

Original Research Article

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UV & FT-IR SPECTROSCOPIC ANALYSIS OF *ANDROGRAPHIS PANICULATA* ETHANOLIC LEAF EXTRACT

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ABSTRACT: *Andrographis paniculata* is an important medicinal plant. In Bangladesh it is popularly known as “Kalmegh”. The present study deals with spectroscopic analysis of ethanolic extract of leaf by UV and FT-IR of this plant. The UV and FT-IR spectrum shows the presence of carbonyl group (ketone), amide, aromatic nature of compounds, sulfur compounds, nitro compounds, halogen compounds, non-conjugated diene, gem distributed, anthracene and flavones, fistein, quercetin, NaQSA [Sodium Salts of Quercetin 5’ Sulfonic Acid], myricetin, anthocyanin types of flavonoids. The above mentioned bioactive compounds are mainly contributed in medicinal utilities of the plant.

KEYWORDS: *Andrographis paniculata*; UV spectroscopy; FT-IR spectroscopy; flavonoids.

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1. INTRODUCTION

From the ancient periods in traditional system medicinal plants have been used in many countries of the world because of its therapeutic properties [1-2]. These medicines are 100% natural and very effective against different serious diseases [3]. *Andrographis paniculata* (Burm.F) Ness (*A. paniculata*) is the most popular medicinal plant with a bright economic horizon, belonging to Acanthaceae family which is widely used for the formation of traditional medicine of diseases such as viral fever, common cold, chicken pox, dysentery, diarrhea, eczema, epidemic encephalitis B,

hepatitis, herpes zoster, mumps, ulcer, neurodermatitis, pharyngolaryngitis, pneumonia, respiratory infections [4-9]. *A. paniculata* also has used widely for the treatment of insect, bug and snake bites [10-11]. The medicinal plant, *A. paniculata* is an annual herb commonly known as “Kalmegh” or “King of bitters” cultivated in many regions of South Asian countries for its well-known medicinal value [12-13]. The traditional medicines of India, China, Hongkong, Pakistan, Bangladesh, Malaysia, Philippines, Indonesia and Thailand are broadly used this plan [10,13]. It grows erect to a height of 30–110 cm (12–43 in) in moist, shady places. The lance-shaped leaves have hairless blades measuring up to 8 cm (3.1 in) long by 2.5 cm (0.98 in). It can be found in a variety of habitats, such as plains, hillsides, coastlines, and disturbed and cultivated areas such as roadsides, farms, and wastelands. *A. paniculata* has been used as medicinal plant for its several pharmacological properties especially anti-microbial, anti-cancer, anti-inflammatory, anti-oxidant, immunostimulant, anti-diabetic, anti-infective, hepato-renal protective, anti-angiogenic, anti-allergic etc [12-29]. According to traditional and modern medicine *A. paniculata* has vast prospective for the curing various diseases [10,14]. In addition, the plant is widely investigated to possess safety and productiveness [30]. Flavonoids and Diterpenoids of *A. paniculata* are the important chemical initiates which are assumed to be liable for most of the biological activities of this plant [31]. The aim of current research of *A. paniculata* ethanolic leaf extract by UV and FT-IR spectroscopy to gain knowledge about the functional groups available in different secondary metabolites in this potential plant. This analysis will carry the understanding about the validation of medicinal uses of this plant.



Fig 1: *Andrographis paniculata* leaf

2. MATERIALS AND METHODS

2.1 Collection and identification of the plant sample

Fully matured fresh leaves of *A. paniculata* were collected from the area of Jahangirnagar University, Dhaka, Bangladesh in the month of April 2018 and identified by the taxonomist of Bangladesh National Herbarium, Dhaka, where a voucher specimen (No.=45932) has been deposited.

2.2 Plant materials preparation

The matured leaves of plant were washed to remove dirt and it was air-dried. Then it was oven-dried at reduced temperature less than 45°C to make it suitable for grinding purpose. The screened (20 mesh) powder was then stored in air-tight container with marking for identification and kept in cool, dark, and dry place for future uses.

2.3 Solvents and Chemicals

Analytical or laboratory grade solvents and chemicals were used in these experiments. All solvents and reagents used in the experiments were procured from E. Merck (Germany), BDH (England).

2.4 Preparation of ethanolic leaf Extract

For the process of extraction, powdered leaf material (120g) is submerged in ethanol in an air-tight separating funnel for 5 days at room temperature with occasionally shaking and stirring. The major portion of the extractable compounds of the plant material will be dissolved in the solvent during this and hence extracted as solution. Then the extract was dried by using a rotary evaporator to get ethanol extract (2.0 g).

