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Study on the Chemical Constituents and Biological Activity of Cosmos Sulphureus Leaf Extract

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A B S T R A C T

This study was carried out to evaluate the chemical constituents and biological activity of Cosmos sulphureus leaf extract. Proximate analysis of Cosmos sulphureus leaf powder shows that it had a moisture content of 13.88 %, crude protein (6.91 %), crude fibre (11.92 %), ether extract (0.41 %), ash (12.09 %) and energy (1392.4 Kcal/kg). Qualitative analysis of Cosmos sulphureus leaf extract revealed the presence of phenolic compound, alkaloids, saponins, tannins, flavonoids, steroids and anthraquinones. GC-MS analysis reveals the presence of 35 bioactive compounds representing 89.18% (Triterpenes (50.07%), sesquiterpenes (23.96%), monoterpenes (7.33%), diterpenes (4.95%) and non-terpenes (2.87%)]. The predominant bioactive compounds in Cosmos sulphureus leaf extract were; 17-Octadecynoic acid (9.94%), γ-Elemene (9.65%), β-Selinenol (9.11%), 8-Heptadecene (8.52%), β-Caryophyllene oxide (8.74 %), Calarene epoxide (7.52%), 9-Hexadecenoicacid (6.52%), Benzene,1,2,3-trimethyl(5.46%), Squalene (5.02%). The extract delivers a broad-spectrum antimicrobial effect against Escherichia coli, Bacillus subtilis, Pseudomonas aeruginosa, Salmonella typhi, Shigella flexenari, Staphylococcus aureus, Candida albicans, Aspergillus niger and Penicillium notatum. Cosmos sulphureus leaf extract was also able to protect against oxidative stress and neutralize free radicals at the source. It was concluded that Cosmos sulphureus leaf extract have bioactive compounds that go far beyond nutrition and its medicinal powerhouse provides powerful: anti-inflammatory, antioxidant, hepato-protective, immuno-modulatory, gastro-protective, anti-helminthic, antidiarrheal, anti-tumor, antimicrobial, antiviral and antifungal properties

INTRODUCTION

Cosmos sulphureus one of nature's most overlook medicines belong to the family Asteraceae. The plant has about 40 species widely distributed in several parts of the world including Africa, Asia, South America and Australia (Saleem et al., 2019). The species sulphureus ad known by its beautiful orange and yellow flowers which makes them unique (Jadav and Gowda, 2017). The plant is a pharmacy in disguise, the leaves, stems, flowers and root all carry unique phytochemicals such as, alkaloids, terpenoids, flavonoids, tannins, phenolic compounds and have been used for centuries as powerful natural medicine (Saleem et al., 2019). Traditionally, extracts from Cosmos sulphureus leaves have been used to treat a great wide disease condition such a coughs, sore throat, fever, asthma and even blood sugar control (Malaka et al., 2015). Research published by (Shimokoriyama et al., 2003) found that Cosmos sulphureus leaf extract are known for their anti-inflammatory, pain relieving and tumor suppressing effects. Studies further showed that it relived chronic inflammation without harming healthy tissue and lowering blood glucose by inhibiting α-glucose, the enzyme responsible for the breakdown of carbohydrates into sugar (Malaka et al., 2015).

Leaves, flowers and roots also delivers powerful antioxidant protection, neutralizing free radicals and helping to protect cellular damage linked to several chronic diseases (Amamiya and Iwashina, 2016). They also have strong antioxidant that help to protect the body against oxidative stress, reinforces the cardiovascular system by strengthening blood vessels (Saleem et al., 2019). Several clinical trials have shown that essential oils from Cosmos sulphureus can act as liver protectors, metabolic regulators and restoring enzyme balance in the body (Megnigueu et al., 2020; Wangkiri et al., 2021). Chlorogenic acid, quercetin, gallic acid, caffeine, p-coumaric acid, and vanillic acid have been found in the plant and they exhibit, hepato-protective, gastro-protective, immuno-stimulatory, hepato-protective, antiviral, anti-helminthic, antifungal, anti-tumor, antimicrobial, antidiabetic properties amongst others (Jadav and Gowda, 2017). Extracts from Cosmos sulphureus leaves and flowers can protect the gastrointestinal tract, reduces intestinal irritation and fight bacteria overgrowth making it a reservoir of bioactive compounds which are weapon against infection, inflammation and degeneration (Sugiharti et al., 2018).

