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IDENTIFICATION OF GREEN SEAWEEDS FROM SOUTHERN COAST OF TAMIL NADU USING SPECTROPHOTOMETRIC STUDIES

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ABSTRACT

The present study was aimed to produce the biochemical maraker using UV-vis analysis and distinguish the morphologically similar green seaweeds using the UV-Vis spectroscopic profile. The crude extracts of *Caulerpa corynephora, Caulerpa scalpelliformis, Chaetomorpha antennia, Enteromorpha compressa, Halimeda macroloba, Ulva fasciata* and *Ulva lactuca* were scanned in the wavelength ranging from 200-1100 nm using Perkin Elmer spectrophotometer and the characteristic peaks were observed and recorded. The qualitative UV-Vis spectroscopic profile of selected green seaweeds extracts was illustrated. The green seaweeds extracts spectrums displayed the metabolites and functional compounds presence at specific nm with varied absorption values. In the present study, the UV-Vis profile for the selected seven green seaweeds was evolved. Thus the present studies on these seaweeds were exhibited novel markers in standardization as useful analytical tools to check not only the quality of the powder but also the presence of adulterants in ayurvedic drugs.

KEYWORDS: UV-Vis; Spectroscopic; Phytoconstituents; Biochemical marker

INTRODUCTION

For centuries, seaweed has been of botanical, industrial and pharmaceutical interest. In recent years research on the chemistry of seaweeds has experienced a tremendous increase due to the need for compounds possessing bioactivities of possible pharmaceutical applications or other potential economic properties (Troell *et al*., 2006; Leary *et al*., 2009; Hela *et al*., 2011; Prabha *et al*., 2013; Papenfus *et al*., 2013). Seaweeds offer a wide range of therapeutic possibilities both internally and externally. Seaweeds have extensive profile source of secondary metabolites. A number of biologically active compounds with varying degrees of action, such as antitumour, anticancer, cytotoxic (Mayer, 1999; Mayer and Lehmann, 2001; Mayer and Gustafson, 2003; 2004; 2006 and 2008). Anti-microtubule, antiproliferative photoprotective, as well as antibiotic and antifouling properties have so far been isolated from marine sources (Villa *et al*., 2010; Mayer *et al*., 2007; Blunt *et al*., 2011). To validate the medicinal values of seaweeds, it is important to study the primary and secondary metabolites of seaweeds. A variety of

techniques can be used to determine and esti mate the presence of such phytoconstituents in medicinal plants. Chromatography and spectroscopic te chniques are the most useful and popular tools used for this purpose. Recent days the modern analytical techniques such as fluorescence, UV-Vis, FT-IR, HPLC, HPTLC and GC-MS are employed for quality assessment in the pharmaceutical industries. The spectroscopic techniques are employed to distinguish the morpholigically similar plants, standardization of plant products using chemical markers are accepted as a strategy for identification and evaluation of the quality of plant derived medicines (Farnsworth *et al*., 1985). This leads the scientist to develop simple, cost-effective and rapid method to detect the phyto constitutents' presence in the plants. Spectroscopic (UV-Vis, FTIR) methods together or separate can be used in this sense as well as conventional methods. With this knowledge the present study was aimed to distinguish the green seaweeds using the UV-Vis spectroscopic profile.

MATERIALS AND METHODS

For the phytochemical analysis, the seaweeds were collected by handpicking. The collected samples were cleaned well with sea water to remove all the extraneous matter such as epiphytes, sand particles, pebbles and shells and brought to the laboratory in plastic bags. The collected samples were then thoroughly washed with tap water followed by distilled water. The washed seaweeds were blotted on the blotting paper and spread out at room temperature in shade to remove the excess water contents. The shade dried samples were ground to fine powder using

mechanical grinder. The powdered samples were stored for further use

Preparation of extracts

The dried and powered seaweed materials (30 g) were extracted successively with 180 ml of hexane, petroleum ether, chloroform and ethanol by using Soxhlet extractor for 8 hrs at a temperature not exceeding the boiling point of the solvent. The aqueous extract was prepared by directly boiling the powder with distilled water. The extracts were filtered using Whatman filter paper (No.1) and then concentrated in vacuum at 40ºC using Rotary evaporator. The residues obtained were stored in a freezer -20º C until further tests.

UV-Visible spectral analysis

To find out the metabolites and functional group present in the crude extracts, the UV-Vis spectroscopic analysis was carried out using Perkin Elmer spectrophotometer. The crude extracts of *Caulerpa corynephora, Caulerpa scalpelliformis, Chaetomorpha antennia, Enteromorpha compressa, Halimeda macroloba, Ulva fasciata* and *Ulva lactuca* were scanned in the wavelength ranging from 200-1100 nm using Perkin Elmer spectrophotometer and the characteristic peaks were observed and recorded. The UV-Vis analysis was repeated twice and confirmed the spectrum. The peak values of UV-Vis were used to distinguish the selected seaweeds.