3. RESULTS AND DISCUSSION

3.1 UV Spectroscopy

The UV absorbance spectra of ethanolic leaves extract of *A. paniculata* were recorded in the range of 250-320nm. The spectrum and the absorption bands are presented in Fig: 2 and Table: 1 respectively. The spectrum shows weak absorption bands at 315-320nm due to the nature of ketone, acetophenone, acrolein, quinoline and 2 nitro furan. The broad band spectrums at 312nm and 278nm indicate the presence of naphthalene and acetophenone, ketones group. These groups confirm the presence of flavone & fistein types of flavonoids. The characteristic bands at 292nm, 284nm, 283nm, 282nm, 281nm, 280nm show the appearance of flavone & fistein in respect of aldehyde, ketone, styrene, benzaldehyde, nitro benzene, benzene, 2 methyl-2-nitro propane groups. The spectrum bands at 289nm, 288nm express 3° amine, polyene (β -Carotain), quinoline, pyrrole along with the existence of quercetin and fistein types of flavonoids. There is a band at 270nm reveals the presence of quercetin & anthocyanin flavonoids due to acetone, phenol, benzoic acid, quinoline, thiophene and octyl nitrate. The bands at 273nm & 286nm indicate alkene group (naphthalene). Another important group amide (protein) is showed by at 287nm band. Carbon tetrachloride is disclosed by the band at 265nm. The sharp bands at 300nm, 285nm, 262nm, 256nm are allowed for nitroso butane, amino group (aniline), toluene, anthracene group respectively. 1,3,5, hexatriene is

indicated by the spectrum band at 254nm.

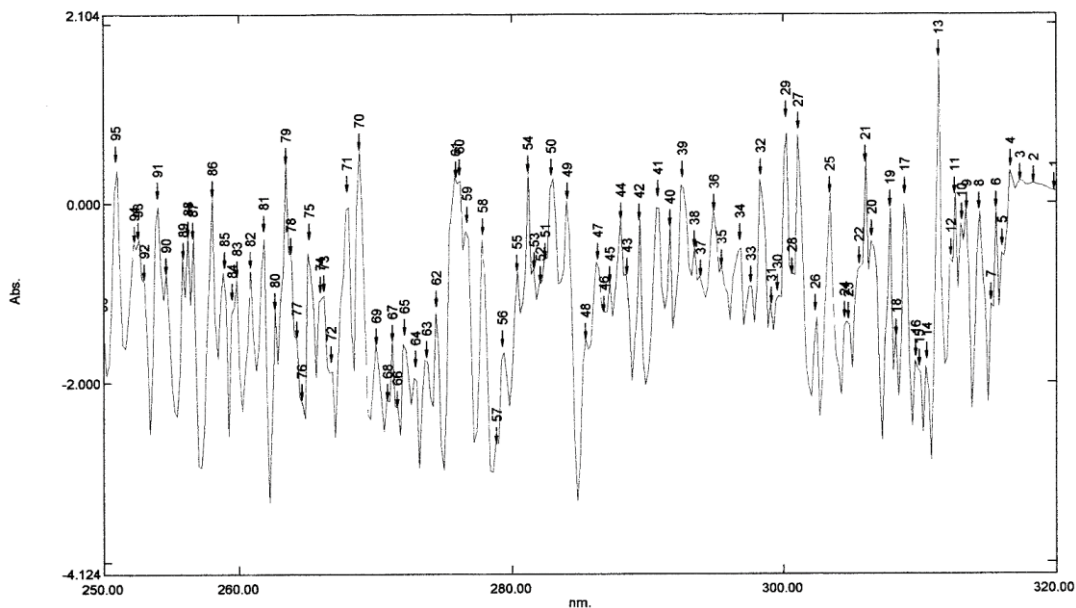


Fig:2 UV Spectrum of ethanolic leaf extract of *A. paniculata*

Table 1: UV spectroscopy of ethanolic leaf extract of *A.paniculata*.

