International Journal of Research in BioSciences
Volume 7 Issue 2, pp. (34-40), April 2018
Available online at http://www.ijrbs.in
ISSN 2319-2844

Research Paper

Phytochemical screening and spectroscopic characterization of Phytoconstituents from rhizome extract of *Hedychium coronarium* J. Koenig

Pooja Pachurekar and Ashwini Kumar Dixit*
Department of Botany, Guru Ghasidas Central University, Bilaspur, Chhasttisgarh 495009, INDIA

(Received March 02, 2018, Accepted March 29, 2018)

Abstract

In this present assessment, characterization of conceivable phytoconstituents from rhizome extract of *Hedychium coronarium* using spectroscopic methods was resolved based on UV-Vis absorbance and IR spectra. Distinctive rhizome extract of *H. coronarium* were utilized for the bioactive constituents were determined by scanning in the wavelength ranging from 200-1100nm and distinguishing peaks were recorded. Qualitative analysis of phytochemicals using FTIR was performed for the detection of chemical bonds and their possible functional groups in phytomolecules by producing an infrared absorption spectrum. In the outcome the different extracts of the rhizome shows the distinctive phytochemical groups giving characteristic UV-Vis peak ranging from 209.5, 272.5, 304.5, 306.9, 323.8 to 984.5 nm. , which confirms the presence of flavonoids. The FTIR spectrum from extracts confirms the different class of organic polymeric molecules including Amines, Alcohols, Phenols, Alkanes, Alkynes, Halides, Ketones, carboxylic acid, inorganic ions, ethers, Aromatic and nitrogenous compounds.

Keywords: Phyto-constituents, UV-Vis spectroscopy, FTIR spectroscopy, Phytochemical screening, *Hedychium coronarium*

Introduction

Naturally occurring bioactive compounds including Phenolics, Flavonoids, Alkaloids, Terpenoids, Glycosides and Saponins from the plants serves as a great therapeutic model in comparison to synthetic drugs. Nowadays plant based drug interest is increasing because of resistance of the pathogens against the synthetic drugs and their side effects.

For the establishment of the plants as potential medicinal agents, it is important to evaluation and screening of their medicinal composition and properties[1]. In order to check presence of medicinal important phyto constituents a variety of models and characterization techniques being used such as Chromatography and spectroscopy[2]. Spectroscopic techniques are (UV- Vis and FTIR) cost-effective and conventional methods[3,4], Fourier Transform Infrared (FTIR) spectroscopy provides the structural properties about the phyto compounds[2], it is based on absorption frequencies (functional group frequencies) which are the key to track the structure–spectral relationships of the analyzed component's vibrations, the functional groups associated with the analyzed molecule, produce characteristic and reproducible absorptions in the spectrum[5].

Ultraviolet-visible spectroscopy (UV-Vis) revels to the photons activity in the UV-visible region. UV-visible spectroscopy based on light from the UV region to visible ranges. The color of the molecules

involved is directly affects the absorption spectra in the associated light ranges. The electronic transitions of the molecule play an important role in these ranges of the electromagnetic spectrum[6].

Hedychium coronarium J. Koenig commonly known as Gulbakawali and White ginger is a perennial herb which belongs to the Zingiberaceae and used as traditional, ethnic and also as modern medicine in many parts of the world[7]. It contains various bioactive phyto constituents which made this plant as valuable drug. The essential oil extracted from leaves, flowers and rhizome of the plant have cercaricidal properties, molluscicidal activity, potent inhibitory action, antimicrobial activities, antifungal, anti-inflammatory, antibacterial and analgesic effects[8]. To screen this medicinal bioactive compounds preliminary phytochemicals and spectroscopic characterization has been done from this plant.