RESULTS

UV-Vis analysis of *C. corynephora*

The qualitative UV-Vis fingerprint profile of different extracts of *C. corynephora* was selected at the wavelengths from 190 to 1100 nm due to sharpness of the peaks and proper baseline. The qualitative UV-Vis spectroscopic profile of aqueous extract of *C.corynephora* was illustrated in Fig. 1. The spectrum showed the metabolites /functional groups at the nm of 382.98, 557.01, 674.17 and 888.75 with the absorption at 0.125, 0.104, 0.100 and 0.109 (1 A). The qualitative UV-Vis spectroscopic profile of ehanolic extract of *C. corynephora* was demonstrated in Fig. 1 B. The spectrum demonstrated the metabolites / functional groups at the nm of 230.94, 430.04, 461.58, 662.84 and 980.91 with the absorption of 0.132, 0.135, 0.134, 0.122 and 0.102 respectively. The qualitative UV-Vis spectroscopic profile of chloroform extract of *C. corynephora* was shown in Fig. 1 C. The spectrum displayed the metabolites / functional groups at the nm of 430.87, 458.20 and 664.07 with the absorption of 1.028, 0.967 and 0.601 respectively. The qualitative UV-Vis spectroscopic profile of petroleum ether extract of *C. corynephora* was displayed in Fig. 1 D. The spectrum showed the metabolites / functional groups at the nm of 409.86, 666.54 and 702.59 with the absorption of 0.216, 0.180 and 0.147 respectively. The qualitative UV-Vis

spectroscopic profile of hexane extract of *C. corynephora* was exhibited in Fig. 1 E. The spectrum showed the metabolites / functional groups at the nm of 210.95, 216.18, 220.15, 408.88 and 669.06 with the absorption of 0.244, 0.186, 0.175, 0.123 and 0.100 respectively.

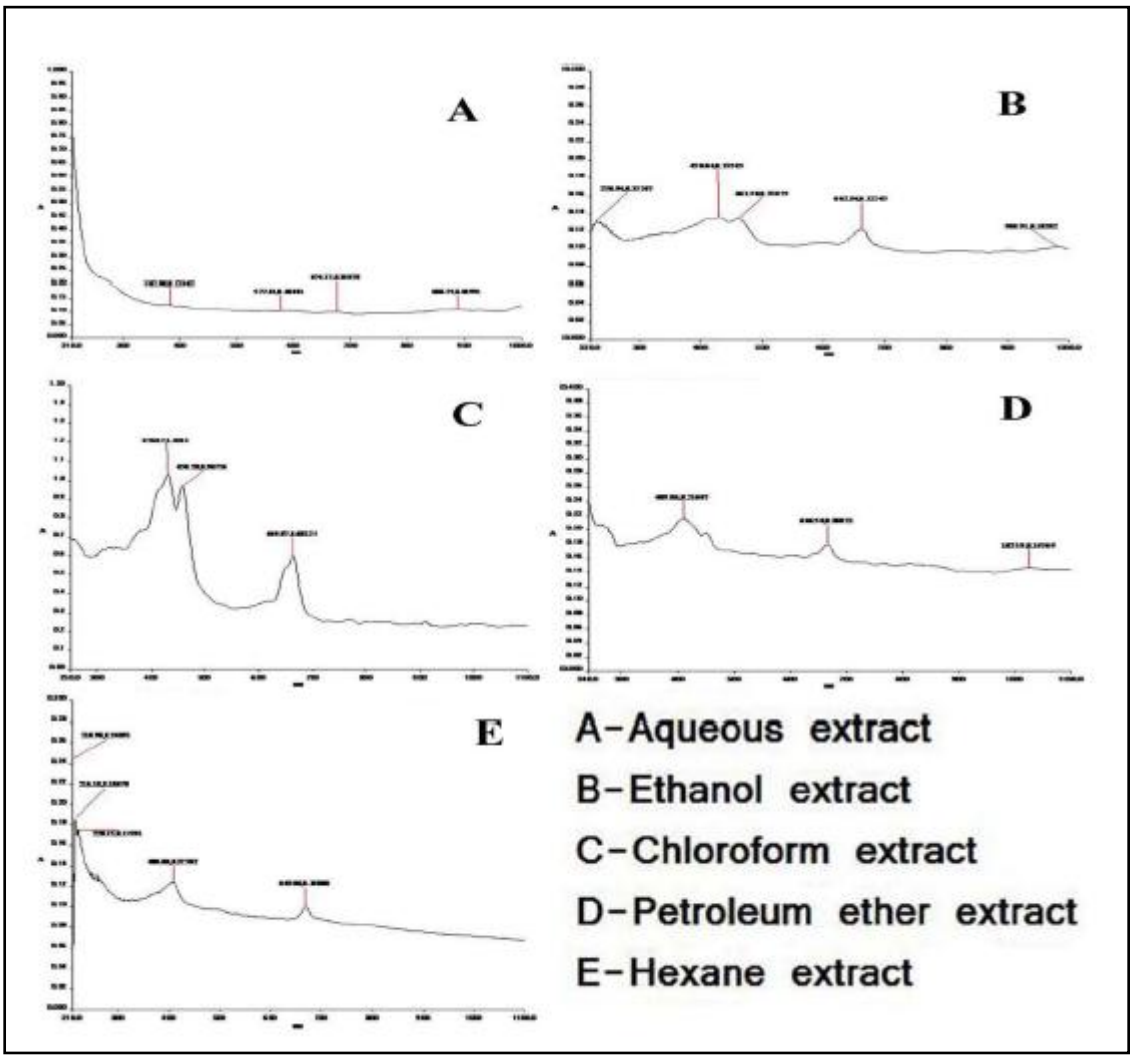

Fig. 1: UV-Vis spectrum of different extracts of *C. corynephora*

UV-Vis analysis of *C. scalpelliformis*

The qualitative UV-Vis spectroscopic profile of different extracts of *C.scalpelliformis* was selected at the wavelengths from 190 to 1100 nm due to sharpness of the peaks and proper baseline. The qualitative UV-Vis fingerprint profile of chloroform extract of *C. scalpelliformis* was illustrated in Fig. 2. The profile showed the metabolites / functional compounds at the nm of 325.83, 381.06, 415.66, 459.45 and 666.10 with the absorption at 0.724, 0.878, 1.110, 0.876 and 0.628 (Fig. 2 C). The qualitative UV-Vis spectroscopic profile of aqueous extract of *C. scalpelliformis* was demonstrated in Fig. 2 A. The spectrum showed the metabolites / functional compounds at the nm of 196.35, 331.99,

