



**QUALITY ASSESSMENT OF SELECTED HERBAL BATH HERBS
BASED ON DRYING METHODS AND STORAGE DURATION**

By

ROSE FAZILA BINTI MD ZUKI

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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Herbal cultivation in Malaysian has been practiced for multiple ways of use. The issue in the herbal industry mainly is inadequacy of raw materials due to the lack of herb cultivation areas, though small to medium scale herbs farm existed, the supply of herbs still insufficient. Besides that, most of herbal products on the market are also not scientific research based, thus the use of them does not safety guaranteed. Therefore, to face this issue, herbal cultivation, also research and development of herbs needs to be enhanced, in order to produce optimum local herbal raw material and to ensure the quality for local herbal production.

There were seven selected herbs for this study, namely *Etingera elatior* (Torch ginger), *Alpinia galanga* (Greater galangal), *Pandanus amaryllifolius* (Pandan), *Cymbopogon nardus* (Citronella grass), *Lawsonia inermis* (Henna), *Citrus hystrix* (Kaffir Lime) and *Piper betle* (Betel leaves). The evaluation of herbs growth made based on cultivation in the herbal garden concept at different locations, also its quality assessment as herbal bath. The herbal garden concept was replicate at three different areas; Institute of Bio-Science, UPM, Kg. Sg. Serdang, Klang and Kg. Ulu Chuchoh, Sepang in Selangor. After all herbs reached maturity stage, found that citronella grass, pandan, henna, betel and kaffir lime had no significant difference in growth performance but torch ginger had significant difference in plant height, leaves size and fresh weight planted in herbal garden concept at these three areas.

Herbal bath produced by combination of these herbs. The assessment of herbal bath quality based on the effect of drying, storing and period of storage, towards their production of essential oil. The herbs were dried under sun and in an oven (50°C), then stored in air-conditioner (AC) room, chiller and freezer for 360 days. As a result, the oven dried herbs had bright, attractive colour and possessed mild

aromatic fragrant compared to sun dried herbs, besides took longer time (day) to dry, it also had dull, pale colour and possessed slightly smoke leaves scent. Next, quality of oven dried herbs that stored in chiller (1-5°C), still maintains until 360 days but fresh herbs that stored in AC room (16-20°C), only maintain between 10-12 days before it started to deteriorate.

Through hydro-distillation method, essential oil of herbal bath was extracted. The highest amount of essential oils produced were 1% (v/w), extracted from sun dried herbs, kept in freezer and chiller for 150 days, also from oven dried herbs, kept in chiller and AC room for 210, 360 and 150 days respectively. The constant essential oil yields produced from extracted oven dried herbs, kept in the chiller for 0-150 days which was 0.625% (v/w). After that, kept the herbs for a longer time, gave varied results.

From this study, the cultivation of herbs at different types of area is possible to be practiced because factors that affected the herbs growth such as herbs morphology, soil fertility and environmental conditions. Herbs cultivating in herbal garden concept has a bigger potential to explore and can become an alternative way to overcome the issue of lack of herbs material raw and cultivation area. For herbal bath processing, oven drying and chiller storage are recommended to be used to keep the quality maintains up to 360 days.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Master Sains

**PENILAIAN KUALITI BEBERAPA HERBA TERPILIH UNTUK
HERBA MANDIAN BERDASARKAN
CARA PENGERINGAN DAN TEMPOH PENYIMPANAN**

Oleh

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Penanaman herba di Malaysia telah diamalkan bagi pelbagai tujuan penggunaan. Isu dalam industri herba terutamanya adalah kekurangan bahan mentah kerana kekurangan kawasan penanaman herba, walaupun ladang herba berskala kecil hingga sederhana wujud, bekalan herba masih tidak mencukupi. Selain itu, kebanyakan produk herba di pasaran juga bukan berasaskan kajian saintifik, maka penggunaannya tidak terjamin keselamatannya. Justeru, bagi menghadapi isu ini, penanaman herba, juga penyelidikan dan pembangunan herba perlu dipertingkatkan bagi menghasilkan bahan mentah herba tempatan yang optimum dan memastikan kualiti untuk pengeluaran herba tempatan.