Materials and Methods

Collection of plant material and extract preparation

The rhizomes of the *Hedychium coronarium* were collected from natural habitats of Kabir chabutara, Amarkantak, Madhyapradesh, India. Then the rhizomes were washed thoroughly in running tap water then after washed with sterile distilled water. The rhizomes were cut, shade dried, ground into fine powder. After grinding the plant material extraction was done using cold maceration method. For the extraction Different solvents: methanol, ethanol, chloroform and ethyl acetate and petroleum ether were used for the maceration. 20 gm of coarsely powdered crude drug was placed in a stopper container with the 200ml of Different solvents individually, and kept in shaker for 8 hours for the agitation until the soluble matter has dissolved and allowed to stand at room temperature for 3 days. After extraction the extracts were filtered through whattman no.1 filter paper and concentrated at 40 ± 1 ^{o}C in a rotator evaporator, and the resulting concentrated solution were resuspended in solvents and stored at 4 ^{o}C for further use. Crude powder of rhizome was also applied for the preliminary phytochemical investigation and spectroscopic characterization.

Preliminary Phytochemical Screening

Preliminary phytochemicals screening was carried out qualitatively on each extract using standard procedures to identify the phyto-constituents [9-11].

UV-VIS and FTIR Spectroscopic characterization

For the characterization of different class of compounds UV-VIS and FTIR profiling of extracts were done. The different extracts were firstly centrifuged at 3000 rpm for 10 min and filtered through Whatmann No. 1filter paper, then the filtrates was diluted with the same extractive solvents. The final samples were subjected to the UV-Vis spectroscopy (UV-VIS Double Beam Spectrophotometer 2203 SYSTRONICS) for the scanning in the different wavelength ranges (200-1100nm) the same extractive solvent was used as reference sample, and characteristic absorption peaks were recorded. For the FTIR analysis dried powder of different solvent extracts were used. To the detection of characteristic peak and their corresponding functional group KBr pellet method was employed in FTIR spectroscope (Shimadzu, IR Affinity 1), with the Scanning range from 400 to 4000 cm^{-1} with a resolution of 4 cm^{-1}.

Results and Discussion

Preliminary phytochemicals screening results

The different class of bio active compounds shows different biological activities and act as therapeutic agents in different biological models. Phytochemical screening tests for different extracts of *Hedychium coronarium* rhizome revealed the presence of active phyto-constituents as alkaloids, cardiac glycosides, Anthraquinones, carbohydrates, phenolics, flavonoids, tannins, steroids, terpenoids, proteins and saponins as shown in table no.1.

Table 1: Prelimenry Phytochemicals screening from different extract of *H. coronarium* rhizome

S. no.	Test name	Crude powder	Methanol extract	Ethanolic extract	Ethyl acetate extract	Chloroform extract	Pet ether extract
1.	Molisch's test for carbohydrates	++	+++	++	++	-	-
2.	Ferric Chloride test for phenolics	–	++	+++	–	–	+
3.	Shinoda test for flavonoids	+	+++	+	–	–	–
4.	Wagner's test for Detection of Alkaloids	++	+	++	–	+++	–
5.	Forth test for saponins	–	+	–	+	–	–
6.	Salkowski's test for phytosterols	+	++	++	+	–	–
7.	Keller Killiani test for cardiac glycosides	+	–	+++	++	–	+
8.	Gelatin test for tannins	–	++	+++	–	+++	+
9.	Borntrager's Test for Anthraquinone	+	–	++	–	–	–
10.	Biuret test for proteins	–	+	+	–	–	–

+++ Highly present; ++ Moderately present; + present and – absent

UV-VIS and FTIR Spectroscopic results

UV-Vis spectrum profile of different extract of rhizome shows the different characteristic peaks with absorption. The UV-Vis spectrum records peaks ranges from 272.5, 304.5, 306.9, 323.8 to 984.5.nm with the corresponding absorption which is shown in table no. 2. For flavonoids maximam absorption in the ranges 230-285 nm (band I) and 300-350 nm (band II). In this present results peaks ranges 272.5, 304.5, 306.9 and 323.8 shows the presence of flavonoids. The results of FTIR detection revels the presence of Amines, Alcohols, Alkanes, Alkynes, Halides, Ketones, carboxylic acid, inorganic ions, ethers, Aromatic and nitrogenous compounds as present in tables (table no. 3, 4, 5, 6, 7).

