best research work.

I am grateful to the staff of Faculty of Chemical Engineering of University Malaysia Pahang for their cheerfulness and professionalism in handling their work. In preparing this thesis, I was in contact with many people, researches, academicians and practitioners. They have contributed towards my understanding and thoughts.

In particular, my sincere thankful is also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. And last, but not least I thank my mother's and other family members for their continuous support while completing this thesis.

ABSTRACT

Pure Jasmine essential oils are primarily used in the perfumery industry and have a very high commercial value due to its therapeutic properties. As Jasmine essential oils are composed of heat-sensitive chemical compounds, the use of conventional steam distillation technique would inevitably inflict thermal degradation to the natural fragrance. In this experimental work, solvent extraction method using ethanol as solvent was employed due to its mild extracting condition and lower operating cost. Three different petal condition were used, which is dry petal,wet petal, and normal petal respectively. The extract compositions were compared using gas chromatography analysis. Preliminary results showed that volatile oil compounds were successfully isolated from Jasmine flowers using these conditions. It was found that the main constituents of the essential oils were benzyl acetate and benzyldehyde. Further studies also revealed that the composition and yield of essential oils was mainly influenced by the different types of petal condition used. The most optimum concentration which is Benzyl Benzoate Concentration 2.6370% and Benzaldehyde Concentration 1.0780% was extracted using dry petal condition . Low yield of the jasmine essential oils can be improved in future study by carrying out the research in larger scale.

ABSTRAK

Pati pengekstrakan minyak bunga melur terutamanya digunakan dalam pembuatan minyak wangi dan mempunyai nilai komersil yang tinggi disebabkan oleh ciri-ciri terapinya. Minyak ini adalah terdiri daripada komponen yang sensitif pada haba, oleh itu penggunaan pengekstrakan wap air sebagai salah satu cara untuk mengekstrakkan minyak ini secara tidak langsung membawa kepada kesan degradasi haba terhadap bau semulajadi minyak bunga melur. Di dalam kajian ini, pengekstrakan minyak ini dilakukan menggunakan kaedah penggunaan pelarut dengan menggunankan pelarut ethanol kerana ia didapati sesuai untuk tujuan pengekstrakan minyak ini dan kos menggunakan cara ini lebih rendah. Tiga jenis keadaan bunga yang digunakan bunga kering, bunga lembap dan bunga normal. Sampel minyak yang didapati daripada kajian ini akan dibandingkan menggunakan analisis gas kromatografi. Keputusan kajian pada peringkat permulaan menunjukan beberapa komponen di dalam minyak ini dapat dikesan menggunakan pelarut-pelarut ini. Komponen utama di dalam minyak bunga melur yang telah dikenalpasti ialah benzil asetat dan benzaldehid. Kajian berikutnya membuktikan pengesanan komponen dan kuantiti minyak ini adalah dipengaruhi oleh faktor utamanya iaitu penggunaan keadaan bunga yang berlainan. Hasil minyak bunga melur yang paling optimum iaitu peratusan kepekatan Benzyl Benzoate sebanyak 2.6370% dan Benzaldehyde sebanyak 1.0780% diekstrak menggunakan bunge melur dalam keadaan kering . Hasil minyak bunga melur yang rendah ini dapat dipertingkatkan pada kajian akan datang menggunakan skala yang lebih besar.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CO_2	=	Carbon dioxide
FID	=	Flame Ionization Detector
GC	=	Gas Chromatography
GC-MS	=	Gas Chromatography - Mass Spectrometer
RI	=	Refrective Index
SFE	=	Supercritical Fluids Extraction

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

Essential oils (EOs) are highly concentrated essences of aromatic plant. Technically, it cannot be classified as perfumes or fragrance oils. It can be extracted using a variety of methods such as steam distillation and solvent extraction. It is widely used in perfumery, aromatherapy, cosmetics, incense, medicine, household cleaning product as well as flavoring food and drink industries. EOs is also known as volatile oils and ethereal oils. Sometime it may also be referred to as oil of the raw plant materials from which it was extracted, for example oils of clave.

EOs can contain hundreds of organic constituents including hormones, vitamin and other natural elements. Therefore, it is important to understand the effect that the oils have and the way it works before using the EOs as part of an aromatherapy treatment.