Sl. No.	Wavelength (nm)	Abs.	Compound	Types of Flavonoids
1.	320.00	0.135	Ketone	
2.	319.00	0.190	Acetophenone	
3.	315.00	-2.216	Acrolein, Quinoline, 2 nitro furan	
4.	312.00	-1.710	Naphthalene	
5.	300.00	0.502	Nitrosobutane	
6.	294.00	-0.952	Thiophene	
7.	293.00	-0.717	Acetaldehyde	
8.	292.00	-1.115	Aldehyde(-CHO)	Flavone &Fistein
9.	290.00	-1.875	Pyrrrole 2- aldehyde	
10.	289.00	-1.570	3°Amine, Polyene(β -Carotain)	Qucercetin&Fisetin
11.	288.00	-0.181	Quinoline, Pyrrole, 3°amine,Polyene(β -Carotain)	Qucercetin
12.	287.00	-1.216	Amide group (protein)	
13.	286.00	-1.032	Naphthalene	
14.	285.00	-2.884	C=O, Amino group(Aniline)	
15.	284.00	0.022	Ketone(C=O) &Aldehyde(CHO)	Flavone &Fistein
16.	283.00	0.266	Ketone(C=O) &Aldehyde(CHO)	Flavone &Fistein

17.	282.00	-0.901	Styrene, Ketone(C=O), Aldehyde (-CHO) group	Flavone &Fistein
18.	281.00	-0.717	Aldehyde (-CHO) group, Ketone(C=O)	Flavone &Fistein
19.	280.00	-1.904	Benzaldehyde, Nitro Benzene, Benzene,2 Methyl-2-nitropropane, Ketones(C=O) group	Flavone &Fistein
20.	278.00	-0.837	Acetophenone, Ketones(C=O) group	Flavone &Fistein
21.	275.00	-2.970	Nitromethene	
22.	274.00	-2.173	-R-NO ₂	
23.	273.00	-1.986	Alkene group (Naphthalene)	
24.	270.00	-1.572	Acetone, Phenol, Benzoic acid, Quinoline, Thiophene, Octyl nitrate	Quercetin& Anthocyanin
25.	265.00	-0.554	Carbon tetrachloride	
26.	262.00	-2.174	Toluene	
27.	256.00	-1.039	Anthracene	Flavone
28.	255.00	-2.010	Benzene	
29.	254.00	-0.035	1,3,5 Hexatriene	
30.	252.00	-0.941	Furan, Pyrrole 2-aldehyde	

3.2 FT-IR Spectroscopy

The FT-IR spectrum of ethanolic extract of *A. paniculata* leaf shows the peak at 630.86 cm⁻¹ indicates the presence of alkyne, C-H bending vibrations and quercetin. The sharp peak at 879.59cm⁻¹ is due to aromatic substitution, gem distributed, olefinic groups. This peak again confirms the presence of quercetin. The very sharp peak at 1046.55cm⁻¹ allows the appearance of sulfur compound, S=O stretching vibrations, thiocarbonyl group sulfoxides and NaQSA [Sodium Salts of Quercetin 5' Sulfonic Acid]. The presence of sulfur compound, thiocarbonyl and NaQSA [Sodium Salts of Quercetin 5' Sulfonic Acid] further supported by the strong peak at 1086.49cm⁻¹. Sulfur compound prominently active against microbes. The FT-IR spectrum shows the peak at 1273.49 cm⁻¹ specifies the existence of C-N stretching, C-O stretching vibration and aliphatic amine, secondary alcohol functional group. Myricetin (flavonoids) with the functional group of nitro or sulfur compounds, gem- dimethyl group, tertiary alcohol, phenol is indicated by the C-CH₃ bending, C-O stretching vibration peak at 1381.53cm⁻¹. The characteristic peaks at 1452.47cm⁻¹ and 2975.03cm⁻¹ point out the presence of C-H bending & C-H stretching respectively and indicates the alkanes functional group. The peak at 1646.37cm⁻¹ shows -C=C- stretching vibration, alkenes and non-

conjugated diene functional group. The peaks 1743.74cm^{-1} and 2928.53cm^{-1} represent the C=O stretching and C-H stretching bonding, carbonyl and cycloalkanes functional group consequently. There is a clear hump at 3391.75cm^{-1} is corresponding to primary amides functional group and N-H stretching, O-H stretching vibrations. FT-IR spectrum of *A.paniculata* leaf reveals the presence of three types of flavonoids viz. quercetin, NaQSA [Sodium Salts of Quercetin 5' Sulfonic Acid], myricetin (Fig: 3, Table: 2). Furthermore, the peak at $800\text{-}600\text{cm}^{-1}$ & $1400\text{-}1000\text{cm}^{-1}$ also indicate the presence of halogen compounds C-Cl stretching & C-F stretching vibration respectively.

