Research Article

Effect of High Polar to Low Polar Solvent System on Thin Layer Chromatography Profiling of *Ficus carica* Linn. Leaves Extract

Tajul Afif Abdullah*, M. Fahmi Abu Bakar[1], Afnani Alwi[1], M. Hailmi Sajili[1], Siti Aishah Abu Bakar[1] and Nor Azi Asminda Johari[1]

[1]*School of Agriculture Science and Biotechnology, Faculty of Bioresources and Food Industry, Universiti Sultan Zainal Abidin, Besut Campus, Besut 22200, Malaysia.*

Abstract | *Ficus carica* Linn. is a well known to posses a number of bioactive substances that have health advantages. Fig plants contains large amounts of phenolic chemicals such as flavonoids, phenolic acids, which have antioxidant, anti-inflammatory, and antibacterial properties. The leaves of *Ficus carica* Linn. were obtained from Taman Herba at the University of Sultan Zainal Abidin, Kampus Besut, Terengganu and grounded into powder form and were then dissolve in polar to non -polar solvents ranging from hexane, chloroform, methanol, ethanol, ethyl acetate and water. All of the sequential extracts were carried out to perform Thin Layer Chromatography (TLC) using solvent systems of varying polarity consist of hexane : acetic acid and hexane : ethyl acetate : acetic acid at various ratio. The TLC profiling of the *F. carica* Linn. extract showed compounds detected under high polar solvent system to low polar solvent system with different RF values.

Received | April 13, 2025; **Accepted** | July 3, 2025; **Published** | November 27, 2026
***Correspondence** | Tajul Afif Abdullah, School of Agriculture Science and Biotechnology, Faculty of Bioresources and Food Industry, Universiti Sultan Zainal Abidin, Besut Campus, Besut 22200, Malaysia; **Email:** tajulafif@unisza.edu.my
Citation | Abdullah, T.F., M.F.A. Bakar, A. Alwi, M.H. Sajili, S.A.A. Bakar and N.A.A. Johari. 2027. Effect of high polar to low polar solvent system on thin layer chromatography profiling of *ficus carica* linn. leaves extract. *Sarhad Journal of Agriculture,* 43(2): 279-287.
DOI | https://dx.doi.org/10.17582/journal.sja/2027/43.2.279.287
Keywords | *Ficus carica Linn,* Fig leaves, Hexane, Ethyl acetate, Rf value.

Copyright: 2027 by the authors. Licensee ResearchersLinks Ltd, England, UK.
This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

Introduction

Ficus carica (fig) is a species of the genus *Ficus* in the Moraceae family, distinguished by milky latex in all parenchymatous tissue, unisexual blooms, anatropous ovules, and clustered drupes or achenes. The fleshy and sweet section of the fig corresponds to the flower receptacles, which grow large and fleshy following fertilisation. The fig has been used in the Middle East and Mediterranean region's cuisine since ancient times and is considered a sign of health. It is believed that fig farming began in the East Mediterranean region and spread to the West Adriatic region (Barolo *et al*., 2014). Due to its many usage, the *Ficus carica*, also known as the fig tree, has woven itself into the fabric of traditional practises across diverse cultures. Figs have been a dietary staple due to their historical significance as a source of essential vitamins, minerals, and dietary fibre. However, the contributions of the fig tree goes beyond mere sustenance. Its leaves, latex, and other constituents have been utilised for a variety of traditional applications. From assisting digestion to alleviating inflammatory conditions, the fig tree has long been utilised as a remedy. Its leaves, which are believed to possess anti-inflammatory properties,

have been used to treat conditions such as arthritis. The fig's utility is not limited to internal health; its use in cosmetics and as an antiseptic demonstrates its versatility. As fig trees have a historical association with respiratory health due to the use of their leaves to treat respiratory distress, their traditional significance is truly holistic. However, it is essential to approach these traditional uses with a balanced perspective, taking their historical and modern contexts into account. Before incorporating *Ficus carica* into health practises, it is always prudent to consult with healthcare professionals to ensure safe and well-informed procedures (Mawa *et al*., 2013).