As antimicrobial resistance is growing every year, the potentials in Cosmos sulphureus suggests that it has earned its place in modern and traditional healing across the globe. Folk knowledge is now backed by antimicrobial assays that show clear zones of inhibition. This research will also help to reduce the emergence of multi- drug resistance in microorganisms against existing antibiotics and reveal novel antibiotics by exploring other options from herbs or medicinal plants.

LITERATURE REVIEW

Site of the Study

The experiment was carried out at the Department of Biochemistry, Gandhi College of Agriculture, Rajasthan, India between the month of August to September, 2025. Experiment was designed at the same department and assigned an approval number ASD-08A-2025.

Sourcing of Plant Materials

Fresh leaves of Sulfur cosmos were harvested at Rajasthan, India in the Month of September, 2025. The leaves were identified at Biological Science Department of Gandhi College of Agriculture, Rajasthan by a certified taxonomist before it was assigned a reference number SD/08/2025F and deposited at the herbarium in the institution. The collected leaves were then sorted, washed in running tap water followed by distilled water and spread in a sieve to allow excess water to drain for 30 minutes. Samples were later shade dried for 2 weeks, grounded into powder and stored in plastic containers prior to extraction.

Preparation of Cosmos Sulphureus Extract

Ethanol extraction of Cosmos sulphureus was carried out using ethanol as the extracting solvents. 200 g of Cosmos sulphureus powders was macerated in 98 percent ethanol for 8 hours. The extract was filtered using Whatman No. 1 filter paper and concentrated using a Rotary evaporator (BUZ-3700, Model AAD-08, China) set at a temperature of 45 °C. Dried extract was sent to the laboratory for further examination.

Proximate Composition of Cosmos Sulphureus Powder

Proximate analysis of Cosmos sulphureus powder was done using KPM Analytics Near Infra-Red Spectroscopy analyzer (Model RH-3800, Netherlands). 100 g of sample was passed through a rotating reflectance dish on top of a reflectance detector and set at a spectral range of 1400 – 2500 nm for optimal measurement. The torch screen was used to select the parameter to examine and results are displayed on the visual display unit as presented in Table 1.

Qualitative Analysis of Non-Volatile Compounds in Cosmos Sulphureus Extract

Qualitative analysis of Non-volatile compounds in Cosmos sulphureus extract was carried out using the method outlined by Doughari (2012); Edeoga et al. (2005) and Sharma (2012) as presented in Table 2.

GC-MS Analysis of Cosmos Sulphureus Extract

The bioactive compound in Cosmos sulphureus extract was carried out using Perkin Elmer GC-MS (Model GC 2400, USA). 5 mL of Cosmos sulphureus extract was injected via the injection port and equipped with a HP-5ms fused silica capillary column (30 m x 0.25 mm, film thickness 0.25 µm). Analytical conditions were: Oven temperature of 50 oC, with 5 minutes' initial hold, and then to 200 oC at 10 oC/min, with final hold time of 10 minutes; helium was used as carrier gas at a flow rate of 1 mL/min. The mass spectrometry section was operated in EI mode with ionization voltage 85 eV and ion source temperature between 200 - 250 oC. Identification confirmation was by comparison of their mass spectra with reference compounds from the Library of National Institute of Standard and Technology (NIST, 2011) and Willey database compared with mass spectra of published spectra (Adams, 2007).

METHODOLOGY

Antibacterial and Antifungal Screening

Six human pathogenic bacteria made up of two Gram-positive (Staphylococcus aureus, Escherichia coli, Shigella flexineri) and two Gram-negative (Pseudomonas aeruginosa, Salmonella typhi and Bacillus subtilis), were used for the antibacterial assay while three fungi (Candida albicans, Penicillium notatum and Aspergillus niger) were used for the antifungal assay. All the organisms were local isolates from the Laboratory bacterial and fungi stock of the Department of Microbiology, Gandhi College of Agriculture, Rajasthan, India. Analysis was carried out according to the procedures of the National Committee for Clinical Laboratory Standards (2002). Briefly, Microplate Alamar Blue Assay was used to determine susceptibility or resistance of the extracts to selected bacteria strains. Organisms were cultured in Mueller Hinton broth and inoculums were adjusted to 0.5 McFarland standard. Stock solutions of the extracts were prepared in DMSO (1:1 concentration). Media was dispensed to all wells. Extract (20 µg/mL) were added in the wells, control wells do not contain extracts. The volume of 96-well plate was made up to 200 µL. Finally, 5x106 cells were added in all wells including both control and test. The plate was sealed with parafilm and incubated for 19 - 21 hours. Alamar Blue Dye was dispensed in each well and shaken at 80 RPM in a shaking incubator for 2 – 3 hours. Plates were covered with foil in shaking incubator. Change in color of Alamar Blue dye from blue to pink indicated the growth in bacterial strains. Absorbance was recorded at 570 nm and 600 nm by the ELISA reader (Spog Auto Microbial Analyzer, Model WD-08-2022, China). Ampicillin was used as the reference drug. The experiment was carried out in triplicate.

