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2 ND INTERNATIONAL SCIENCE, ENGINEERING AND TECHNOLOGY COLLOQUIUM



THE POWER OF SCIENTIFIC INNOVATION

INTELLIGENT SOLUTIONS FOR A SUSTAINABLE WORLD

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PREFACE

Welcome to the 2nd International Science, Engineering and Technology Colloquium 2025 (ISETC 2025)!

It is with great pleasure that we present this year's colloquium, a distinguished gathering of scholars, researchers, and professionals dedicated to the advancement of applied sciences. Held virtually on 9th July 2025, ISETC 2025 serves as a platform to highlight cutting-edge research, foster meaningful networking, encourage collaborations, and explore innovative solutions to global challenges.

This year's theme, "The Power of Scientific Innovation: Intelligent Solutions for a Sustainable World" highlights our shared goal to solve global challenges through applied science. It celebrates innovation as a key to building a more sustainable and resilient future. We're proud to feature keynote speakers and presenters who bring fresh insights, bold ideas, and breakthroughs shaping tomorrow's world.

We would like to extend our heartfelt appreciation to the Faculty of Applied Sciences, Universiti Teknologi MARA, Perak Branch, Tapah Campus, for their outstanding support and assistance throughout the planning and execution of the event. Their dedication has been instrumental to the success of this colloquium. We would like to sincerely thank all participants and researchers for their valuable contributions. We also appreciate the reviewers for their careful evaluations and helpful feedback. Your hard work and support mean a lot to us.

As editors, we are proud to present this collection of proceedings. It is an honour to bring together the interesting and meaningful work of our speakers and authors. We hope the ideas shared will lead to new discoveries, encourage more research, and help solve global challenges through science and innovation.

Warm regards,

Dr. Emi Norzehan Mohamad Mahbob
Dr. Saiyidah Nafisah Hashim
Ms. Lili Widarti Zainuddin
Ms. Nurul Nazwa Mohammad
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ISETC 2025 Proceedings Editors

GC-MS DETECTION OF POSSIBLE ADULTERANTS IN TRADITIONAL MALAY PAIN-RELIEF MEDICINE FROM RETAIL MARKETS

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Abstract: Traditional Malay remedies have gained loyal consumers due to their accessibility and lower cost compared to modern pharmaceutical medicine. Known as complementary medicine, this Malay herbal medicine is mainly used as pain-reliver and derived from various types of natural medicinal plants. However, the question concerning these remedies' authenticity and quality has arisen because of the rapid commercialization. This study expresses concern and fear regarding the contents of herbal remedies claimed to relieve pain. Therefore, this study was conducted to detect possible adulterants in traditional Malay herbal medicines used for pain treatment using GC-MS. Ten samples of Malay herbal medicines were collected to undergo extraction by centrifugation and filtration. Gas chromatography-mass spectroscopy was used for analysis where electron ionization in scan mode was applied for mass spectrometric detection and the compounds were identified using NIST spectrum library. The result showed that most of the natural compounds detected in the samples were eugenol, hexadecanoic acid, oleic acid and octadecanoic acid which aligned with the plant-based ingredients as claimed. Moreover, 7 out of 10 samples contained compounds with analgesic properties. Combining liquid chromatography-mass spectrometry (LC-MS) is recommended in further study to detect diverse type of compound such as polar, non-volatile and thermally unstable compound as GC-MS is only limited in detecting volatile and semi-volatile compounds.

***Keywords*:** *Herbal medicine, adulterants, pain-reliver, anti-inflammatory, GC-MS*

INTRODUCTION

Through authorization of herbal medicine by the government that permit herbal medicine to be sold in local shops, retail markets or e-commerce platforms within Malaysia, the production of herbal medicine has escalated thus enhancing their accessibility and availability (Ariffin et al., 2021). However, to lessen the production costs of herbal medicine, some irresponsible manufacturers adulterate herbal remedies to make large profits by replacing authentic herbal formulations with harmful or irrelevant substances whether intentionally or unintentionally (Gafner et al., 2020). According to Bairagee et al. (2025), the addition of unknown substances and adulterants in herbal remedies may contribute to adverse effect to the consumer such as kidney failure. This study aims to identify potential adulterants and assess the prevalence of adulteration in traditional Malay herbal pain relievers using GC-MS. The reliability of GC-MS as an effective tool for screening any unsafe chemicals used in herbal remedies has been proven (Vadivel et al., 2018).