725.00, and 736.00 with the absorption of 0.062, 0.061, 0.088, and 0.051 respectively. The qualitative UV-Vis spectroscopic profile of hexane extract of *C. scalpelliformis* was showed in Fig. 2 E. The spectrum showed the metabolites / functional compounds at the nm of 332.04, 352.03, 409.96 and 669.41 with the absorption of 0.068, 0.067, 0.078 and 0.070 respectively. The qualitative UV-Vis spectroscopic profile of ethanolic extract of *C. scalpelliformis* was displayed in Fig. 2 B. The spectrum displayed the metabolites / functional compounds at the nm of 233.26, 411.47 and 663.66 with the absorption of 0.121, 0.127 and 0.088 respectively. The qualitative UV-Vis spectroscopic profile of petroleum ether extract of *C. scalpelliformis* was exhibited in Fig. 2 D. The spectrum demonstrated metabolites / functional compounds at the nm of 407.52 and 669.03 with the absorption of 0.203 and 0.164 respectively.

UV-Vis analysis of *C. antennia*

The qualitative UV-Vis spectroscopic profile of different extracts of *C. antennia***,** were selected at the wavelengths from 190 nm to 1100 nm due to sharpness of the peaks and proper baseline. The qualitative UV-Vis spectroscopic profile of aqueous extract of *C. antennia* was illustrated in Fig. 3. The spectrum displayed the metabolites / functional compounds at the nm of 196.02, 334.03, 340.07, 382.53 and 701.02 with the absorption at 1.126, 0.238, 0.230, 0.213 and 0.186 (Fig. 3A). The qualitative UV-Vis spectroscopic profile of chloroform extract of *C. antennia* was demonstrated in Fig. 3 C. The spectrum showed the metabolites / functional compounds at the nm of 382.94, 414.58, 507.50, 608.04 and 667.71 with the absorption of 0.657, 0.963, 0.208, 0.167 and 0.438 respectively. The qualitative UV-Vis spectroscopic profile of petroleum ether extract of *C. antennia* was showed in Fig. 3 D. The spectrum demonstrated the metabolites / functional compounds at the nm of 328.16, 408.98 and 668.15 with the absorption of 0.088, 0.092 and 0.062 respectively. The qualitative UV-Vis spectroscopic profile of hexane extract of *C. antennia* was displayed in Fig. 3 E. The spectrum showed the metabolites / functional compounds at the nm of 332.03, 409.94 and 669.05 with the absorption of 0.031, 0.028 and 0.019 respectively. The qualitative UV-Vis spectroscopic profile of ethanolic extract of *C. antennia* was exhibited in Fig. 3 B. The spectrum showed the metabolites / functional compounds at the nm of 410.98 and 665.79 with the absorption of 0.385 and 0.166 respectively.

UV-Vis analysis of *E. compressa*

The qualitative UV-Vis spectroscopic profile of various extracts of *E. compressa* were selected at the wavelengths from 190 nm to 1100 nm due to sharpness of the peaks and proper baseline. The qualitative UV-Vis spectroscopic profile of aqueous extract of *E.*

compressa was illustrated in Fig. 4. The spectrum showed the metabolites / functional compounds at the nm of 256.07, 380.95, 625.39 and 900.50 with the absorption at 0.308, 0.050, 0.026 and 0.020 (Fig. 4A). The qualitative UV-Vis spectroscopic profile of ethanolic extract of *E. compressa* was demonstrated in Fig. 4 B. The spectrum displayed the metabolites / functional compounds at the nm of 229.99, 232.28 and 273.23 with the absorption of 0.296, 0.248 and 0. 278 respectively. The qualitative UV-Vis spectroscopic profile of hexane extract of *E. compressa* was showed in Fig. 4 C. The profile explained the metabolites / functional compounds at the nm of 259.96 with the absorption of 0.460. The qualitative UV-Vis spectroscopic profile of chloroform extract of *E. compressa* was displayed in Fig. 4 D. The spectrum showed the metabolites / functional compounds at the nm of 220.99, 261.01 and 361.01 with the absorption of 0.026, 0.010 and 0.098 respectively. The qualitative UV-Vis spectroscopic profile of petroleum ether extract of *E. compressa* was exhibited in Fig. 4 E. The spectrum displayed the metabolite / functional compound at the nm of 244.48 with the absorption of 0.011.