The name of the oil is the same as the name of the plant from which it is derived. The function of the essential oil in the plant is not thoroughly understood. It is probable that the odors of the flowers act as attractants (or repellents) for certain insects, aiding in natural selection. Root oils, wood oils and leaf oils may act as a protection against plant parasites and against depredations of animals. From the vast number of species of plant that are known, about 3000 essential oils have been well identified, though only some 150 have been exploited for commercial production

A plant produces its essential oil in the protoplasm of its cells. The oil is an excretion, which does not participate in the metabolism of the plant. The oils are rich in energy and chemically very active; therefore, it is somewhat surprising for the plant to expel such an amount of energy without making use of it. The oils are stored in the form of micro droplets in the glands of the plants. After diffusing slowly through the wall of the gland, these droplets spread out on the surface of the plant before evaporating and filling the air with perfume.

There are many types of common essential oils; Rose, Bergamot, Lavender, Jasmine and etc. Each of these raw materials requires different methods of extraction. Plants like Rose and Jasmine which contains very little volatile oils needs solvent-extracted since it is too delicate to be distilled. Hence chemical solvents such as hexane and supercritical CO_2 are employed to extract the important aromatic ingredients.

Since the EOs is very sensitive to temperature and highly volatile, it requires a high degree of expertise to extract the oils from the raw material because the method used are time consuming and an expensive process.

Jasmine EOs has widespread applications. It can be used as antidepressant, antiseptic, antispasmodic, and expectorant for dry skin, labor pains, cough, headache, depression, exhaustion and sensitive skin. On top of that the aroma can be described as warm, floral and exotic.

1.2 Problem Statement

Jasmine flower contains very little volatile oil, and it needs to be solvent extracted since it is too delicate to be distilled. Conventionally, chemical solvents are employed to extract the important aromatic ingredients. In this study, supercritical CO_2 are used as solvent in supercritical extraction.

There are many other factors to be taken into consideration when producing a good quality essential oil, which is important for its full benefit. Soil quality, climatic and geographic conditions all contribute to the overall quality of the essential oil.

In some cases the length of cultivation is most important. Jasmine flowers must be picked by hand at dawn on the very first day they open. In this project, the Jasmine flower is being used as the substrate. *Jasminum officinalis*, or also known as Melur in Malay Language, is commonly extracted for its essential oils using methanol and ethanol as solvent. Conventional steam distillation method is not suitable to process such material since it induces thermal degradation of many compounds contained in the flower. The constituents of the Jasmine solvent-extracted oils contain all the fragrance compounds (among others include benzyl acetate, benzyl benzoate, linalool, phytol, fatty acid methyl ester and paraffins). The latter compounds do not contribute to the scent of jasmine flowers. This extraction product undergoes further processing to separate fragrance compounds from these undesired co-extractives.

Solvent extraction uses very little heat so it is able to produce essential oils from whose fragrance would otherwise be destroyed or altered during steam distillation. Solvent extraction is used on delicate plants to produce higher amounts of essential oils at lower cost. Other than the study on this method it is important to improve the existing products of fragrance and also try to encourage the development of local technologies to take advantage of market opportunities.

Each method of extraction actually has it own advantages and disadvantages. This study is important in discovering solvent extraction method as the most optimal methods for capturing the total spectrum of volatile constituent in this jasmine plant. All in all, the study on this research is important in order to improve the effective extraction based on flower petals' conditions that affects production amount of jasmine essential oil.

1.3 Objective

Due to the promising commercialization potential shown by Jasmine essential oil, the main objective of this work is to carry out preliminary study on essential oils and promote the best condition of flower for producing highest quantity of essential oils.

1.4 Scope

To achieve the above objectives, the following research scopes had been identified:

i. Determination of the optimum conditions (petal condition) in extraction of essential oils using solvent extraction

ii. Evaluation of the quality and yield of the jasmine extracted.

iii. Analysis of the product compositions obtained through this extraction process.

CHAPTER 2

LITERATURE REVIEW

2.1 Essential Oils Background

Essential oils are liquid that is generally distilled from various parts of plant that have strong aromatic components. These aromatic substances are made up of different chemical compounds that can be found naturally in the plant, for instance, alcohol, hydrocarbons, phenol, aldehydes, esters and ketones. Besides that, it may also contain hundreds of organic constituents, including hormones, vitamins and other natural elements. Essential oils 75 to 100 times more concentrated than the oils in dried herbs.

For the plant, essential oils act as agent to attract or repel insects (odors of the flowers); Leaf oils, wood oils, and root oils may serve to protect against plant parasites or depredations by animals as well as anti-bacterial agent which is utilizing the hormone in the oil. All in all there are only about 700 aromatic plants aromatic among all types of plants in the world. Thus they are all important for the production of essential oils.