Antioxidant Activity

DPPH Radical Scavenging Activity Radical scavenging activity was determined by a spectrophotometric method based on the reduction of a methanol solution of DPPH using the reported method previously reported by Yamaguchi et al. (1998). Briefly, 1mL of Cosmos sulphureus extract was added to 1 mL of the 0.3 mM DPPH solution and shaken vigorously. The reaction is allowed to stand for about 1 hour at 30 oC in the dark and absorbance is monitored by multiplate reader at an optic density of 517nm. Upon reduction, the color of the solution fades (Violet to pale yellow). Absolute methanol was used to zero the spectrophotometer. N-gallic acid was used as the reference compounds. The experiment was carried out in triplicate.

The activity was determined as a function of the % Radical Scavenging Activity which was calculated using the formula:

% Radical Scavenging Activity = YC- YS/YC × 100

Where: YC = Absorbance of the control YS = Absorbance of the sample

RESULTS AND DISCUSSION

In Table 1, Cosmos sulphureus powder contained 13.88 % moisture content which was lower than 3.3 % reported for Caesalpinia pulcherrima powder by Rotimi et al. (2008). Moisture content between 12.0 -15.0 % has been reported to inhibit microbial growth in a sample thus preventing spoilage and increasing their shelf life (Shittu and Alagbe, 2021). Crude protein of 6.91 %

recorded in this study was lower than 22.16 %, 18.13 %, 20.40 %, 18.90 % and 19.91 % reported for Albizia saman, Albizia falcatariae, Albizia procera, Albizia guachapele and Albizia lebbeck leaves by Chitra and Balasubramanian (2016). Result obtained suggests that Cosmos sulphureus powder is low in protein and cannot be utilized as a protein supplement in animal feed (Adewale et al., 2021).

High dietary fibre enhances the easy digestion of feed in the gastrointestinal tract, however, 11.92 % recorded in Cosmos sulphureus powder was within 11.52 % reported for Sida acuta leaf by Shittu and Alagbe (2021) but lower than 13.10 % and 14.20 % reported for Gliricidia sepium and Gmelina arborea leaves by Oji et al. (2007); Odeyinka (2001). The reasons for the variation in results can be attributed to geographical locations, age of plant and species (Alagbe, 2022; Ojediran et al., 2024a). Ash content of 12.09 % was higher than 9.84 % recorded for Blighia sapida leaves by Adebowale (2001). This result suggests that Cosmos sulphureus powder is loaded with minerals that are necessary for the normal metabolic process in the body (Omokore and Alagbe, 2019). Ether extract 0.41 % reveals that Cosmos sulphureus powder can prevent the risk cardiovascular disease when supplemented in the diet of animals (Hernandez and Alagbe, 2025a; Ojediran et al., 2024b). Result obtained was lower than 2.33 % reported by Oderinde and Ajayi (2000) for Calophyllum inophyllum seed. Energy composition of 1392.4 Kcal/kg was lower than 1440.8 Kcal/kg reported for Mucuna utilis leaves by Bressani (2002) but higher than 1220.1 and 1140.5 (Kcal/kg) recorded by Alabi and Alausa (2006) for Leucaena leucocephala and Lablab purpureus leaves respectively. The result suggests that Cosmos sulphureus powder cannot be used as an energy source in livestock feed.