The presence of bioactive compounds, such as phenolic compounds and flavonoids, in *Ficus carica* leaves contributes to their prospective health benefits. Secondary metabolites found in plants that have been studied for their antioxidant, anti-inflammatory, and potential therapeutic properties are phenolic compounds and flavonoids (Amirah Nadiah *et al*., 2023). Phenolic compounds are an organic compound class containing phenol rings. It is known that *Ficus carica* leaves contain phenolic compounds such as chlorogenic acid, gallic acid, and caffeic acid. In fig leaves, chlorogenic acid is one of the most prevalent phenolic compounds. Phenolic compounds have potent antioxidant properties, neutralising detrimental free radicals in the body and possibly lowering the risk of oxidative stress-related diseases (Nadeem and Zeb, 2018). Flavonoids, a class of polyphenolic chemicals, are present in a diverse range of plant- based food sources. The leaves of *Ficus carica* possess flavonoids such as quercetin, rutin, and kaempferol. Quercetin has garnered recognition for its anti-inflammatory, antioxidant, and prospective antiviral properties. Flavonoids have demonstrated considerable potential in numerous study investigations due to their capacity to promote general well-being and potentially play a role in the mitigation of chronic ailments. Thin layer chromatography (TLC) is a chromatography technique to separate mixtures compounds in an extract based to the compound polarity. In TLC a sample applied on the plate where a solvent mixture or mobile phase is drawn up the plate via capillary action. Different polarity compounds in an extracts would react differently with the adsorbent plate producing different Rf.

This study aims to classify *F. carica* L. leaves biomolecules extract based on its solvents polarity ranging from solvents chosen based on the polarity of the solute of interest. Multiple solvents were used ranging from least polar to most polar, as follows: Hexane < Chloroform < Ethylacetate < Acetone < Methanol < Water. This information would assist in extraction of targeted class of bioactive compounds in the *F. carica* Linn. leaves extract.

Materials and Methods

Plant material

The leaves of the fig plant were collected in Universiti Sultan Zainal Abidin (UniSZA) Kampus Tembila, located at Besut Terengganu. Two weeks old of fresh and healthy leaves of the 3 years old *Ficus carica* L. plant were pick and cleaned under running tap water to remove dirt and further dried at room temperature. The dried leaves were ground into a powder form using a grinding mill and weighed in analytical scale.

Sample preparation

The extract were prepared by maceration method using 30 g of dried leaves powder soaked in 300 ml of solvent and placed on shaker at 120 rpm for three consecutive days before filtered through Whiteman filter paper. The solvent used were methanol, chloroform, ethanol, ethyl acetate, hexane and water. The extracts were then evaporated in a rotary evaporator to obtained the sticky paste known as crude extract. The sticky extracts obtained were then transferred into falcon tube while the extraction using water was dried using a freeze dryer. All the crude extracts were kept in chiller at 4°C temperature. The extracts were prepared with respectively solvent of extracts (1mg/mL) for Thin Layer Chromatography (TLC) works.



Figure 1: *Samples prior to elution and spotted onto TLC plate*

Thin layer chromatography

The samples were then spotted onto the TLC plate. The sample solutions were placed at the bottom of the plate using a capillary tube. A narrow strip of the sample solution was drawn over the plate to enhance a clear separation during subsequent chromatographic development. Once the sample has been spotted, the TLC plates were then allowed to dry to stop the dilution spot from spreading throughout the TLC plate (Figure 1).

TLC chamber was prepared by using five (5) beakers and saturating it with 10 mL of solvent phase which were prepared with different solvent system:
Hexane: Acetic acid (9:1)

- Hexane: Ethyl acetate: Acetic acid (5:4:1)
- Hexane: Ethyl acetate: Acetic acid (4:4:2)
- Hexane: Ethyl acetate: Acetic acid (3:6:1)
- Hexane: Ethyl acetate: Acetic acid (2:7:1)

(Gujjeti *et al*., 2013).

The TLC plate was left in the chamber for the solvent to migrate up the plate and the development time, the distance travelled by the solvent, and the required separation resolution (Figure 2). The TLC plate was carefully removed from the chamber after development and allowed to dry. The iodine vapours were used for detecting the bands on the TLC plates (Figure 3). Subsequently, the TLC plate was visualized and observed under a Spectroline UV Viewing Cabinet to be examined and identified the separated compounds. The Rf values were determined to identify the components present in the samples thus providing useful information for further research and identification of the mixture's contents.



Figure 2: *Separation of samples in a closed chamber*



Figure 3: *Iodine chamber to apply iodine vapours on TLC plate.*

Statistical analysis

In this study, data on R_F using different type of solvent system with a different ratio of polar solvent were taken as mean in line with standard statistical procedure.