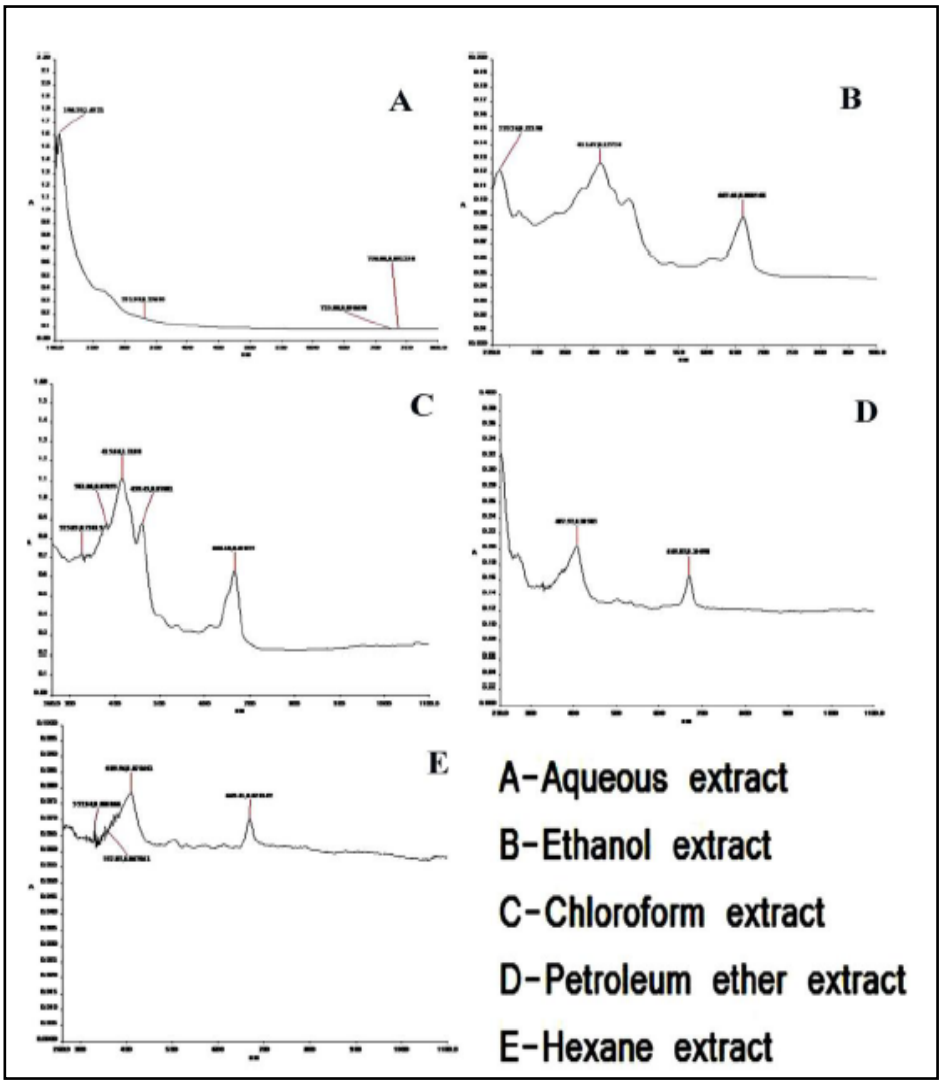

Fig. 2: UV-Vis spectrum of different extracts of *C. scalpelliformis*

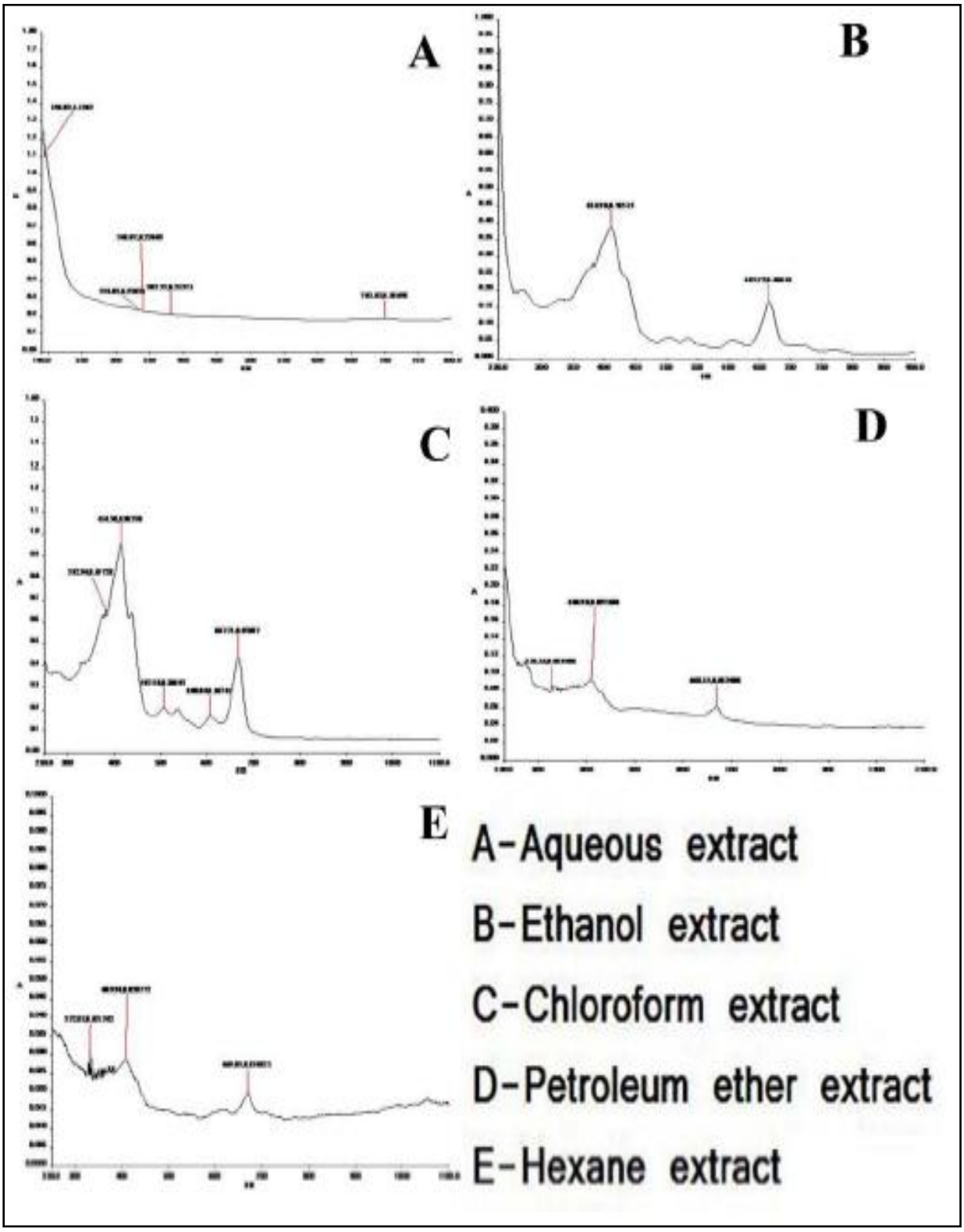

Fig. 3: UV-Vis spectrum of different extracts of *C. antennia*

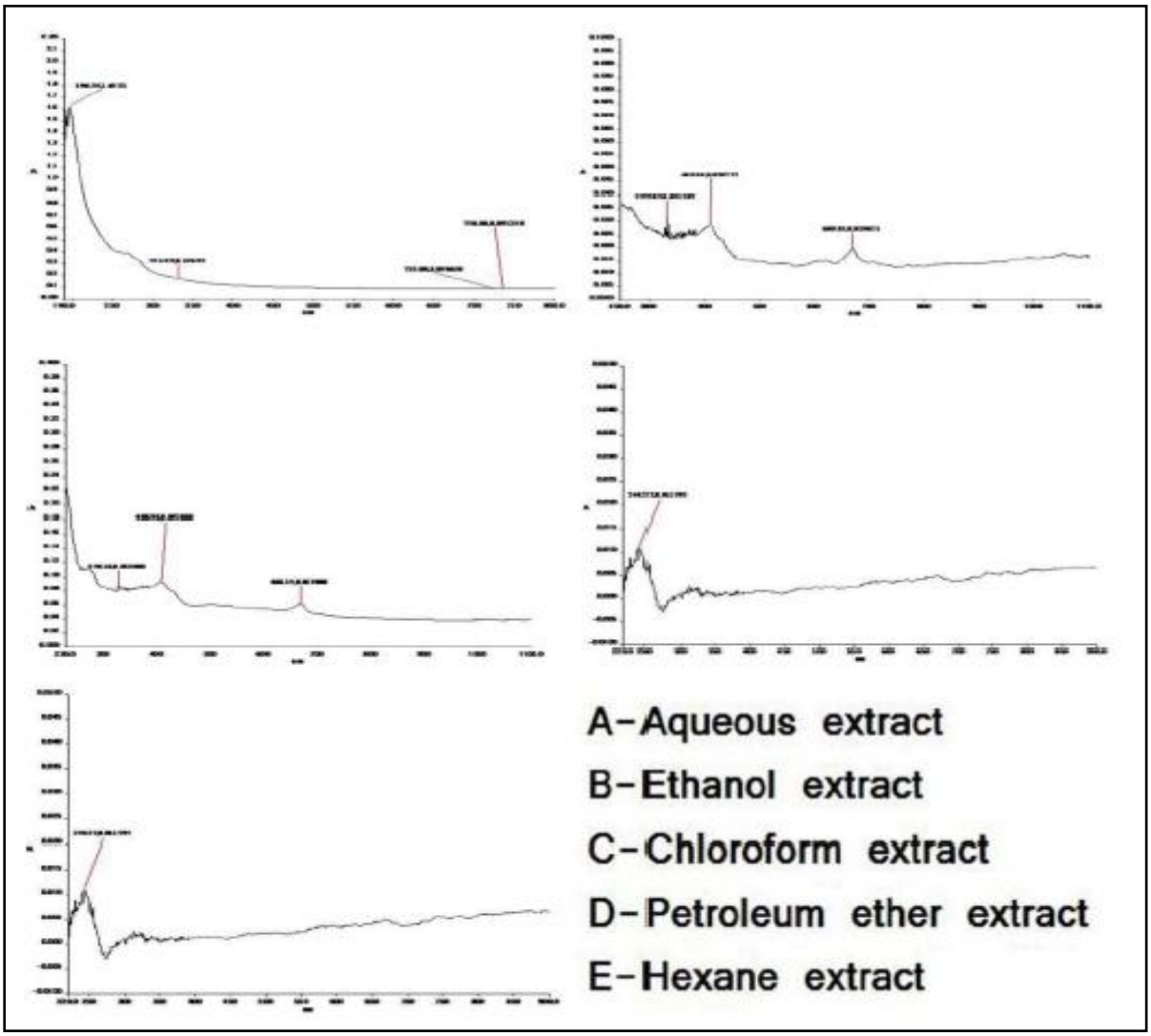

Fig. 4: UV-Vis spectrum of different extracts of *E. compressa*

UV-Vis analysis of *H. macroloba*

The qualitative UV-Vis spectroscopic profile of different extracts *of H. macroloba* were selected at the wavelengths from 190 nm to 1100 nm due to sharpness of the peaks and proper baseline. The qualitative UV-Vis spectroscopic profile of aqueous extract of *H. macroloba* was illustrated in Fig. 5. The spectrum showed the metabolites / functional compounds at the nm of 328.09, 334.86, 378.08 and 809.03 with the absorption at 0.142, 0.141, 0.130 and 0.119 (Fig. 5 A). The qualitative UV-Vis spectroscopic profile of chloroform extract of *H. macroloba* was demonstrated in Fig. 5 C. The spectrum showed the metabolites / functional compounds at the nm of 335.07, 432.05, 459.47 and 664.12 with the absorption of 1.292, 1.446, 1.416 and 0.964 respectively. The qualitative UV-Vis spectroscopic profile of petroleum ether extract of *H. macroloba* was illustrated in Fig. 5 D. The spectrum displayed the metabolites / functional compounds at the nm of 222.06, 226.04 and 228.90 with the absorption of 0.197, 0.153 and 0.152 respectively. The qualitative UV-