Table 2: UV-VIS Peak Values and absorptions of different Extracts of *H. coronarium* Rhizome

S. no.	Different Extract	Peak value (nm)	Absorption
1.	Methanol extract	272.5	0.931
		323.8	2.791
		474.5	0.741
		660.0	0.592
		984.5	0.470
2.	Ethanol extract	345.0	2.050
		390.5	2.012
		209.5	0.725
3.	Chloroform extract	304.5	1.074
		593.8	2.122
4.	Pet ether extract	409.4	1.794
		306.9	1.264

Table 3: FTIR peak values of the crude powder of the *H. coronarium* rhizome

S. no.	Crude Powder Peak values	Functional groups
1.	3693.68	Alcohol and hydroxyl compound (O-H strech)
2.	2916.37	Saturated aliphatic (Methylene C-H stretch)
3.	2845.00	Saturated aliphatic (Methylene C-H stretch)
4.	1635.64	Olefinic alkane Alkenyl C=C stretch
5.	1382.96	Saturated aliphatic (*gem*-Dimethyl or ‘‘iso’’- doublet)
6.	1033.85	Aliphatic fluoro compound C-F stretch
7.	1026.13	Primary amine (C-N strech)
8.	937.40	Inorganic ions (Silicate ion)
9.	864.11	Aromatic ring Aromatic C-H out-of-plane bend
10	763.81	Aromatic ring 1,2-Disubstitution (ortho)
11.	621.08	Aliphatic bromo compound C-Br stretch
12	418.55	Unknown Compound