Results

TLC were performed on all sequential extracts of *F. carica* Linn. obtained by sequential extraction method in order to confirm the extract's nature by analysing its TLC chromatograms and to isolate the extract's active ingredient. The retention factors (Rf) of *F. carica* extracts in different solvent system are shown below (Table 1 to Table 6):

Table 1: *TLC profile of F.carica hexane extract in 5 solvent system.*

Extract	Solvent system	No of spot	Rf value
Hexane	Hexane: acetic acid (9:1) – *Beaker 1*	01	0.05
	Hexane: Ethyl acetate: Acetic acid (5:4:1) – *Beaker 2*	02	0.73,0.83
	Hexane: Ethyl acetate: Acetic acid (4:4:2) – *Beaker 3*	02	0.85,0.93
	Hexane: Ethyl acetate: Acetic acid (3:6:1) – *Beaker 4*	01	0.85
	Hexane: Ethyl acetate: Acetic acid (2:7:1) – *Beaker 5*	02	0.87,0.97

By comparing the result to those of prior research, Gujjeti *et al*., (2013) using the same solvent system and same solvent extraction but different plant extract which is *F. carica* and *Madhuca Indica*. The result show that it provided a different spot which indicates a different compound and priorities. The TLC profiling of all five extracts produces an

impressive result indicating the presence of a large number of phytochemicals. Diverse phytochemicals have distinct Rf values in various solvent systems. The variation in Rf values of phytochemicals is a crucial indicator of their polarity and aids in the selection of an appropriate solvent system for column chromatographic separation of purified compounds. For the separation of purified compound from plant extract, varying ratios of solvents with variablepolarity can be utilised. Only by analysing the Rf values of compounds in different solvent systems can the most appropriate solvent system for a particular plant extract be determined. Different Rf values of the compound are also indicative of their polarity (Gujjeti *et al.*, 2013).

Table 2: *TLC profile of F.carica methanol extract in 5 solvent system.*

Extract	Solvent system	No of spot	Rf value
Methanol	Hexane: acetic acid (9:1) – *Beaker 1*	01	0.07
	Hexane: Ethyl acetate: Acetic acid (5:4:1) – *Beaker 2*	01	0.7
	Hexane: Ethyl acetate: Acetic acid (4:4:2) – *Beaker 3*	01	0.88
	Hexane: Ethyl acetate: Acetic acid (3:6:1) – *Beaker 4*	02	0.88, 0.95
	Hexane: Ethyl acetate: Acetic acid (2:7:1) – *Beaker 5*	02	0.87, 0.87

Table 3: *TLC profile of F.carica ethanol extract in 5 solvent system.*

Extract	Solvent system	No of spot	Rf value
Ethanol	Hexane: acetic acid (9:1) – *Beaker 1*	01	0.07
	Hexane: Ethyl acetate: Acetic acid (5:4:1) – *Beaker 2*	01	0.68
	Hexane: Ethyl acetate: Acetic acid (4:4:2) – *Beaker 3*	01	0.85
	Hexane: Ethyl acetate: Acetic acid (3:6:1) – *Beaker 4*	01	0.85
	Hexane: Ethyl acetate: Acetic acid (2:7:1) – *Beaker 5*	01	0.90

The Rf value in TLC is affected by various compound characteristics and experimental factors, resulting in a varied migration behaviours on the TLC plate. The polarity of the compounds is a significant factor which affect its Rf values. Polar compounds have stronger interactions with the polar stationary phase (e.g., silica gel), resulting in a slower migration and lower Rf values, whereas non-polar compounds prefer the non-polar mobile phase (solvent) and migrate quicker, resulting in higher Rf values (Kumar *et al.*, 2013). Polar compounds posses partial positive and negative charges because of large changes in electronegativity between atoms in their chemical structure. Through dipole-dipole interactions and hydrogen bonding, these polar chemicals tend to interact more strongly with the polar stationary phase in TLC. In which they attach to the stationary phase more, resulting in slower migration along the TLC plate. As a result, polar molecules has lower Rf values in general. On the other hand, non-polar compounds have a more uniform distribution of electron density inside their molecules, resulting in the absence of large partial charges. Non-polar molecules in TLC have a lesser affinity for the polar stationary phase and prefer to interact with the non-polar mobile phase (solvent). As a result, non-polar molecules move more readily with the mobile phase, resulting in quicker migration along the TLC plate. As a result, non-polar molecules often have higher Rf values. Rf values are also affected by the polarity of the mobile phase (solvent or solvent system). The more polar the mobile phase, the more efficiently it fights for interactions with polar molecules, resulting in slower movement and lower Rf values. Non-polar chemicals move more readily when the mobile phase is less polar, resulting in larger Rf values. The presence of various functional groups inside a molecule can contribute polarity and impact the Rf value. For example, polar functional groups such as hydroxyl (-OH), carboxyl (-COOH), and amino ($-NH_2$) can form hydrogen bonds, enhancing the overall polarity of the chemical. As a result of the higher interactions with the stationary phase, molecules having these functional groups tend to have lower Rf values (de Oliveira et al., 2021).