Vis spectroscopic profile of hexane extract of *H. macroloba* was displayed in Fig. 5 E. The spectrum showed the metabolites / functional compounds at the nm of 267.01, 329.06 and 351.05 with the absorption of 0.087, 0.085 and 0.083 respectively. The qualitative UV-Vis spectroscopic profile of ethanolic extract of *H. macroloba* was exhibited in Fig. 5 B. The spectrum displayed the metabolites / functional compounds at the nm of 328.13, 665.52 and 737.90 with the absorption of 0.176, 0.149 and 0.139 respectively.

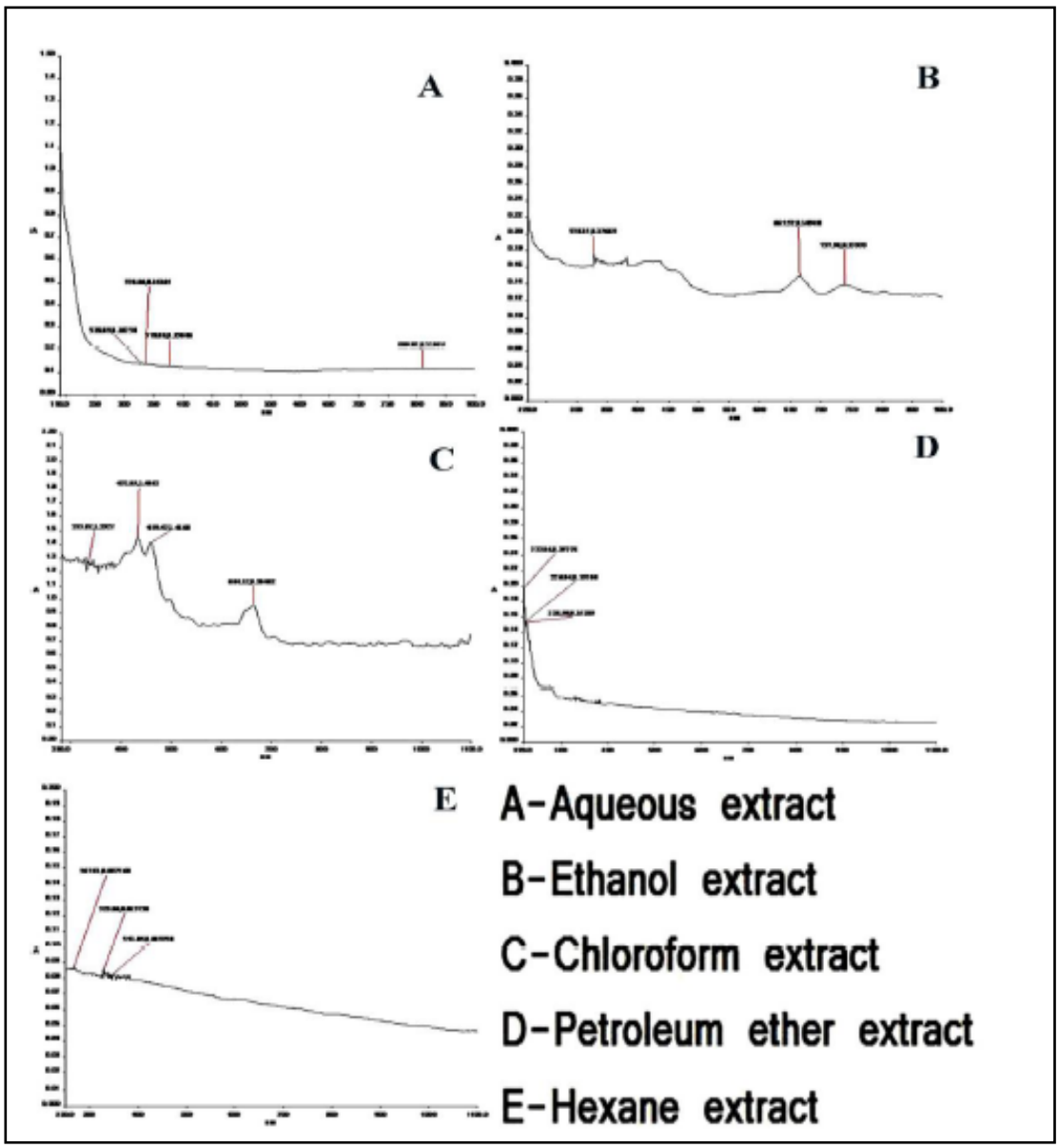

Fig. 5: UV-Vis spectrum of different extracts of *H. macroloba*

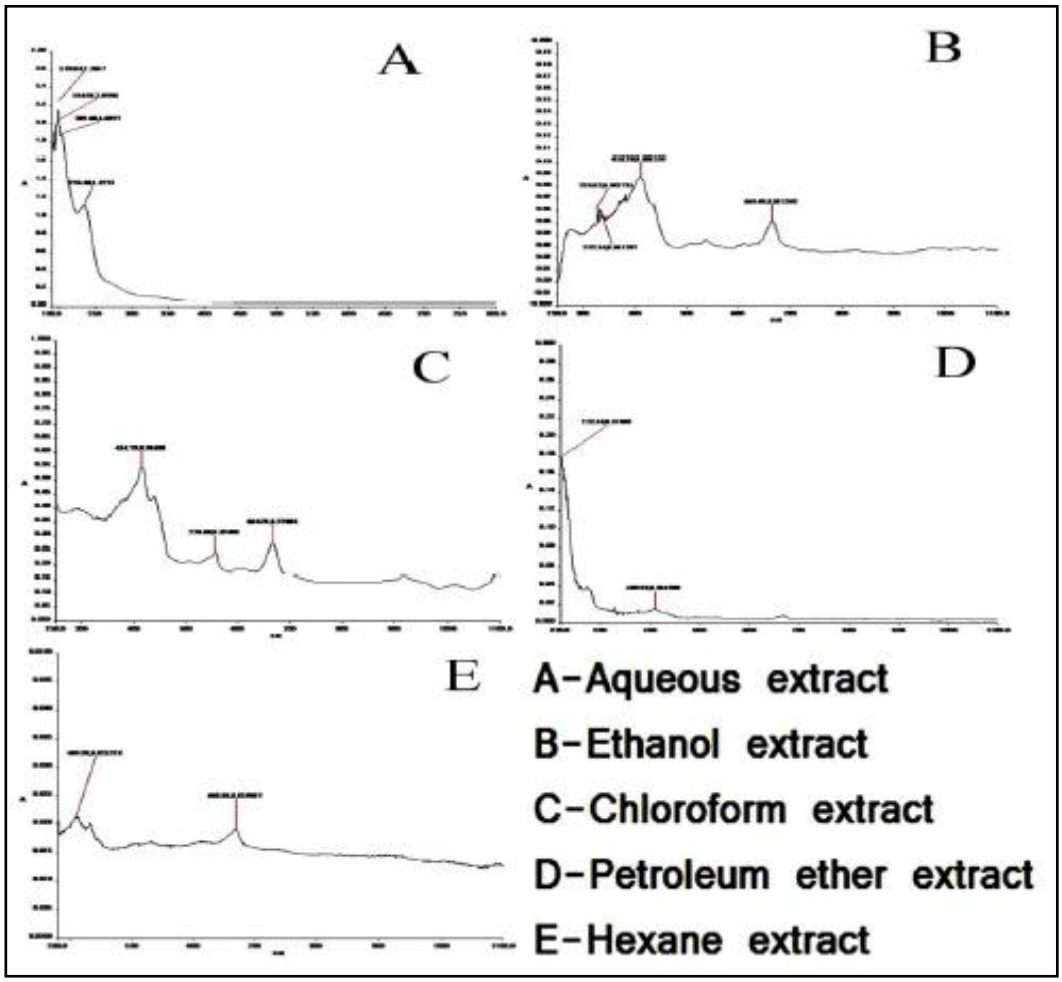

Fig. 6: UV-Vis spectrum of different extracts of *U. fasciata*

UV-Vis analysis of *U. fasciata*

The qualitative UV-Vis spectroscopic profiles of different extracts of *U. fasciata* were selected at the wavelength from 190 to 1100 nm due to sharpness of the peaks and proper baseline. The qualitative UV-Vis spectroscopic profile of aqueous extract of *U. fasciata* was illustrated in Fig 6. The spectrum displayed the metabolites and functional compounds at the nm of 196.38, 199.04, 203.68, and 234.46 with the absorption at 2.039, 2.246, 1.897, and 1.123 (Fig. 6 A). The qualitative UV-Vis spectroscopic profile of ehanolic extract of *U. fasciata* was demonstrated in Fig. 6 B. The spectrum showed the metabolites and functional compounds at the nm of 328.02, 333.14, 410.20, and 665.49 with the absorption of 0.062, 0.061, 0.088, and 0.051 respectively. The qualitative UV-Vis spectroscopic profile of chloroform extract of *U. fasciata* was illustrated in Fig. 6 C. The spectrum showed the metabolites and functional compounds at the nm of 414.79, 556.88, and 666.78 with the absorption of 0.546, 0.244 and 0.274 respectively. The qualitative UV-Vis spectroscopic profile of petroleum ether extract of *U. fasciata* was displayed in Fig. 6 D. The spectrum displayed the metabolites and functional

compounds at the nm of 222.14 and 409.98 with the absorption of 0.178 and 0.014 respectively. The qualitative UV-Vis spectroscopic profile of hexane extract of *U. fasciata* was exhibited in Fig. 6 E. The spectrum showed the metabolites and functional compounds at the nm of 409.98 and 668.86 with the absorption of 0.021 and 0.019 respectively.

