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Study on Effect of Solvent on Extraction of Phytochemical Constituents of Red Acalypha (*Acalypha Wilkesiana*) Leaves

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Abstract

Solvent plays an important role in the medicinal application of any medicinal plant. The medicinal usefulness of any plant solely depends on the solvent-extractable phytochemicals contained in such solvent extract. Hence this research work is aimed in examining the extractive value and qualitative phytochemical screening of extracts gotten from red acalypha (*Acalypha wilkesiana*) leaves using five different solvents. The leaves of red acalypha were obtained, rinsed, cut into smaller pieces, air-dried, ground into powdery sample, and sieved with 40 mm mesh size. The plant sample was extracted using five different solvents (acetone, chloroform, ethyl acetate, methanol, and water) at ratio 1:10 for 72h. Each solvent extract was screened for nine phytochemicals (flavonoid, carotenoid, phenol, oxalate, tannin, saponin, alkaloid, phytate and ascorbic acid). The extractive value of the solvents showed that water had the highest extractive value (13.49±0.34%), followed by methanol (10.92±0.52%), acetone (2.46±0.08%), ethyl acetate (1.48±0.01%) while the least was in chloroform (0.99±0.00%). Qualitative phytochemical screening of the raw *Acalypha wilkesiana* leaves shown that the following seven phytochemicals; flavonoids, carotenoids, phenol, tannin, saponin, phytate and ascorbic acid) were detected out of the nine-phytochemical screened for. Water and methanol extracts contained seven phytochemicals while acetone and ethyl acetate extracts contained one phytochemical and no phytochemical was detected in chloroform extract. Raw leaf sample of red acalypha and its water and methanol extracts contained 77.8%, acetone and ethyl acetate extracts contained 11.1% of phytochemicals screened. Water and methanol are excellent solvents for effective extraction of phytochemicals from red acalypha leaves.

Keywords: Red Acalypha; Phytochemicals; Solvents; Extraction; Extractive Value

Introduction

For many centuries, medicinal plants have been used for therapeutic purposes for the treatment of various diseases [1]. Medicinal plants contain biologically active chemical substances known as phytochemicals such as saponins, tannins, essential oils, flavonoids, alkaloids, and other compounds which have preventive or curative properties [2]. Plant analysis provides chemical information about plants and serves as a guide for their various utilization. Plants leaves have attracted several research interests in food, pharmaceutical, metallurgical, corrosion and other industries [3]. Their usefulness can only be revealed if there are chemical data generated from chemical analysis [4]. Chemical analyses of plant leaves are done to know their proximate, trace metals, heavy metal, mineral, phytochemical, vitamins, and antioxidant [4]. Red acalypha (*Acalypha wilkesiana*) is an ornamental plant common in most gardens and building surroundings in Nigeria. Its other names include Acalypha amentaceae and Acalypha tricolor, while its common names are copperleaf, Joseph's coat, fire dragon, beef steak plant and match-me-if-you-can [5]. The Hausas in Northern Nigeria call it "Jiwene" and "Jinwinini", while the Yorubas in South-Western Nigeria call it "aworoso" and it is also available round the year [6]. They are traditionally used in the treatment or management of diverse ailments such as diabetes, jaundice, hypertension, fever, liver inflammation, schistosomiasis, dysentery, respiratory problems including bronchitis, asthma, and pneumonia as well as skin conditions such as scabies, eczema, and mycoses [7]. However, there is little or no information on the extractive values and the effect of solvents on extractable phytochemicals contained in red acalypha leaves. Consequently, this research focuses on the extractive values and effect of five different solvents on

phytochemical constituents of red acalypha leaves with the view of establishing the most effective solvent(s) in obtaining phytochemicals from raw red acalypha leaves which will be more potent for medicinal therapy.

Materials and Methods

Source of materials

Red acalypha plant was collected from the premises of a residential building in Ondo-City, Ondo State, Nigeria. The plant was authenticated in the Department of Bioscience and Biotechnology, University of Medical Sciences, Ondo- City, Ondo State, Nigeria. All chemicals used were of the analytical grade with the highest purity available (>99.5%) and procured from Sigma Aldrich, USA.