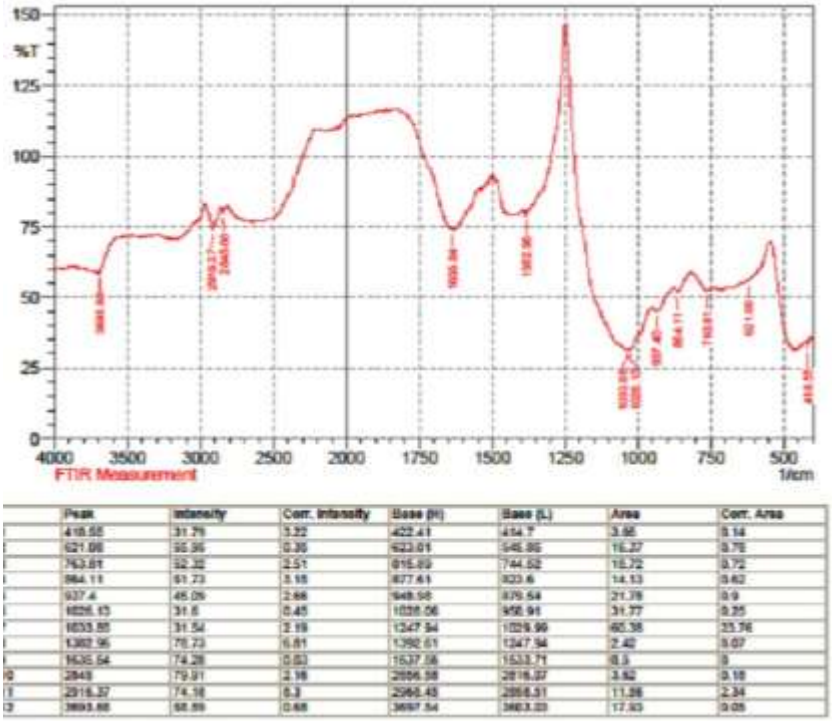

Figure 1: FTIR spectra of crude powder of *H. coronarium* rhizome

Table 4: FTIR peak values of Ethanolic extract of *Hedychium coronarium* rhizome

S. no.	Ethanol Extract Peak values	Functional groups
1.	3442.37	Alcohol and hydroxy compound O-H stretch
2.	2976.74	Saturated aliphatic (alkane/alkyl) Methyl C-H stretch
3.	1641.76	carbonyl compound group (Quinone or conjugated keton)
4.	1454.32	Inorganic ions (Carbonate ion)
5.	1384.79	Aliphatic nitro compound
6.	1049.69	Aliphatic organohalogen C-Br stretch
7.	939.39	Aromatic ring C-H bend
8.	886.27	Ether and oxy compound (Epoxy and oxirane rings)
9.	669.89	Aliphatic organohalogen C-Br stretch

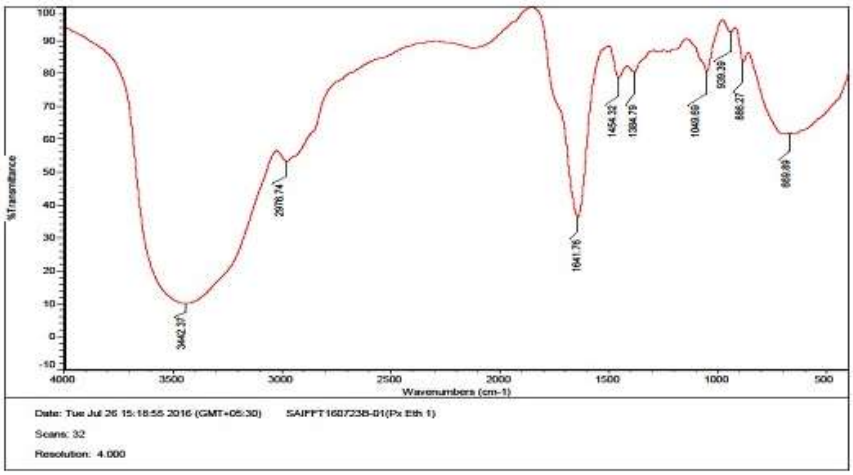

Figure 2: FTIR spectra of ethanolic extract

Table 5: FTIR peak values of methanolic extract of *H. coronarium* rhizome

S. no.	Methanol Extract Peak values	Functional groups
1.	3448.55	Alcohol and hydroxy compound O-H stretch
2.	2083.00	Inorganic ions (Cyanide ion, thiocyanate ion and related ions)
3.	1640.34	Olefinic Alkene group Alkenyl C=C stretch
4.	1017.70	Saturated aliphatic (alkane/alkyl) (Methyne (>CH−) stretch)
5.	597.85	Aliphatic organohalogen (C-I stretch)

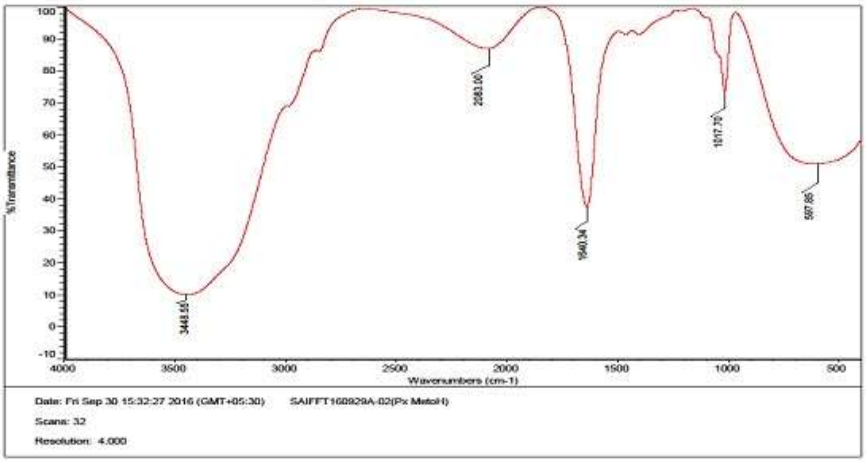

Figure 3: FTIR spectra of methanolic extract

Table 6: FTIR peak values of chloroform extract of *Hedychium coronarium* rhizome