Terdapat tujuh jenis herba yang dipilih untuk kajian ini iaitu *Etltingera elatior* (Kantan), *Alpinia galanga* (Lengkuas), *Pandanus amaryllifolius* (Pandan), *Cymbopogon nardus* (Serai Wangi), *Lawsonia inermis* (Inai), *Citrus hystrix* (Limau purut) dan *Piper betle* (Daun Sirih). Penilaian terhadap pertumbuhan herba dibuat berdasarkan penanaman herba dalam konsep taman herba di lokasi berbeza, juga penilaian kualitinya sebagai herba mandian. Konsep taman herba telah direplikasi di tiga kawasan berbeza; Institut Bio-Sains, UPM, Kg. Sg. Serdang, Klang dan Kg. Ulu Chuchoh, Sepang di Selangor. Setelah semua herba mencapai peringkat kematangan, didapati bahawa serai wangi, pandan, inai, sirih dan limau purut tidak mempunyai perbezaan yang ketara dalam prestasi pertumbuhan tetapi kantan mempunyai perbezaan yang ketara dari segi ketinggian pokok, saiz dan berat segar daun yang ditanam dalam konsep taman herba pada ketiga-tiga kawasan ini.

Herba mandian dihasilkan dengan gabungan tujuh jenis herba ini. Penilaian kualiti herba mandian ini dibuat berdasarkan kesan pengeringan, penyimpanan

dan tempoh penyimpanan, terhadap jumlah ekstrak minyak pati dan kandungan kimianya. Herba tersebut dikeringkan terus di bawah cahaya matahari dan di dalam ketuhar (50°C), kemudian disimpan di dalam bilik penghawa dingin (AC), peti sejuk dan peti beku selama 360 hari. Hasilnya, herba yang dikeringkan di dalam ketuhar mempunyai warna yang cerah, menarik dan menghasilkan aroma harum dan lembut berbanding herba yang dikeringkan di bawah sinar matahari, selain mengambil masa yang lebih lama (hari) untuk kering, ia juga mempunyai warna kusam, pucat dan menghasilkan aroma wangi dengan sedikit bau daun terbakar. Seterusnya, kualiti herba yang dikeringkan di dalam ketuhar dan disimpan dalam peti sejuk (1-5°C), masih kekal sehingga 360 hari tetapi herba segar yang disimpan di dalam bilik AC (16-20°C), kualitinya kekal di antara 10-12 hari. sebelum ia mula berkulat.

Melalui kaedah penyulingan air, minyak pati herba mandian telah diekstrak. Jumlah tertinggi minyak pati yang dihasilkan ialah 1% (v/w), diekstrak daripada herba yang dikeringkan di bawah matahari, disimpan di dalam peti sejuk dan peti beku selama 150 hari, juga daripada herba yang dikeringkan di dalam ketuhar, disimpan di dalam peti sejuk dan bilik AC selama 210, 360 dan 150 hari masing-masing. Hasil minyak pati yang tetap dihasilkan daripada ekstrak herba yang dikeringkan di dalam ketuhar, disimpan di dalam peti sejuk selama 0-150 hari iaitu 0.625% (v/w). Selepas daripada itu, menyimpan herba untuk masa yang lebih lama, memberikan hasil ekstrak minyak pati yang berbeza.

Hasil daripada kajian ini mendapati, penanaman herba pada pelbagai jenis kawasan mungkin boleh diamalkan kerana faktor yang mempengaruhi pertumbuhan herba adalah seperti morfologi herba, kesuburan tanah dan keadaan persekitaran. Penanaman herba berkonsepkan taman herba mempunyai potensi yang lebih besar untuk diterokai dan boleh menjadi kaedah alternatif untuk mengatasi masalah kekurangan bahan mentah dan kawasan penanaman herba. Untuk pemprosesan herba mandian, pengeringan ketuhar dan penyimpanan di dalam peti sejuk adalah disyorkan untuk mengekalkan kualiti sehingga 360 hari.