Table 1. Proximate Composition of Cosmos Sulphureus Powder

Constituents	Concentration (%)
Moisture	13.88
Crude protein	6.91
Crude fibre	11.92
Ether extract	0.41
Ash	12.09
Energy (Kcal/kg)	1392.4

In Table 2, the qualitative analysis of non-volatile compounds in Cosmos sulphureus powder reveals the presence of alkaloids, flavonoids, phenols, tannins, steroids, saponins and anthraquinones. The outcome of this findings is in agreement with the reports of Lilian et al. (2012); Prasad and Shriniwas (2000). This result suggests that Cosmos sulphureus powder contains unique molecules (phytochemicals) that makes it one of the most versatile therapeutic and healing plant (Hernandez and Alagbe, 2025b). The herb is not just a medicine but nutrient rich and it contains compounds that environmental friendly, safe and natures prescription (John, 2024a). The presence of tannins, alkaloids and saponins shows that Cosmos sulphureus powder possess antimicrobial properties making it potent against pathogenic organisms comparable to commercial antimicrobials (John, 2024b). Flavonoids and phenols are compounds with strong antioxidant

potentials, these compounds neutralize free radicals and protect cells from oxidative stress preventing the body against chronic diseases (John, 2024b). Research has also shown documented its antidiarrheal effect, helping to reduce intestinal inflammation and easing digestion due to the presence of saponins and steroids (Prasad and Shriniwas, 2020; John, 2024c). The synergy in these non-bioactive compounds helps to regulate immune function, reduce pain, calm inflammation and provides a bronchodilator effect which opens airways making it easier to breathe (John, 2024c).

Table 2. Qualitative Analysis of Non-Volatile Compounds in Cosmos Sulphureus Powder

Compounds	Outcome	Procedure
Phenols	Blue-black or brown colouration	0.5 g of powdered Cosmos sulphureus sample was boiled with 10 ml of distilled water for 5 mins and filtered while hot .Then 1ml of ferric chloride solution was added.
Terpenoids	reddish-brown precipitate colouration	2 g of powdered Cosmos sulphureus was mixed in 3 ml of chloroform. 2 ml of concentrated H2SO4 was then added to form a layer.
Flavonoids	yellow coloration	1 g of powdered Cosmos sulphureus sample was separately boiled in 20 ml of water and then filtered. 10 ml of dilute ammonia solution was added to a portion of the filtrate, followed by the addition of concentrated H2SO4
Anthraquinones	delicate rose pink colour	1 g of powdered Cosmos sulphureus sample was boiled with 5 ml of 10 % hydrochloric acid for 10 mins. The mixture was filtered while hot and filtrate was allowed to cool. The cooled filtrate was partitioned against equal volume of chloroform and the chloroform layer was transferred into a clean dry test tube using a clean pipette.
Glycosides	a greenish ring	2 g of powdered Cosmos sulphureus was treated with 5 ml of glacial acetic acid containing one drop of ferric chloride solution. This was underplayed with 1 ml of concentrated sulphuric acid.
Alkaloids	creamy white precipitate/ brown or reddish- brown	1 g of powdered Cosmos sulphureus sample was boiled with water and acidified with 3 ml of 1 % HCl on a

	precipitate/orange-brown precipitate.	steam bath. The solution obtained was filtered and 3 ml of the filtrate was treated with few drops of Mayer's reagent/ Wagner's reagent or Dragendorff's reagent.
Steroids	Reddish-brown colour	2 g of powdered Cosmos sulphureus sample was dissolved in 5 ml of chloroform. 0.5 ml of concentrated H2SO4 was carefully added to form a layer
Saponins	fairly stable emulsion	1g of powdered Cosmos sulphureus was boiled with 10 ml of distilled water in a bottle bath for 10 mins. The mixture was filtered while hot and allowed to cool
Tannins	brownish green or blue black colouration	1g of powdered Cosmos sulphureus sample was separately boiled with 20 ml distilled water for five minutes in a water bath and was filtered while hot. 1 ml of cool filtrate was distilled to 5 ml with distilled water and a few drops of 10 % ferric chloride.
	Summary	
Components		
Alkaloids	+	
Flavonoids	+	
Phenols	+	
Tannins	+	
Sterioids	+	
Saponins	+	
Anthraquinones	+	
Glycosides	-	