S. no.	Chloroform Extract Peak values	Functional groups
1.	3421.99	Alcohol and hydroxy compound (O-H stretch)
2.	2923.27	Saturated aliphatic (Methylene C-H stretch)
3.	2855.97	Saturated aliphatic (Methylene C-H stretch)
4.	1745.03	Carbonyl compound (Alkyl carbonate)
5.	1674.78	Nitrogen multiple and cumulated double bond compound (Open-chain imino (-C=N-)
6.	1457.21	Inorganic ions (Carbonate ion)
7.	1375.91	Inorganic ions (Nitrate ion)
8.	1183.46	Nitrogen multiple and cumulated double bond compound (Cyanate (-OCN and C-OCNstretch))

9.	1090.64	Silicon-oxy compounds (Si-O-Si)
10.	1029.28	Primary amine (C-N)
11.	947.08	Saturated aliphatic (alkane/alkyl) Methyne (>CH−) stretch
12.	891.16	Olefinic alkene group Vinyl C-H out-of-plane bend
13.	757.16	Aromatic ring 1,3-Disubstitution (meta)

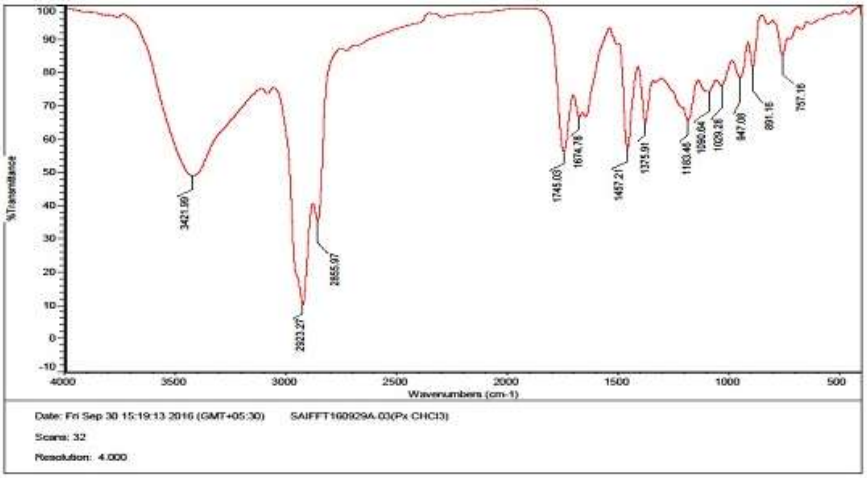

Figure 4: FTIR spectra of chloroform extract

Table 7: FTIR peak values of ethyl acetate extract of *H. coronarium* rhizome

S. no.	Ethyl acetate Extract Peak values	Functional groups
1.	2990.48	Carboxylic acid (O-H of $–CO_2H$)
2.	1764.19	Carbonyl compound (Open-chain acid anhydride)
3.	1462.33	Saturated aliphatic compound (Methyl C-H. bend)
4.	1377.16	Alcohol and hydroxy compound (O-H stretch)
5.	1242.64	Ether and oxy compound (Aromatic ethers, Aryl-O stretch)
6.	1055.87	Silicon-oxy compounds (Si-O-Si)
7.	935.30	Inorganic ions (Silicate ion)
8.	849.49	Aromatic ring (aryl) 1,4-Disubstitution (para)
9.	772.82	Aliphatic organohalogen (C-Cl stretch)
10.	641.09	Acetylenic compound (Alkyne C-H bend)