Table 4: *TLC profile of F. carica ethyl acetate extract in 5 solvent system.*

Extract	Solvent system	No of spot	Rf value
Ethyl acetate	Hexane: acetic acid (9:1) – *Beaker 1*	01	0.08
	Hexane: Ethyl acetate: Acetic acid (5:4:1) – *Beaker 2*	01	0.7
	Hexane: Ethyl acetate: Acetic acid (4:4:2) – *Beaker 3*	02	0.85, 0.93
	Hexane: Ethyl acetate: Acetic acid (3:6:1) – *Beaker 4*	02	0.85. 0.98
	Hexane: Ethyl acetate: Acetic acid (2:7:1) – *Beaker 5*	02	0.93, 1.0

Links Researchers

Table 5: *TLC profile of F.carica chloroform extract in 5 solvent system.*

Extract	Solvent system	No of spot	Rf value
Chloroform	Hexane: acetic acid (9:1) – *Beaker 1*	01	0.05
	Hexane: Ethyl acetate: Acetic acid (5:4:1) – *Beaker 2*	02	0.73. 0.98
	Hexane: Ethyl acetate: Acetic acid (4:4:2) – *Beaker 3*	02	0.85, 0.95
	Hexane: Ethyl acetate: Acetic acid (3:6:1) – *Beaker 4*	02	0.83, 0.98
	Hexane: Ethyl acetate: Acetic acid (2:7:1) – *Beaker 5*	01	0.9

Table 6: *TLC profile of F.carica extraction*

Extract	Solvent system	No of spot	Rf value
Water	Hexane: acetic acid (9:1) – *Beaker 1*	0	-
	Hexane: Ethyl acetate: Acetic acid (5:4:1) – *Beaker 2*	01	0.1
	Hexane: Ethyl acetate: Acetic acid (4:4:2) – *Beaker 3*	01	0.25
	Hexane: Ethyl acetate: Acetic acid (3:6:1) – *Beaker 4*	01	0.08
	Hexane: Ethyl acetate: Acetic acid (2:7:1) – *Beaker 5*	01	0.13

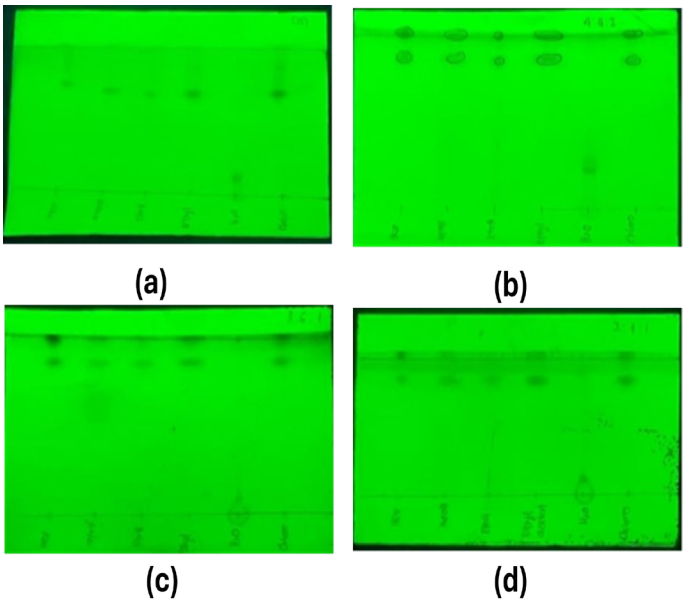

Figure 4: *A: TLC profile of F. carica extractions in (i) solvent system B: TLC profile of F. carica extractions in (iii) solvent systemC: TLC profile of F. carica extractions in (iv) solvent system andD: TLC profile of F. carica extractions in (v) solvent system*