Preparation and extraction of red acalypha leaves

Red acalypha leaves were obtained, rinsed in water, cut into smaller pieces for easy drying, air-dried, ground, and finally sieved to give 40 mm mesh size powder. It was put in air-tight containers and kept in a refrigerator at 4°C prior to analysis. The powdered sample was divided into portions, packed in an airtight container labelled appropriately prior to extraction. The sample was extracted separately with each solvent (acetone, chloroform, ethyl acetate, methanol, and water) at ratio 1:10 for 72h during which it was intermittently shaken on a shaking orbit machine The resulting mixture was filtered through a 0.45µm nylon membrane filter. The extracts were desolventised to dryness under reduced pressure at 40oC by a rotary evaporator (BUCHI Rotavapor, Model R-124, Germany). Weight of extract obtained was used to calculate the percentage yield (extractive value) of extract in each solvent and the dry extracts were stored in a refrigerator (4 °C) prior to analysis [8-11].

Phytochemical analysis of red acalypha leaves and its solvent extracts

The presence of major phytochemical secondary metabolites, namely, saponins, alkaloids, flavonoids, ascorbic acid, phytate, oxalate, tannins, phenolics, and terpenoids were determined using standard phytochemical methods with some modifications.

Qualitative determination of phytochemicals of red acalypha leaves and its solvent extracts

Test for flavonoids (*Cyanidine* test)

This was done according to the method of Stankovic [12]. About 0.2g of the plant sample/extract was added with 2mL methanol and 1 mL of concentrated sulphuric acid added. A spatula was used to add a powder of magnesium chloride ($MgCl_2$) and the mixture observed for 1 min for effervescence and observed for a brick red coloration.

Test for phenol

A small quantity of the extract/ plant sample (about 0.5g) was added to about 0.5mL of $FeCl_3$ solution. A deep bluish green solution was an indication of the presence of phenol [13].

Test for ascorbic acid

Plant samples/extract were crushed in acetic acid and filtered. Few drops of 2, 6-dichlorophenolindophenol solution to the 0.5mL of the filtrate. The presence of faint pink confirmed that ascorbic acid was present [14].

Test for saponin

About 0.2g of the extract/plant sample was shaken with 5 mL of distilled water and then heated to boil. Frothing (appearance of creamy mist of small bubbles) showed the presence of saponin [14].

Test for tannin

About 0.2 g of plant sample/extract was stirred with 5mL of distilled water and later filtered. A few drops of FeCl3 solution were added to 1mL of the filtrate. A blue-black green or blue green precipitate was evidence for the presence of tannin [14].

Test for alkaloid (Wagner's test)

This was done according to the method of Joshi [15]. About 0.2g of the plant sample/extract was stirred with 0.4mL of 1%HCl in a water bath for 5 min and filtered. Two grams (2g) of Potassium iodide and 1.27g of iodine were dissolved in 5mL of distilled water and the solution was diluted to 100 mL with distilled water. Two drops of this iodine solution were added to the filtrate; a brown-colored precipitate indicated the presence of alkaloids.

Test for oxalate

About 0.5g of sample/extract was boiled with 1mL of 2% H_2SO_4 solution on water bath. It was filtered while warm and a few drops 1% $KMNO_4$ was added. The pink color confirms the presence of oxalate [16].

Test for phytate

About 0.5 g of the sample/extract was mixed with 2mL of 2% HCl solution. It was filtered and two drops of 0.3% ammonium thiocyanate (NH_4SCN) solution and 2mL of distilled water were added and shaken. 3 to 4 drops of 10% $FeCl_3$ solution were then added. Yellow coloration indicates the presence of phytate [16].

Test for carotenoids

About 0.5 g of the sample/ extract was mixed with 2mL of distilled water. 5mL of 2% w/v alcoholic KOH solution was added and the mixture was heated on a water bath for 10 minutes. 2mL of chloroform and 0.5g of Na_2SO_4 were added and shaken thoroughly.

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A violet color indicates the presence of carotenoids [16].

Statistical analysis

Statistical significance tests were performed using SPSS (v.20, IBM SPSS Statistics, US) at $p<0.05$ by means of one-way analysis of variance (ANOVA) followed by LSD post hoc multiple comparison and the experimental results were expressed as mean ± standard mean deviation of three replicates.