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LIST OF ABBREVIATIONS

AC	Air-conditioner
ANOVA	Analysis of variance
Cm	centimetre
cmolc kg-1	centimoles of positive charge per kilogram of soil
CRD	Complete Randomized Design
et al.	et alia
g	gram
GC-MS	Gas Chromatography Mass Spectrometer
kg	kilogram
L	litre
LSD	Least Significant Different
mg	milligram
mg P kg-1	milligram of potassium per kilogram of soil
ml	millilitre
mS m-1	millisiemens per meter
ph	-log (H ⁺)
RCBD	Randomized Complete Block Design
R&D	Research and Development
v/w	volume over weight

CHAPTER 1

INTRODUCTION

Herb plays an important role in human daily life. Multiple ways of used including in cooking, cosmetic, traditional medicines and many more, either in fresh form or processed, also in some commercial purposed, essential oil or water are used. Some herbs also used as insect repellent, also as biological agent for their ornamental plants (Ismail *et al.*, 2016).

According to WHO (2000), herbs also define as leaves, flowers, fruits, seeds, stems, wood, bark, rhizomes or other plant parts. It may refer to whole plant parts, certain parts of the plant only or in powder form that have value or use such as for cooking, health, landscaping, pest control agents, dyes and food flavourings. Besides that, herbs also referred to as medicinal plants, usually used as ingredients in early health care, which have been practiced for centuries (Siti, 2013).

Based on the survey conducted, it was found that 64% of Malaysians use various types of herbs and herbal products in daily life (Suzi *et al.*, 2020), and the largest consumers of herbs and their products are women primarily for medical and beauty purposes, even though they have less knowledge of neither safety nor efficacy on their health (Sooi and Keng, 2013). Moreover, there a lot of herbal products that can easily be found in the market nowadays. Herbs on the market are available in three forms, that are raw or dried ingredient, extract (essential oil or water) and complete product (Alzahrin, 2018).

Most herbs are found growing wild in the forest, however some species are commercially grown such as *Kaempferis galangal*, *Aloe vera* and *Morinda citrifolia* (Mohd, 2015), grown in mono-cropping or mixed-cropping conventional agriculture system (DOA, 2018). Mono-cropping refers to one type of herb grown in one area at a time (Putra *et al.*, 2020) while for mixed-cropping, there are two or more types of crops or crops and livestock integrated together in one area at a time (Anna and Agnieszka, 2021). Other than that, herbs also been grown around houses area (Ismail *et al.*, 2016) especially for species that prominent in the Malay community and commonly used in daily dishes (Mohd, 2015).

Method of cultivation depends on the needs and purposes of the grower whether for commercial or personal use. Under mixed-cropping system, various planting concepts can be applied and practiced such as homegarden, herbal garden, kitchen garden, edible garden and many more concepts depending on the purpose and theme of the crops cultivation (Vineeta *et al.*, 2019). Advantages of mixed cultivation are various yields can be obtained optimally in a given harvest time, efficient land used, biological pest control can occur naturally and can be landscaped with a little touch of creativity.

In Malaysia, herbal industry has been identified as potential economic activity that can contribute to economic growth (Mohamad, 2018) as the global herbal industry has recorded rapid growth in these recent years. Global herbal medicine market claims by World Health Organization (WHO) in 2016 was worth US\$71.19 billion and expected to reach US\$5 trillion by 2050, whereby, China and India are the main growers and exporters. The herbs are exported in form of fresh, dried, paste, and powder, also for their essential oils (Alzahrin, 2018).

Herbal industry faces issues and challenges such as insufficient supply of raw materials, lack of herbal cultivation areas (Mohd, 2015) and herbs' products on the market are not research based (Laupa, 2015). Malaysia is the 12th biodiversity richest country; however, it is estimated that, about 45% of raw herbs materials are imported (Mohd, 2015) and from that value, 66% are from China (Rohana *et al.*, 2017). Herbs cultivation area in Malaysia are decreasing from 4,000ha to 2,000ha within two years (2017-2019), which also affected the production from about 12,000 tonnes to 9,000 tonnes to the industry (DOA, 2020). In addition to the issue of herbal raw materials supply, the dumping of herbal-based products that do not go through the R&D process before being marketed should also be emphasized because it can cause harm to practitioners (Nur Hamizah, 2017).

Based on the high consumption of herbs among Malaysians compared to domestic production and as a guide to the nutritional value of herbal products which is herbal bath, herbs cultivation in the country needs to be intensified and expanded, also research and development (R&D) related to the quality of herbal-based products need to be enhanced. Thus, to produce optimum local herbal raw material in order to ensure and control the herbs quality for local herbal production. Therefore, this study was conducted;

1. to evaluate the growth differences of seven selected herbs cultivated in herbal garden concept at three different areas,
2. to evaluate the quality of herbal bath herbs (herbal-based product) due to the effects of different drying methods, different storage condition and period of storage.