Next, the Rf values of flavonoids can be affected by the flavonoid's specific class and structural properties. Flavonoids are diverse polyphenolic compounds found in plants, with subclasses like flavones, flavonols, flavanones, flavan-3-ols (catechins), and anthocyanins. Each subclass has unique structural features impacting interactions with the stationary and mobile phases during TLC. Flavones and flavonols, with hydroxyl groups on the benzene rings, have increased polarity and lower Rf values due to stronger interactions with the polar stationary phase. Flavanones, lacking a double bond between C2 and C3, are less polar, leading to higher Rf values. Flavan-3-ols, like catechins, have a catechol moiety with hydroxyl groups, resulting in lower Rf values due to increased polarity. Anthocyanins, responsible for vibrant colors in fruits and flowers, exhibit high polarity and relatively lower Rf values. TLC is valuable for identifying flavonoids, considering factors like solvent system, sample concentration, and impurities. It aids researchers in characterizing these biologically active compounds in plant extracts and natural products (Panche *et al.*, 2016). The Rf values of compounds can be significantly influenced by the extraction process using different solvents. Extraction is a crucial step in obtaining compounds from a sample for analysis, and the choice of solvent plays a vital role in the efficiency and selectivity of the extraction process. Different compounds have varying affinities for different solvents based on their chemical properties, polarity, and interactions with the solvent molecules (Alara *et al.*, 2021).

Lastly, according to Tzanova *et al.*, 2020 the factors that can be affects Rf value is extraction using different solvents. Extraction is a crucial step in obtaining compounds from a sample for analysis, and the choice of solvent plays a vital role in the efficiency and selectivity of the extraction process. Different compounds have varying affinities for different solvents based on their chemical properties, polarity, and interactions with the solvent molecules. To obtain a representative sample for examination, chemicals from a sample are dissolved in a suitable solvent. Because of their chemical characteristics and polarity, various compounds have varied solubilities and affinities for different solvents. When a sample is extracted with a certain solvent, specific chemicals are selectively dissolved based on their compatibility with the polarity of the solvent. Polar solvents such as ethanol or methanol, for example, will successfully

extract polar chemicals from the sample, whereas non-polar solvents such as hexane or diethyl ether would preferentially extract non-polar compounds (Altemimi *et al*., 2017). After extraction, the sample is spotted on a TLC plate and chromatographic separation occurs. The TLC plate is then developed with a mobile phase (solvent) that flows up the plate via capillary action, bringing the spotted compounds with it. The chemicals in the sample will partition between the stationary phase (e.g., silica gel) and the mobile phase depending on their affinities for the two phases throughout this process.

According to (Speltini *et al*., 2013) compounds with a higher affinity for the stationary phase will interact more strongly and migrate at a slower rate, resulting in lower Rf values. Compounds with a higher affinity for the mobile phase, on the other hand, will move quicker, resulting in higher Rf values. As expected, from the researcher (Elham *et al*., 2021) the extraction solvent used might directly change the composition of the sample placed to the TLC plate, and hence the Rf values of the compounds during TLC analysis. To achieve accurate and trustworthy TLC findings, evaluate the solvent's characteristics and compatibility with the compounds of interest, since the Rf value is a significant parameter utilised for compound identification and separation in chromatographic procedures. The analysis of Rf values of phytochemicals is a crucial aspect in comprehending their polarity and aids in the identification of suitable solvent systems for the isolation of pure substances by column chromatography (Manik *et al*., 2017). Hexane was used to create a non-polar solvent extract. Non-polar solvent hexane is effective at removing non-polar chemicals from samples. The TLC separation will prefer polar molecules when used with acetic acid as the mobile phase, which is polar due to the presence of the acidic functional group. Lower Rf values and slower migration on the TLC plate are caused by polar molecules in the solvent extract interacting more with the acetic acid component of the mobile phase (Yaseen *et al*., 2021). When ethyl acetate and acetic acid are combined as the mobile phase for TLC separation, the separation becomes more balanced. Due to their affinity for hexane, nonpolar compounds will migrate quicker, while polar compounds will interact with the ethyl acetate and acetic acid components, resulting in intermediate Rf values (Olives *et al*., 2017). The non-polar solvent extract derived from hexane will primarily interact with the hexane constituent of the mobile phase. Nevertheless, the increased ratios of ethyl acetate and acetic acid result in a minor enhancement in the polarity of the mobile phase. The proposed combination of techniques aims to effectively separate compounds by leveraging their varying degrees of polarity, particularly in the moderate to high range. It is expected that compounds exhibiting stronger interactions with the polar components of the mobile phase will result in lower Rf values.

Hexane solvent extract showed a minimal interaction with the polar components of the mobile phase. However, the mobile phase is comparatively polar due to the significant presence of ethyl acetate and acetic acid. Therefore, compounds with moderate to high polarity will interact with the mobile phase more, resulting in reduced Rf values (Mohan *et al*., 2019; Barwick, 1997). Despite the non-polar nature of the hexane solvent extract, the highly polar mobile phase will result in significant interactions with the polar compounds present in the sample. The compounds' Rf values will be reduced, and their migration on the TLC plate will be slower (Duistermaat and Kolk, 2000).