+: Present; - Not detected

Bioactive profiling of Cosmos sulphureus leaf extract by GC-MS is presented in Table 3 reveals the presence of 35 bioactive compounds representing 89.18 % [(Triterpenes (50.07 %), sesquiterpenes (23.96 %), monoterpenes (7.33 %), diterpenes (4.95 %) and non-terpenes (2.87 %)]. The predominant bioactive compounds in Cosmos sulphureus leaf extract were; 17-Octadecynoic acid (9.94 %), γ-Elemene (9.65 %), β-Selinenol (9.11 %), 8-Heptadecene (8.52 %), β-Caryophyllene oxide (8.74 %), Calarene epoxide (7.52 %), 9-Hexadecenoic acid (6.52 %), Benzene,1,2,3-trimethyl (5.46 %), Squalene (5.02 %). Other compounds recorded in this study were less than 2 % however, they offer incredible healing but together unlock deeper level of synergy (Alagbe, 2022). 17-Octadecynoic acid

are natural ally for detoxification and liver health (John, 2024b). They also inhibit colon cancer growth and reduce chronic inflammation at the cellular level (Henandez and Alagbe, 2025b). γ-Elemene and β-Selinenol prevents infections and accelerated healing of ulcers and wounds (Singh et al., 2022; Singh et al., 2021). They also contribute to cholesterol balance, curbs inflammation, pains and supports reproductive and metabolic health (Alagbe, 2025). β-Caryophyllene oxide and Calarene epoxide protects liver and kidney tissue from oxidative stress, reducing damage from toxins and supporting detoxification (John, 2024d; Mamza et al., 2012). Benzene,1,2,3-trimethyl have been suggested to stimulate digestive enzyme release, improving nutrient absorption and help to regulate gastric acidity (John, 2024e; Klavina et al., 2015). Squalene contains immuno-modulatory compounds that help to balance immune activities, stimulating it when body defenses are low and calming it when it is over reactive (John, 2024e). This helps the body to respond to threats without spiraling into chronic inflammation (Alagbe, 2022). 8-Heptadecene have been shown to regulate glucose level and improve insulin sensitivity (Devendran and Balasubramanian, 2011). 1,8-Cineole helps to relax blood vessels and improves circulation (Subavathy and Thilaga, 2015). All the bioactive compounds in Cosmos sulphureus leaf extract are weapon against infection, inflammation, degeneration and can be utilized as natural alternative to antibiotics (John, 2024c).

Table 3. Bioactive Profiling of Cosmos Sulphureus Leaf Extract By GC-MS

Peak	Compounds	R.T (min)	% Area
1	m-Ethyl toluene	5.547	0.91
2	2,3,5,8-Tetramethyldecane	5.721	0.62
3	Benzene isothiocyanate	6.008	1.44
4	17-Octadecynoic acid	6.552	9.94
5	2,21 -Methylenebis(6-tertbutyl-4- ethyl) Phenol	6.904	0.21
6	1,8-Cineole	6.911	0.67
7	Calarene Epoxide	7.005	7.52
8	Cyclohexylhexanoate	8.221	0.11
9	β-Sesquiphellandrene	8.550	0.06
10	α-Ionone	9.221	0.18
11	α-Patchoulene	9.660	0.02
12	Limonen-6-ol Pivalate	9.881	0.96
13	γ-Elemene	10.02	9.65
14	α-Bisabolol	12.33	1.33
15	α-Caryophyllene	12.51	0.42
16	9-Hexadecenoic Acid	12.75	6.52
17	Isopropyltetradecanoate	12.89	0.26
18	Cis,cis-9,12-Octadecadienoic Acid	13.11	0.15
19	Isopropyltetradecanoate	14.07	0.07
20	8-Heptadecene	14.58	8.52
21	Squalene	14.80	5.02
22	Ethyl-9-Octadecenoate	15.08	0.51
23	3-methylButyl acetamide	15.77	0.45

24	Undecane, 2,10-dimethyl	18.05	0.22
25	Benzene,1,2,3-trimethyl	18.41	5.46
26	2,2-Dichloroethanol	18.73	8.09
27	Hexane,1-hexyloxy-5-methyl	19.08	0.17
28	1-Iodo-2-methylnonane	19.11	0.57
29	α-Amyrin	20.06	0.09
30	Hexatriacontane	21.33	0.15
31	Veridiflorol	22.84	0.62
32	4-Heptafluorobutyryloxyhexadecane	23.05	0.24
33	β-Selinenol	24.17	9.11
34	β-Himachalene	25.72	0.18
35	β-Caryophyllene oxide	25.63	8.74
	Total		89.18
	No. of Compounds		
	Monoterpenes		7.33
	Sesquiterpenes		23.96
	Diterpenes		4.95
	Triterpenes		50.07
	Non-terpenes		2.87