Unlike fragrance oils or perfume, essential oils are derived from the true plants. Perfume oils are unnaturally created fragrances since it contains artificial substances. As such, it does not offer the therapeutic benefit that essential oils do. Consequently pure essential oils are very expensive. Fortunately, they are also highly effective because a few drops at a time are sufficient to achieve the desired effects.

These oils could promote healing of the body and the mind. Typically, these essential oils are used in three primary ways:

i. As odorants in cosmetics, perfumes, detergents, soap and etc
ii. As flavors in bakery goods, candies, meat, soft drinks, and also as food additives.
iii. As pharmaceuticals in dental products and group of medicines.

Today, we could also easily find synthetic essential oils in the market where the price would be cheaper than the pure ones. There are a few differences between synthetic essential oils and pure essential oils. Synthetic essential oils are produced by blending aromatic chemicals mostly derived from coal tar.

These oils may duplicate the smell of the pure essential oils, but the complex chemical components of each essential oil created in nature determine its true aromatic benefits. While synthetic essential oils are not suitable for aromatherapy, they add an approximation of the natural scent to crafts, potpourri, soap and perfume at a fraction of the cost. The reason of these synthetic products is mainly to reduce the cost of production.

The oil of the essential oils bears the name of the plant from which it was derived, for example Rose oil, and Bergamot oil. Such oils were called essential oils because they were thought to represent the very essence of odors and flavors. Essential oils can be divided into two broad categories:

I. Large volume oils which are usually distilled from leafy material, (e.g. lemon grass, citronella and cinnamon leaves).

II. Small volume oils which are usually distilled from fruits, seed, buds and, to a lesser extent, flowers, (e.g. cloves, nutmeg and coriander).

Essential oils are the volatile oils distilled from aromatic plant materials. The odor and flavor of the oils is usually dependent upon these oxygenated compounds. Many oils are terpenoids; fews are benzene derivatives. Table 2.1 shows the important constituents of the more common essential oils (Naik S.N., Lentz.H., 1989).

Table 2.1: Essential Oils from Some Natural Plants.

Name	Part of the plant used	Botanical name	Important constituents	Uses
Lemongrass and citronella	Leaf	*Cymboposon spp*	Citral Citronella Terpenes	Perfumery Disinfectant
Eucalyptus	Leaf	*Eucalyptus globules Eucalyptus citriodora Eucalyptus dives*	Cineale Citronella Terpenes	Not mention
Cinnamon leaf	Leaf	*Cinnamon zeylanicum*	Eugenol	Used to make artificial vanilla
Clove	Bud	*Eugenia caryophyllus*	Eugenol	Dentistry flavouring
Turpentine	Not mention	*Pinus spp*	Terpenes	Paints
Lavender	Flower	*Lavendula intermedia*	Linalool	Perfumery
Sandalwood	Wood	*Santaium album*	Sanatols	Perfumery
Nutmeg	Nut	*Myristica fragrans*	Myristicin	Not mention
Almond	Nut	*Prunis communis*	Benzaldehyde	Not mention
Corainder	Seed	*Coriandrum sativum*	Linalool Terpenes	Not mention

2.1.1 Properties and uses of the essential oils

Each essential oil has it own properties and uses which can be classified and identified accordingly to the type of plant it was derived. Table 2.2 shows the properties and uses of the top essential oil . From Table 2.2, it can be concluded that the significant use of the essential oil is mainly contribute to pharmaceuticals industry where most of it have the anti-depressant properties.

Table 2.2: Properties and Uses of the Top Essential Oils.

Essential oil	Biological Name	Properties	Uses
Clory Sage	*Salvia Sclarea*	Warming, soothing, antiseptic, anticonvulsive, astringent, antiphlogistic, digestive, deodorant, tonic, uterine, bactericidal, antidepressant.	Menstrual problems, anxiety, depression, high blood pressure, acne boils, oily skin and hair, cramp, migraine, the genitor-urinary system disorders such as amenorrhoea, wrinkles, ulcers.
Eucalyptus	*Eucalyptus Globulus*	Antiseptic, analgesic, antineuralgic, antirheumatic, antispasmodic, diuretic, expectorant, antiviral, hypoglycaemic, febrifuge, vulnerary, depurative, stimulant.	Muscular aches and pains, poor circulation, rheumatoid arthritis, asthma, bronchitis, flu, cold, epidermics, chicken pox, headaches, neuralgia, throat infections, skin disorders such as burns, cuts, herpes, wounds, insect bites.
Geranium	*Pelargonium Graveolens*	Soothing, refreshing, relaxing, antidepressant, astringent, antiseptic, antihaemarrhagic, deodorant, diuretic, fungicidal, anti-inflammatory	Anxiety, adrenocortical glands and menopausal problems, sore throat, tonsillitis, cellulites, engorgement of breast, broken capillaries, eczema, hemorrhoids, oily complexion, mature skin, ulcers, wounds.
Jasmine	*Jasminum Officinale*	Analgesic (mild), antidepressant, anti-inflammatory, antiseptic, antispasmodic, aphrodisiac, carminative, cicatrisant, expectorant, galactagogue, sedative, tonic (uterine)	Depression, nervous exhaustion and stress related conditions, jasmine is said to produce the feeling of optimism, confidence, euphoria, and it is especially good in cases of apathy, indifference, or listlessness.