As a non-polar solvent, chloroform is adept at removing non-polar substances from a sample. The solvent extract derived from chloroform will consist primarily of less polar compounds (Kuyukina *et al*., 2001). The mobile phase consists predominantly of hexane, a non-polar solvent, with a little polar component represented by acetic acid. Compounds lacking polarity that are extracted using chloroform will have a greater propensity to interact with hexane, leading to enhanced migration rates and elevated Rf values. The potential for interaction with polar compounds may arise due to the polar component of the mobile phase, however the dominant influence is expected to be exerted by hexane (Lu *et al*., 2015). Also the mobile phase consists of a combination of non-polar solvent hexane, and polar solvents ethyl acetate and acetic acid. The non-polar molecules present in the chloroform extract will exhibit a preference for interaction with hexane, resulting in accelerated migration and elevated Rf values. The potential for interaction with the polar components is contingent upon the polarity of the molecule (Lu *et al*., 2015).

While with proportions of ethyl acetate and acetic acid that are balanced, the polarity of this mobile

phase marginally increases. Non-polar compounds will continue to migrate quicker due to their affinity for hexane; however, the polar components may influence migration, resulting in slightly lower Rf values compared to the 5:4:1 mobile phase (LeDoux, 2011). Methanol is a polar solvent capable of dissolving a wide variety of polar and moderately polar compounds. The methanol solvent extract is likely to contain compounds with moderate to high polarity. In the mobile phase of hexane and acetic acid, non-polar hexane is combined with polar acetic acid. The extracted polar compounds exhibited stronger interactions with the acetic acid resulting in delayed migration and a lower Rf values. Due to their affinity for hexane, nonpolar compounds could migrate more rapidly. Hexane ethyl acetate, acetic acid mobile phase comprises a mixture of polar (ethyl acetate and acetic acid) and non- polar (hexane) solvents. Polar compounds in the methanol extract are apt to interact with the ethyl acetate and acetic acid components, resulting in migration and Rf values that are intermediate (Yara-Varón *et al*., 2016).

Ethanol is a moderately polar solvent that can dissolve both polar and non-polar compounds. The ethanol solvent extract would retain compounds with different degrees of polarity. In this hexane and acetic acid mobile phase, non-polar hexane is coupled with polar acetic acid. Compounds extracted from ethanol with moderate to high polarity will interact more with acetic acid, resulting in slowed migration and decreased Rf values. Due to their affinity for hexane, nonpolar compounds could migrate faster. In this mobile phase of hexane, ethyl acetate, and acetic acid contains non-polar (hexane) and polar (ethyl acetate and acetic acid) solvents. Polar compounds in the ethanol extract interacted with ethyl acetate and acetic acid constituents which leads to intermediate migration and Rf values on the TLC plate (Kenny *et al*., 2013). Ethyl acetate is a moderately polar solvent that can, to varying degrees, dissolve both polar and non-polar compounds. The ethyl acetate-obtained solvent extract will likely contain compounds with varying polarities (Mohd Zin *et al*., 2021). In this mobile phase of hexane and acetic acid, nonpolar hexane is combined with polar acetic acid. Compounds with moderate to high polarity in the ethyl acetate extract has a higher interaction with acetic acid which resulted in delayed migration and a lower Rf values on the TLC plate (Aral *et al*., 2017). Due to their affinity for hexane, nonpolar compounds could migrate faster. This mobile phase of hexane, ethyl acetate, and acetic acid combines polar (ethyl acetate and acetic acid) and non-polar (hexane) solvents. Interactions between the ethyl acetate and acetic acid constituents and polar molecules from the ethyl acetate extract will result in intermediate migration and Rf values (Santana *et al*., 2009).

Conclusions and Recommendations

The results obtained in the present investigation indicated that *Ficus carica* Linn leaves extracts as a rich source of active compounds and secondary metabolites. These findings suggested that *Ficus carica* Linn. leaves extracts contains active compounds which dissolved in both polar and non polar solvents which indicates of the polarity of the compound. This study would be a platform for further purification and characterization of the active compounds.

Acknowledgements

This research was supported by Universiti Sultan Zainal Abidin (UniSZA) through a DPU 1.0 Grant (UniSZA/2021/ DPU1.0/04) (R0308). The manuscript has not been published or submitted to other journals previously and all authors have contributed significantly and agrees with the content of the manuscript.