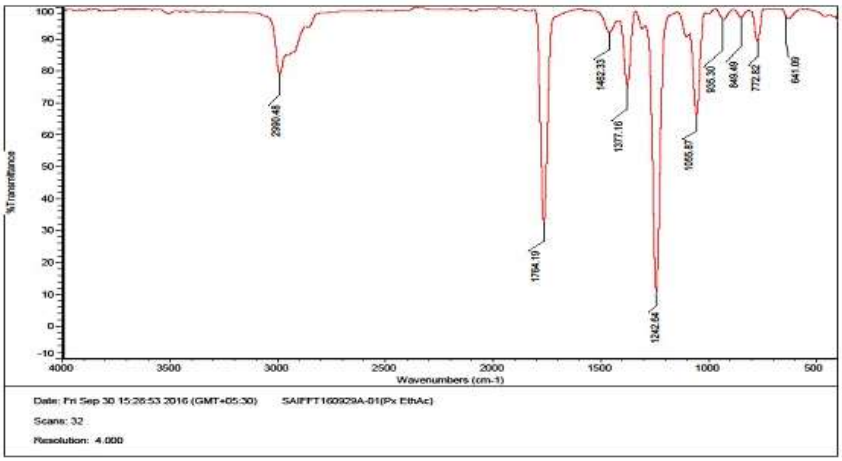

Figure 5: FTIR spectra of Ethyl acetate extract

Conclusion

Preliminary phytochemicals, FTIR and UV-VIS spectroscopic analysis of different extracts of *Hedychium coronaronarium* rhizome shows the broad spectrum of Phyto- constituents. Results

indicates the presence of different class of secondary metabolites such as Phenolics, flavonoids, terpenoids, inorganic and nitrogen compounds, these compounds are associated with different biological activities and properties. On the basis of results we can concluded that *Hedychium coronarium* has huge biological components and further research are required for the isolation and their therapeutic formulations of these compounds.

References

1. Nair R., Chanda S., Activity of some medicinal plants against certain pathogenic bacterial strains. Indian Journal of Pharmacology, 38:142-144 **(2006)**

2. Saxena M., Saxena J., Evalution of phytoconstituents of *acorus calamus* by FTIR and UV-Vis spectroscopic analysis, International Journal of Biological & Pharmaceutical Research. 3(3): 498-501 **(2012)**

3. Aysal P., Ambrus A.D., Lehotay S.J., Cannavan A., Validation of an efficient method for the determination of pesticide residues in fruits and vegetables using ethyl acetate for extraction. Journal of Environmental Science Heal, 42: 481-490 **(2007)**

4. Ibrahim M., Hameed A.J., Jalbout A., Molecular Spectroscopic Study of River Nile Sediment in the Greater Cairo Region. Applied Spectroscopy, 62(3): 306-311 **(2008)**

5. Coates J., Interpretation of infrared spectra, a practical approach, Encyclopedia of analytical chemistry **(2000)**

6. Gunasekaran S., UV-VIS spectroscopic analysis of blood serum. Asian Journal of Microbiology Biotech and Environmental Science, 5(4): 581-582 **(2003)**

7. Sirirugsa P., Thai Zingiberaceae: species diversity and their uses. In: International conference on biodiversity and bioresources: conservation and utilization. Phuket, Thailand, 23–27 **(1997)**

8. Bisht N.S., Bhandari S., In vitro plant regeneration from seedling explants of *Hedychium coronarium* J. Koenig. Journal of. Mol. Pl. Res, 43:5546-5551 **(2012)**

9. Harborne J.B., Phytochemical methods. London: Chapman and Hall, Ltd **(1973)**

10. Evans W.C., Trease and Evans Phamacognose, Ed. 14th. W. B. Saunders Company Limited, Singapore;. p. 315-6 **(1998)**

11. Khandelwal K.R., Techniques and experiments, practical pharmacognosy. ed 17th. Nirali Prakashan, Pune; 149-56 **(2007)**