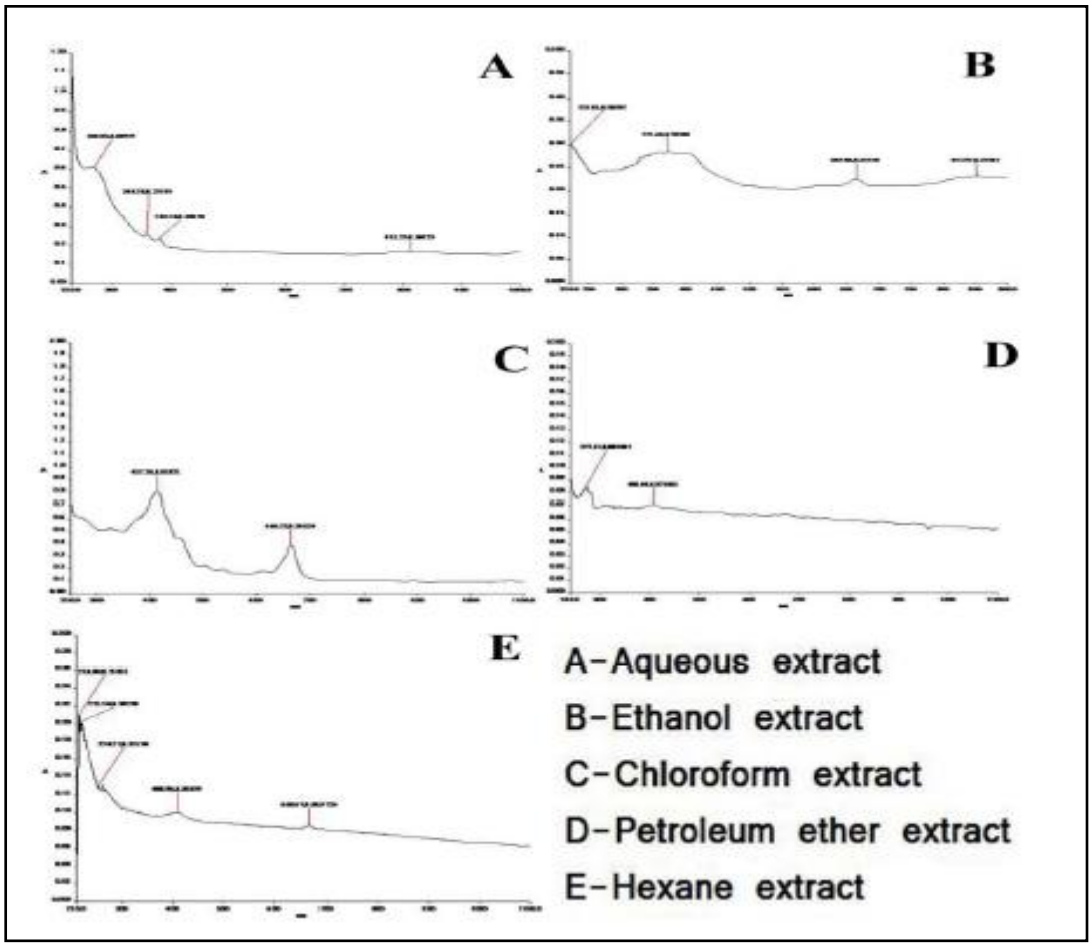

Fig. 7: UV-Vis spectrum of different extracts of *U. lactuca*

UV-Vis analysis of *U. lactuca*

The qualitative UV-Vis spectroscopic profile of different extracts of *U. lactuca* was selected at the wavelengths from 190 to 1100 nm due to sharpness of the peaks and proper baseline. The qualitative UV-Vis spectroscopic profile of aqueous extract of *U. lactuca* was illustrated in Fig. 7. The spectrum showed the metabolites and functional compounds at the nm of 268.84, 360.20, 382.76 and 811.25 with the absorption at 0.609, 0.253, 0.240 and 0.169 (Fig. 7 A). The qualitative UV-Vis spectroscopic profile of ehanolic extract of *U. lactuca* was demonstrated in Fig. 7 B. The spectrum displayed the metabolites and functional compounds at the nm of 222.01, 371.64, 665.06 and 852.95 with the absorption at 0.302, 0.285, 0.225 and 0.232 respectively. The qualitative UV-Vis

spectroscopic profile of chloroform extract of *U. lactuca* was showed in Fig. 7 C. The spectrum showed the metabolites and functional compounds at the nm of 413.26 and 666.32 with the absorption of 0.810 and 0.386 respectively. The qualitative UV-Vis spectroscopic profile of petroleum ether extract of *U. lactuca* was displayed in Fig. 7 D. The spectrum displayed the metabolites and functional compounds at the nm of 273.13 and 408.04 with the absorption of 0.085 and 0.071 respectively. The qualitative UV-Vis spectroscopic profile of hexane extract of *U. lactuca* was exhibited in Fig. 7 E. The spectrum showed the metabolites and functional compounds at the nm of 216.04, 221.36, 254.27, 408.96 and 668.67 with the absorption of 0.210, 0.202, 0.131, 0.100 and 0.085 respectively.

DISCUSSION

In pharmacognosy, the phytochemical assessment is one of the important and vital tools for quality assessment, which includes preliminary phytochemical screening, chemoprofiling and marker compound analysis using modern analytical techniques such as fluorescence, UV-Vis, FT-IR, HPLC, HPTLC and GC-MS. The spectrometric and chromatographic screening methods could provide the needed preliminary observations to select crude plant extracts with potentially useful properties for further chemical and pharmacological investigations (Mathekaga and Meyer, 1998). Spectroscopic methods have become firmly established as a key technological podium for secondary metabolite profiling in both plant and other species (Fernie *et al.,* 2004). UV-Vis analysis can be used as effective markers in identifying authentic from its adulterants (Johnson and Krishnaveni, 2012; Krishnaveni and Johnson, 2012; Sahaya Sathish *et al.*, 2012; Janakiraman *et al.,* 2011). The crude extract was subjected to UV-Vis analysis for the identification of constituents present in crude extracts of seven green seaweeds viz., *Ulva fasciata, Caulerpa scalpelliformis, Halimeda macroloba, Enteromorpha compressa, Caulerpa corynephora* and *Ulva lactuca*. In the present study, the UV-Vis profile for the selected seven green seaweeds was evolved. Thus the present studies on these seaweeds were exhibited novel markers in standardization as useful analytical tools to check not only the quality of the powder but also the presence of adulterants in ayurvedic drugs.

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