MATERIALS AND METHODS

Ten traditional Malay herbal medicines with indication of pain relief were obtained either from physical shop or online platform. The methodology used in this study was adopted from (Lin et al., 2018). Approximately 5 g of each sample was weighed and dissolved in 20 ml of ethanol. The mixture was subsequently homogenized in an ultrasonic bath for 30 minutes while agitated for 5 minutes. The solution was then undergoing centrifugation at 2000 rpm for 5 minutes. After centrifugation, the resultant supernatant was passed through a 0.22-µm PTFE syringe. The extract was analysed using GC-MS with spitless injection, helium as the carrier gas and injection temperature of 250 ℃. A temperature program ramping to 300 ℃ where the total runtime of the analysis was 29 minutes. For mass spectrometer, electron ionization mode was used, and acquisition mode was a scan mode. The source temperature was set at 230 ℃ and quadrupole temperature at 150 ℃. Lastly, NIST Mass Spectral Library was utilized to compare the obtained compound spectra with the spectra of known compound.

RESULTS AND DISCUSSION

All the samples undergone detailed visual examination where the Kementerian Kesihatan Malaysia (KKM) sticker along with the country of origin of the herbal medicine were observed. All the data were recorded in Table 1. Based on Table 1, 4 out of 10 samples have KKM sticker presented on the sample's packaging.

Table 1. Sample information with KKM sticker, country of origin and compound detected with analgesic effect

Sample	KKM Sticker	Country of origin	Compound with analgesic effect
1	/	Malaysia	Present
2	-	Malaysia	Absent
3	-	Malaysia	Present
4	-	Malaysia	Present
5	-	Indonesia	Present
6	/	Malaysia	Absent
7	/	Malaysia	Present
8	/	Malaysia	Present
9	-	Malaysia	Present
10	-	Malaysia	Absent

Hexadecanoic acid, oleic acid, eugenol, limonene, humulene, caryophyllene, octadecanoic acid and aR-turmerone were some of the natural-derived compounds found in the samples. In addition, sample 1, 3, 4, 5, 7, 8 and 9 showed some compound that possess analgesic effect to reduce pain and inflammation. The analgesic properties compound identified were eugenol, 4H-pyran-4-one, α-humulene, p-cymene, eucalyptol, linalool and pentadecanoic acid. This showed that 70% of the samples have the therapeutic effects as claimed. However, in sample 4, the ingredients listed mainly from an animal-based compound but, the result only revealed the compound with a natural origin. This highlights the misinformation and material inconsistency advertised by the product. Next, synthetic compounds were also presented in sample 1, 9 and 10 which were benzaldehyde, 1,2-benzisothiazol-3(H)-one, methylparaben and propylparaben. The detected synthetic compounds were not classified as synthetic drugs but instead, these compounds have been used as preservative agent in production of herbal medicine. Lastly, based on Table 1, analgesic agents were absent in three samples which were sample 2, 6 and 10.

CONCLUSIONS

In conclusion, natural and synthetic compound can be effectively identified using GC-MS in traditional Malay herbal pain-relief medicine. The inauthenticity and irrelevant ingredients in the samples also can be disclosed by this study. However, any adulteration of synthetic drug such as corticosteroid cannot be detected in all the samples. This is due to the limitation of GC-MS that unable to detect polar and non-volatile compound such as dexamethasone. Therefore, LC-MS is recommended to use in this analysis along with GC-MS as it is known to identify broad range of compound such as polar, non-volatile and thermally unstable compounds.

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