			Jasmine is also used for catarrh, coughs, laryngitis, dysmenorrhoea, labor pains, uterine disorders, skin problem such as dry, greasy, irritated, sensitive skin, and for muscular spasms and sprains.
Lavender	*Lavendula Vera Officinalis*	Analgesic, anticonclusive, antidepressant, antimicrobial, antirheumatic, antiseptic, antispasmodic, antitoxic, deodorant, sedative, diuretic, choleretic, hypotensive, stimulant, tonic, vulnery, cytophylatic, insecticide	Excellent first aid oil. It soothes cuts, bruises and insect bites. One of the most versatile therapeutic essences. For nervous system disorders such as depression, headache, hypertension, insomnia, migraine, sciatica, shock. Useful in treating skin conditions such as acne, allergies, athlete's foot, boils, dandruff, dermatitis, sunburn, eczema. Treatment of disorders such as rheumatism, throat infections, flu, bronchitis, and asthma.
Lemon	*Citrus Limonum*	Refreshing, antiseptic, stimulating, anti-anaemic, antirheumatic, antisclerotic, antitoxic, hypertensive, antiscorbutic, bactericidal, insecticidal, astringent, tonic,	Warts, depression, acne and indigestion, arthritis, cellulites, high blood pressure, nosebleeds, obesity, poor circulation, rheumatism, asthma, throat infections, bronchitis, cold, fever, flu. Treatment of anemia, brittle nails, corns, mouth ulcers, greasy skin, cuts, spots, and varicose veins.
Peppermint	*Menthe Piperita*	Digestive, cooling, refreshing, mentally stimulating, analgesic, anti-inflammatory, antimicrobial, antiseptic, antiviral, astringent, expectorant, stomachic, hepatic, cordial, antispasmodic.	Muscle fatigue, bad breath, toothache, bronchitis, indigestion, and travel sickness, neuralgia, muscular pains, asthma, sinusitis, spasmodic cough, cramp, dyspepsia, skin problem such as acne, dermatitis, ringworm, scabies, and nausea.

Ylang Ylang	*Cananga Odorata ver genuina*	Antidepressant, anti-infections, euphoric, relaxant, antiseptic, hypotensive, aphrodisiac, nervine, regulator, sedative (nervous), stimulant (circulatory), tonic	Depression, nervous tension, high blood pressure, hyperpnoea, (abnormally fast breathing), tachycardia, digestive upsets. For skin care such as hair growth, acne, hair rinse, oily skin, irritated and insect bites. For nervous system disorders such as frigidity, impotence, insomnia.

2.1.2 Hazardous essential oils

Not all essential oil are safe to use in aromatherapy. This is due to the high toxicity levels that the essential oils might have. Some of the oil can be hazardous as they can cause severe dermal irritation and even damage the mucous membranes and delicate stomach lining in undiluted form. Hence dermal application should be avoided as a general practice; it is advisable to use essential oils only for external remedies. Oils that fall under this category are bitter almond, calamus, camphor (brown & yellow), cassia, cinnamon (bark), fennel (bitter), pine (dwarf), rue, sage (common), thyme (red), wintergreen, garlic, onion, mustard and wormwood. (Guidelines for Essential oils use 2003).

2.1.2.1 Toxicity

Essential oil such as Ajowan, Basil (exotic), Camphor (white), Cassia, Cedarwood (Virginian), Cinnamon (leaf), clove (bud), coriander, Eucalyptus, fennel (sweet), hyssop, juniper, nutmeg, pepper (black), sage (Spanish), tagetes, thyme (white), turmeric, should be used only on dilution (at least 1:3) and for a maximum of two weeks due to toxicity levels.