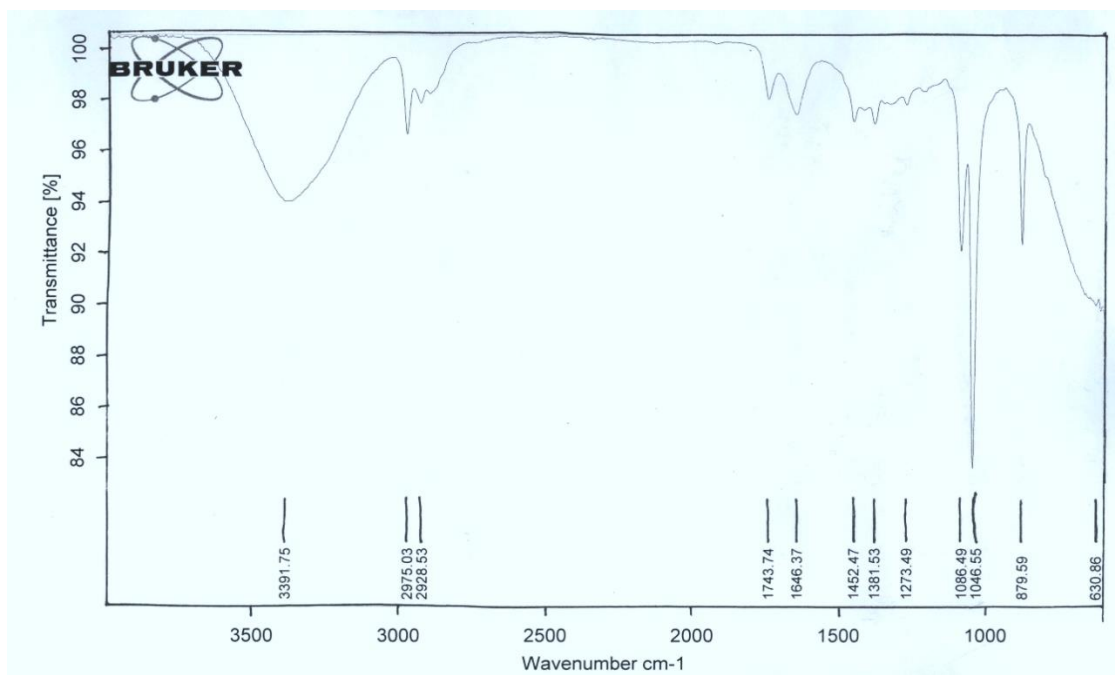


Fig 3: FT-IR Spectrum peaks of ethanolic leaf extract of *A. paniculata*

Table 2: FT-IR spectroscopy of ethanolic leaf extract of *A. paniculata*

Sl no.	Peak value (cm^{-1})	Bonding Types	Functional group	Types of Flavonoids
1.	630.86	C-H bending	Alkyne	Quercetin
2.	879.59	C-H bending vibration	Aromatic Substitution, gem distributed, Olefinic group	Quercetin
3.	1046.55	S=O stretching vibration	Sulfur compounds, Sulfoxides, Thiocarbonyl group	NaQSA
4.	1086.49	S=O stretching vibration	Sulfur compounds, Thiocarbonyl group	NaQSA
5.	1273.49	C-N stretching C-O stretching	Aliphatic amine Secondary alcohol	

6.	1381.53	C-CH ₃ bending C-O stretching	Nitro or Sulfur compounds, gem-dimethyl group, tertiary alcohol, Phenols	Myricetin
7.	1452.47	C-H bending	Alkanes	
8.	1646.37	-C=C- stretching N=O stretching	Alkenes, Non conjugated diene, O-NO ₂	
9.	1743.74	C=O stretching	Carbonyl, Cyclopentanone, Saturated Esters	
10.	2928.53	C-H (stretching in CH ₃)	Cycloalkanes	
11.	2975.03	C-H Stretching	Alkanes	
12.	3391.75	N-H stretching O-H stretching	Primary amides, Alcohols	
800-600(cm ⁻¹)C-Cl stretching, 1400-1000(cm ⁻¹)C-F stretching				

4. CONCLUSION

The results of the analysis give the introductory knowledge as a potential source of drugs to determine the chemical composition of *A. paniculata* leaf. The presence of chromophoric groups, functional groups and flavonoids are mainly contributed in the medicinal utilities of the plant. The present study enhances the traditional usage of *A. paniculata* which possess several known and unknown bioactive compounds. By isolating and identifying these bioactive compounds new noble drugs can be formulated to treat various diseases.

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CONFLICT OF INTEREST

No conflict of interest exists.

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