Results and Discussion

The extractive values of red acalypha leaves in different solvents are shown in (Table 1). The five different solvents used are acetone, chloroform, ethyl acetate, methanol, and water. The extractive value of a substance in a solvent is a measure of ability/ capability of a solvent to extract bioactive ingredient/ compound from a substance [17] The extractive values of red acalypha in acetone were 2.46±0.08%, chloroform was 0.99±0.00%, ethyl acetate was 1.48±0.01%, methanol was 10.92±0.052% and water was 13.49±0.34%. The extractive values of red acalypha in acetone and ethyl acetate were not significant different at $p < 0.05$. There was also no significant difference at $p < 0.05$ for extractive values of red acalypha in methanol and water. The propensity of solvent in extracting phytochemicals from red acalypha was highest in water, followed by methanol, acetone, ethyl acetate and least in chloroform. This suggested that polar solvents were more effective in extracting bioactive constituent in red acalypha leave [18-20].

Table 1: Extractive values (% yield) of red acalypha leaves in different solvents

Parameters	Extractive Value (%)
Acetone	2.46b±0.08
Chloroform	0.99a±0.00
Ethyl acetate	1.48b±0.01
Methanol	10.92c±0.52
Water	13.49c±0.34

NOTE: Within each row, mean values followed by the same superscript are not significantly different at P<0.05 level according to Duncan's New Multiple Range Test (DMRT); Values represent means of triplicate determination ±standard deviation

The qualitative phytochemical screening of red acalypha leaves and their solvent extracts is presented in Table 2. There were nine phytochemicals screened for red acalypha leaves and their solvent extracts and these bioactive constituents were flavonoids, carotenoids, phenol, oxalate, tannin, saponin, alkaloids, phytate and ascorbic acid. Flavonoids, carotenoid, phenol, tannin, saponin, phytate and ascorbic acid were detected in raw red acalypha leaf and this amount to 77.8% of the phytochemical present in the plant sample. Methanol and water extracts contained flavonoid, phenol, oxalate, tannin, saponin, phytate and ascorbic acid and this gave 77.8% phytochemical detectable. It was only carotenoids and alkaloids that were not detected in water and methanol extracts of red acalypha leaves. Acetone and ethyl acetate extracts contained only phytates and this resulted in 11.1% of detectable phytochemicals. None of the nine phytochemicals was detected in chloroform extract of red acalypha leaves. It was conspicuously observed that solvents with high polarity had higher detectable phytochemicals than solvents with low polarity. Hence solvents high polarity such as water and methanol served as better solvents in getting extracts with higher medicinal potentials from red acalypha leaves.

Table 2: Qualitative phytochemical screening of red acalypha leaves and their solvent extracts.

Parameter	Red acalypha	Solvent extracts				
		Acetone	Chloroform	Ethyl acetate	Methanol	Water
Flavonoids	+	_	_	_	+	+
Carotenoids	+	_	_	_	_	_
Phenol	+	_	_	_	+	+
Oxalate	_	_	_	_	+	+
Tannin	+	_	_	_	+	+
Saponin	+	_	_	_	+	+
Alkaloids	_	_	_	_	_	_
Phytate	+	+	_	+	+	+
Ascorbic acid	+	_	_	_	+	+
%Phytochemical detectable	77.8	11.1	0	11.1	77.8	77.8

+ =Present - = Absent

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Conclusion

Red acalypha leaves contained essential phytochemicals which were better extracted with methanol and water. Acetone, ethyl acetate and chloroform are poor solvents in extraction of bioactive ingredients from red acalypha leaves. Since majority of phytochemicals detected in red acalypha leaves are also potent antioxidants, then further research can be conducted to investigate the antioxidant activities of methanol and water extracts of red acalypha leaves on edible oils to ascertain their suitability as natural antioxidants over the synthetic ones that are human unfriendly.