Percentage Inhibition of extracts from Cosmos sulphureus is presented in Table 4. The experiment showed that Cosmos sulphureus extract was active against all the test bacteria strains with Escherichia coli (80.02 %), Bacillus subtilis (89.07 %), Pseudomonas aeruginosa (91.06 %), Salmonella typhi (86.11 %), Shigella flexenari (70.44 %) and Staphylococcus aureus (75.59 %). This result suggests that Cosmos sulphureus extract contains a cocktail of bioactive compounds with antibacterial properties making it potential candidate capable of inhibiting the activities of some Gram +ve and Gram –ve bacteria by disrupting their cell walls (John, 2024a; Shittu et al., 2024). The presence of major compounds in Cosmos sulphureus extract like; 17-Octadecynoic acid, γ-Elemene and β-Selinenol acts as antibacterial agents and also as liver protectors, helping to reduce inflammation and restore enzyme balance in the body (Alagbe, 2023). The result obtained in this study is in consonance with the reports of Neloy et al. (2024) when the potentials of Codariocalyx motorius leaf extract was observed. Owuna et al. (2013) also reported that ethanolic extract from the leaves of Artemisia annua was able to inhibit the activities of Escherichia coli, Streptococcus faecalis, Pseudomonas auroginosa, Klebsiella pneumoniae, Candida albicans and Staphylococcus aureus.

Table 4. Percentage Inhibition of Extracts from Cosmos Sulphureus

Name of bacteria	Drug (Ampicillin)	Percentage inhibition
Escherichia coli	78.00	80.02
Bacillus subtilis	85.00	89.07
Pseudomonas aeruginosa	80.00	91.06
Salmonella typhi	70.00	86.11

Shigella flexenari	65.00	70.44
Staphylococcus aureus	70.00	75.59
Candida albicans	65.00	70.90
Aspergillus niger	70.00	75.00
Penicillium notatum	80.90	85.00

Percentage radical scavenging activity of extracts from Cosmos sulphureus is presented in Table 5. The antioxidant activity of Cosmos sulphureus extract was measured in terms of hydrogen donating or radical scavenging ability, using the stable radical DPPH. The percentage radical scavenging ability of Cosmos sulphureus extract (71.88 %) was higher than that of the standards (gallic acid) (60.51 %). Similarly, Cosmos sulphureus extract was active on Aspergillus niger (75.00 %), Penicillium notatum (85.00 %) and Candida albicans (70.90 %). The observed high % radical scavenging of Cosmos sulphureus extract can be explained by the fact that the extract is capable of donating hydrogen atom. Also extracts rich in monoterpene hydrocarbons have been reported to have high antioxidant activity (Tepe et al., 2005). The excellent antioxidant activity of Cosmos sulphureus extract, probably, is due to the presence of phenolic compounds and high concentrations of monoterpene hydrocarbons. Phenolic compounds have the capacity to neutralize free radicals, prevent oxidative damage that accelerates ageing and contribution to diseases (Alagbe, 2021). This antioxidant activities of Cosmos sulphureus extract supports every system in the body. Research conducted by Ali et al. (2016) has shown that Chenopodium ambrosioides essential oil was active against Escherichia coli and Candida albicans confirming their high antioxidant capacity. Similar outcome was recorded by James and Mom (2021) has also proven that methanol extracts from Prosopis africana can inhibit the activities of Klebsiella pneumoniae, Pseudomonas aeruginosa and Microsporum canis. Cosmos sulphureus extract have also proven to have pharmacological power to stop the proliferation of fungi making it useful for treating infections naturally. Traditional healers have used the extract to topically treat wounds, skin infections and irritations (Akki et al., 2009).

Table 5. Percentage Radical Scavenging Activity of Extracts from Cosmos Sulphureus

Parameter	% Radical Scavenging Activity
Cosmos sulphureus extract	71.88
Gallic acid (standard)	60.51

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, f Cosmos sulphureus extract has a long history of use across continents as a medicinal and edible power house. Its versatility made it a companion in traditional medicine and shows promise as a natural anti-inflammatory, antiviral, antifungal, antibacterial, immuno-modulatory, gastro-protective, hepato-protective, anti-helminthic, antidiabetic, amongst others. It

also offers incredible healing by its ability to fight infection, relieve pain and help to balance immune activities in the body.

FURTHER STUDY

This research still has limitations, so it is necessary to conduct further research related to the topic of Study on the Chemical Constituents and Biological Activity of Cosmos Sulphureus Leaf Extract in order to perfect this research and increase insight for readers.

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