Novelty Statement

This paper discusses effect of different polarity extraction solvent and solvent system of F. carica Linn leaves extract on its Rf value.

Authors Contribution

Tajul Afif Abdullah: Carried out the experiment and data collection.
M. Fahmi Abu Bakar and M. Hailmi Sajili: Proof read the article.
Afnani Alwi: Checked and approved the methods for the experiment.
Siti Aisyah Abu Bakar and Nor Azi Asminda Johari: Corrected the manuscript for grammar and language.

Generative AI or AI assisted technology statement
The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have no conflict of interest.

References

Alara, O.R., N.H. Abdurahman and C. . Ukaegbu.2021. Extraction of phenolic compounds: A review. Cur. Res. in Food Sci., 4: 200–214. https://doi.org/10.1016/j.crfs.2021.03.011

Ali,B.,M.Mujeeb,V.Aeri,S.R.Mir,M.Faiyazuddin and F. Shakeel. 2012. Anti-inflammatory and antioxidant activity of *Ficus carica* Linn. leaves. Nat. Prod. Res. 2011. https://doi.org/10.1080/14786419.2010.488236

Altemimi, A., N. Lakhssassi, A. Baharlouei, D.G. Watson.and D.A. Lightfoot. 2017. Phytochemicals: Extraction, isolation, and identification of bioactive compounds from plant extracts. Plants *(Basel)*.6(4):*42*. https://doi.org/10.3390/plants6040042

Amirah, N.A., F.H.I. Ahmad, A.R. Muhammad, S. Syahmi, S. Maheshwari, V. Kumar, G. Bhadauria, A. Mishra, I.F. Rasool, A. Aziz, W. Khalid, H. Koraqi, S.A. Siddiqui, A.L. Farga, W.F. Lai, A. Ali, A. El Ghouizi, D. Ousaaid, H. Laaroussi and R.T. Mahajan. 2023. Industrial Application and Health Prospective of Fig (*Ficus carica*) By-Products. Int. J. All. Health Sci., 52 (December): 1487–1503.

Aral, H., K.S. Çelik, R. Altındağ and T. Aral. 2017. Synthesis, characterization, and application of a novel multifunctional stationary phase for hydrophilic interaction/reversed phase mixed-mode chromatography. Talanta., 174: 703–714 https://doi.org/10.1016/j.talanta.2017.07.014.

Barolo, M.I., M.N. Ruiz and S.N. López. 2014. *Ficus carica* L. (*Moraceae*): An ancient source of food and health. Food Chem., 164(April): 119–127. https://doi.org/10.1016/j.foodchem.2014.04.112

Barwick, V.J. 1997. Strategies for solvent selection - A literature review. TrAC - Trends in Analytical Chem., 16(6): 293–309. https://doi.org/10.1016/S0165-9936(97)00039-3

De Oliveira, J.M., M.C. Dias, D.C.G.A. Pinto and A.M.S. Silva. 2021. *Thin Layer Chromatography* In: Plant flavonoids: Chemical characteristics and biological activity. Molecules, 26(17): 1–16. https://doi.org/10.3390/molecules26175377

Duistermaat, J.J. and J.A.C. Kolk. 2000. Proper Actions p. 93-130. In Compact Lie Groups. https://doi.org/10.1007/978-3-642-56936-4_2

Elham, A., M. Arken, G. Kalimanjan. A. Arkin and M.Iminjan.2021.A review of the phytochemical, pharmacological, pharmacokinetic, and toxicological evaluation of Quercus Infectoria galls. J. Ethn.m., 273: 113592. https://doi.org/10.1016/j.jep.2020.113592

Gujjeti, R.P., M. Estari and E. Mamidala. 2013. Phytochemical Analysis and TLC Profile of *Madhuca indica* Inner Bark Plant Extract Isolation and Characterisation of bioactive molecules from Natural Sources View project Bioinformatics View project Phytochemical Analysis and TLC Profile of *Madhuca indica*. Int. J. Sci. Eng. Res., 4(10).

Kenny, O., T.J. Smyth, C.M. Hewage and N.P. Brunton. 2013. Antioxidant properties and quantitative UPLC-MS analysis of phenolic compounds from extracts of fenugreek (*Trigonella foenum-graecum*) seeds and bitter melon (*Momordica charantia*) fruit. Food Chem., 141(4): 4295–4302. https://doi.org/10.1016/j.foodchem.2013.07.016

Kumar, S., K. Jyotirmayee.and M. Sarangi. 2013. Thin layer chromatography: A tool of biotechnology for isolation of bioactive compounds from medicinal plants. Int. J. Pharma. Sci. Rev. Res., 18(1):126–132.