References

1. Ogbonna AI, Ogbonna SUA, Ugwu EI, Onyimba IA, Ogbonna CI, et al. (2021) Biochemical analysis and antimicrobial activity of ethanolic and aqueous leaf extracts of Acalypha wilkesiana varmorea Müll. Arg. (Copperleaf). Journal of Botany Research 1 (4): 131-137.
2. Mamta S1, Jyoti S1, Rajeev N, Dharmendra S, Abhishek G (2013) Phytochemistry of medicinal plants. Journal of Pharmacognosy and Phytochemistry 1(6): 168-182.
3. Eddy NO, Udoh CL (2005) Proximate evaluation of the nutritional value of some soup thickener. CHEMCLASS Journal 2: 12-14.
4. Eddy NO, Ekop AS (2005) Comparative studies of the level of toxicant in the seeds of Terminalia catappa (Indian almond) and Coulaedulis (African walnut). CHEMCLASS Journal 2: 14-76.
5. Christman S (2004) Acalypha wilkesiana. Floridata.com LC, Florida.
6. Ikewuchi CJ, Ikewuchi CC, Onyeike EN, Uwakwe AA (2010) Nutritional potential of the leaves of Acalypha wilkesiana 'Godseffiana' Muell. Arg J Appl Sci Environ Manage 14(3): 21-24
7. Seebaluck R, Gurib-Fakim A, Mahomoodally F (2015) Review medicinal plants from the genus Acalypha (Euphorbiaceae). A review of their ethnopharmacology and phytochemistry. Journal of Ethnopharmacology 159: 137-157.
8. Arawande JO, Araoye KT, Gbenga-Fabusiwa FJ, Ijitona OO, Amuho EU (2022a) Refined palm kernel oil stabilization via addition of water Chaya leaf extract and buylated hydroxytoluene. Biomedical Journal of Scientific and Technical Research 39(4): 38401-38407.
9. Arawande JO, Aderibigbe AS (2020) Stabilization of edible oils with bitter leaf (Vernonia amygdalina) and water bitter leaf (Struchium sparganophora) extracts. SAR Journal of Medical Biochemistry 1(1): 9-15.
10. Arawande JO, Akinnusotu A, Alademeyin JO (2018) Extractive value and phytochemical screening of ginger (Zingiber officinale) and turmeric (Curcuma longa) using different solvents. International Journal of Traditional and Natural Medicine 8(1): 13-22.
11. Bopitiya D, Madhujith T (2014) Efficacy of pomegranate (Punica granatum L.) peel extracts in suppressing oxidation of white coconut oil used for deep frying. Tropical Agricultural Research 25(3): 298-306.
12. StankoviC MS, Zia-Ul-Haq M, BojoviC BM, UZoviC MD (2014) Total phenolics, flavonoid content and antioxidant power of leaf, flower and fruits from cornelian cherry (Cornus mas l.). Bulg J Agric Sci 20: 358-363
13. Sofowora A (2008) Medicinal plants and traditional Medicine in Africa, 3rd ed. Spectrum Blocks Limited, Ibadan, Nigeria pp: 199-204.
14. Hunds SS, Prakash P, Roy B (1985) Bioactivity directed extraction and fractionation of E. alba: An hepatoprotective drug of Indian Origin. Ind J Pharm Sci 13: 50-51.
15. Joshi A, Bhobe M, Saatarkar A (2013) Phytochemical investigation of the roots of Grewia microcos. J Chem Pharm Res 5: 80-87.
16. Brindha SB, Purushothaman K (1981) Phytochemical analysis of E. alba. BMEMR 3(1): 84-96.
17. Arawande JO, Olatide M, Gbenga-Fabusiwa FJ (2022b) Preliminary phytochemical screening and antioxidant activity of chaya leaf extracts on refined palm kernel oil. Applied Food Science Journal 6(3): 1-7.
18. Arawande JO, Orimoloye RO, Adeleke RA, Afolabi FO, Adesuyi TA, et al. (2023) Study on solvent extraction values and antioxidant properties of bioactive extracts obtained from leaves, tuber peels and tubers of sweet potato. Biomedical Journal of Scientific and Technical Research 48(4): 39856-39861
19. Arawande JO, Osungbemiro BW (2022) Evaluation of the extractive values and phytochemical constituents of sandpaper leaf, waterleaf, bitter gourd, and neem using different solvents. Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS) 13(2): 80-86
20. Arawande JO, Orimoloye RO, Adeleke RA, Adesuyi TA, Osungbemiro BW (2022c) Investigation of solvent efficiency in extraction of bioactive constituents from leaves, tuber peels and tubers of sweet potato. Journal of Pharmaceutical Research 7(1): 173-178.

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