Overall, of the study related to the herb's growth and herbal bath herbs quality after their processing were as in the flowchart below:

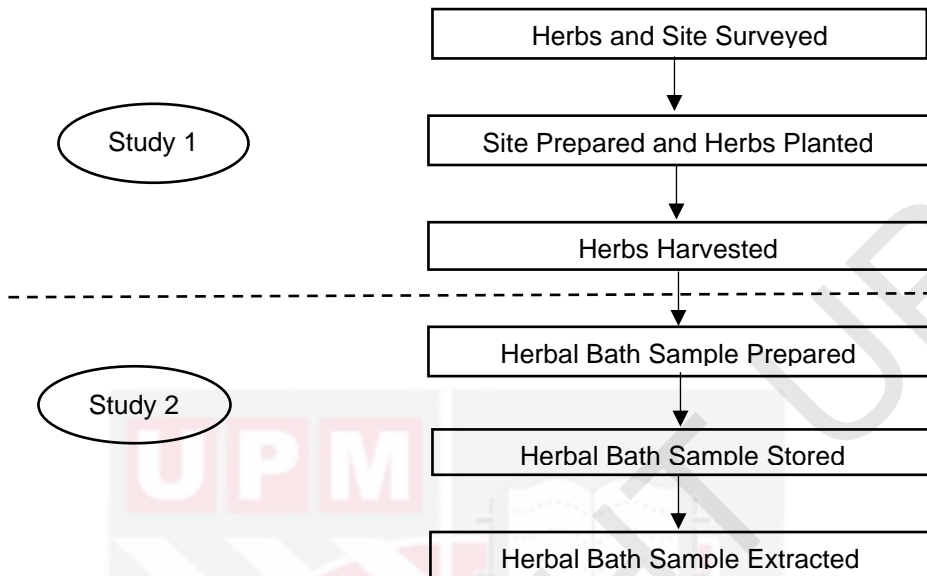


Figure 1.1: Research Framework Flowchart of the overall study in title: Quality Assessment of Selected Herbal Bath Herbs Based on Drying Methods and Storage Duration.

The study began by conducting a survey related to herbs commonly used in daily life and for this study, focus on the herbs used for herbal bath practises. From the observations conducted and personal interview of herbs researcher (Noor Ismawaty Nordin, Senior Research Officer, MARDI Serdang, Selangor, pers. comm. 20 November 2018), traditional herbs practitioners (Marhalim Markom, Kg. Ulu Chuchuh, Sepang, Selangor, pers. comm. 8 January 2019), and villagers as well as questionnaires and reviewed previous studies, then the type of herbs was selected and planted after the site ready.

There were seven types of herbs planted and used for this study, namely *Etlingera elatior* (torch ginger), *Alpinia galanga* (greater galangal), *Pandanus odorus* (pandan), *Cymbopogon nardus* (citronella grass), *Lawsonia inermis* (henna), *Citrus hystrix* (kaffir lime) and *Piper betel* (betel leaves), the herbs also used to produce herbal bath. Herbal bath is a practise of combining selected herbs in water to be bath with it for certain purpose.

The research was conducted in two parts. The first part was a field study on herbs grown in herbal garden concept. The herbs were planted in the plots and monitored until they reached maturity and suitable for harvesting. All herbs were measured their leaf part (length, width and fresh weight) and plant height to evaluate the growth development of herbs grown in different areas. In addition, the soil assessment was conducted to determine the soil fertility level before and after planting activities.

Part two was a laboratory study, the mature herbs leaves were harvested and dried (oven and sun drying) to produce herbal bath samples. The samples were stored in three different storage conditions (air conditioning, chiller and freezer) for 360 days. Every 0, 30, 90, 150, 210 and 360 days, samples were extracted through hydro-distillation method. The results of the extraction process were then, analysed using the GC-MS method for chemical content (for this study only 0-day samples were analysed).

The herbs were assessing their quality as herbal bath toward its appearance, essential oils appearance and yield, also the chemical compound changes due to the effect of drying processing, storage condition and period of storage.



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