Kuyukina, M.S., I.B. Ivshina, J.C. Philp, N. Christofi, S.A. Dunbar and M.I. Ritchkova. 2001. Recovery of *Rhodococcus* biosurfactants using methyl tertiary-butyl ether extraction. J. Microb. Method., 46(2): 149–156. https://doi.org/10.1016/S0167-7012(01)00259-7

LeDoux, M. 2011. Analytical methods applied to the determination of pesticide residues in foods of animal origin. A review of the past two decades. J. Chroma. A., 1218(8): 1021–1036. https://doi.org/10.1016/j.chroma.2010.12.097

Lu, W., Z. Wang and Z. Yuan. 2015. Characteristics of lipid extraction from *Chlorella sp.* cultivated in outdoor raceway ponds with mixture of ethyl acetate and ethanol for biodiesel production. Bioresour. Tech., 191: 433–437. https://doi.org/10.1016/j.biortech.2015.02.069

Manik, S., R. Abid and S. Mehak. 2017. Phytochemical screening and thin layer chromatography of *Ficus carica* leaves extract. Pharma. Biosci. J., February: 18–23. https://

doi.org/10.20510/ukjpb/5/i1/147022

Mawa, S., K. Husain and I. Jantan. 2013. *Ficus carica* L. (Moraceae): Phytochemistry, Traditional Uses and Biological Activities. Eviden. Based Complem. Alternat Med., 2013: 974256 https://doi.org/10.1155/2013/974256

Mohan, R., M. Vidhyalakshmi and V. Sivakumar. 2019. Microwave Assisted Rapid Extraction and Characterization of Coumarin from Fig Plant (*Ficus carica*). Asian J. Sci. Appli. Tech., 8(1): 1–4. https://doi.org/10.51983/ajsat-2019.8.1.1043

Mohd Zin, Z., A.Z.M. Sanuri, N. Bashah, K. Ibrahim, H. Yahya and M.K. Zainol. 2021. Effect of different extraction solvents on antioxidant properties of water lily (*Nymphaeaceae antares*) flower petal and stamen. Food Res., 5(3): 359–368.https://doi.org/10.26656/fr.2017.5(3).653

Nadeem, M. and A. Zeb. 2018. Impact of maturity on phenolic composition and antioxidant activity of medicinally important leaves of *Ficus carica* L. Physiol. Molecul. Biol. Plant., 24(5): 881–887. https://doi.org/10.1007/s12298-018-0550-3

Olives, A.I., V. González-Ruiz and M.A. Martín. 2017. Sustainable and Eco-Friendly Alternatives for Liquid Chromatographic Analysis. ACS Sustain. Chem. Eng., 5(7): 5618–5634. https://doi.org/10.1021/acssuschemeng.7b01012

Panche, A.N., A.D. Diwan and S.R. Chandra. 2016. Flavonoids: An overview. J. Nutrit. Sci., 5. https://doi.org/10.1017/jns.2016.41

Santana, C.M., Z.S. Ferrera, M.E.T. Padrón and J.J.S. Rodríguez. 2009. Methodologies for the extraction of phenolic compounds from environmental samples: New approaches. Molecul., 14(1): 298–320. https://doi.org/10.3390/molecules14010298

Speltini, A., D. Merli and A. Profumo. 2013. Analytical application of carbon nanotubes, fullerenes and nanodiamonds in nanomaterials-based chromatographic stationary phases: A review. Analytica Chimica Acta., 783: 1–16. https://doi.org/10.1016/j.aca.2013.03.041

Tzanova, M., V. Atanasov, Z. Yaneva, D. Ivanova and T. Dinev. 2020. Selectivity of current extraction techniques for flavonoids from plant materials. Process., 8(10):1– 30. https://doi.org/10.3390/pr8101222

Yara-Varón, E., A.S. Fabiano-Tixier, M. Balcells, R. Canela-Garayoa, A. Bily and F. Chemat. 2016. Is it possible to substitute hexane with green solvents for extraction of carotenoids? A theoretical versus experimental solubility study. RSC Advan., 6(33): 27750–27759. https://doi.org/10.1039/C6RA03016E

Yaseen, M., M. Ullah, S. Subhan, W. Ahmad, F. Subhan and M. Shakir. 2021. Recovery and characterization of useful benzene derivatives from spent engine oil through solventextraction. Chem. Eng. Res. Design., 175: 51–60 https://doi.org/10.1016/j.cherd.2021.08.031