ISSN 2581 – 4303

Available Online at www.ijpba.info
International Journal of Pharmaceutical & Biological Archives 2018; 9(2):85-90

RESEARCH ARTICLE

Phytochemical analysis and antioxidant activity in leaves of *Dodonaea viscosa* L.

C. Priyankadevi, A Arunprasath

Department of Botany, PSG College of Arts and Science, Coimbatore, Tamil Nadu, India

Received: 05 April 2018; Revised: 25 April 2018; Accepted: 27 June 2018

ABSTRACT

The present investigation was focused on the phytochemical screening, Fourier transform-infrared (FT-IR) spectral analysis, and antioxidant activity of *Dodonaea viscosa* using various organic solvent extracts. Ethanol and petroleum ether leaf extracts from the leaves *D. viscosa* were tested for the presence of phytochemical constituents, FT-IR analysis, and antioxidant was carried the qualitative analysis of phytoconstituents such as alkaloids, phenols, flavonoids, steroids, tannins, thiols, glycosides, resins, and saponins, and was richly present in petroleum ether and methanolic extracts compared to other extracts. The FT-IR spectrum showed the presence of carbonyls (C=O), phenol (C-O), thioethers (C-S), disulfides (S-S), normal polymeric O-H, phenolic compounds, and arylthio ethers. Plant extracts were screened for the antioxidant activity evaluating their 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical in scavenging ability. The total ascorbic acid content of the extracts was also evaluated. The results revealed that *D. viscosa* had the best DPPH scavenging activity with a value of ethanolic extract and was better than that of the standard ascorbic acid extract gave the highest ascorbic acid content of *D. viscosa*.

Keywords: *Dodonaea viscosa,* Fourier transform-infrared, leaf extract, phytochemistry, Sapindaceae.

INTRODUCTION

Almost all the medicinal plants available in the world have great potential sources for discovery as well as protection of new drugs of benefit to humankind. At present, there are a lot of approaches almost all the medicinal plants available in the world have great potential sources for available to reach for new biologically active ingredients in the medicinal plants for the preparation of safe drugs. Scientifically, many works have been expended to evaluate and discover new antioxidant, antimicrobial, and antifungal ingredients from different kinds of natural sources such as soil, microorganisms, animals, and plants. Different types of folk medicine or herbal medicine are among the most important resources. Check and need to check or systematic screening of these available traditional herbs may result in the discovery of novel effective bioactive compounds for the formulation of drug.

Phytochemicals are naturally occurring in the medicinal plants, leaves, vegetables, and roots that have defense mechanism and protect from various diseases. They are primary and secondary compounds. Chlorophyll, proteins, and common sugars are included in primary constituents and secondary compounds have terpenoid, alkaloids, and phenolic compounds.[17] Terpenoids exhibit various important pharmacological activities, i.e., anti-inflammatory, anticancer, antimalarial, inhibition of cholesterol synthesis, antiviral, and antibacterial activities.[20] Terpenoids are very important in attracting useful mites and consume the herbivorous insects.[15] Alkaloids are used as anesthetic agents and are found in medicinal plant.[13] The present study is aimed to analyze the phytochemical constituents and antioxidant activity of *Dodonaea viscose.*

MATERIALS AND METHODS

Collection of plant materials

The selected medicinal plant, *D. viscosa* L., was collected in hillock of Mudumalai hills located in Tamil Nadu - Kerala border near Kinathukadavu in Coimbatore district. The geographical position of the study area is located at 10°47’ N longitude and latitude is 76°55’E

***Corresponding Author:**
A Arunprasath,
Email: arunprasath@psgcas.ac.in

Preparation of extracts and phytochemical studies

The leaves were cleaned and shade dried. The dried leaf was ground into fine powder. The powder was subjected to extraction with petroleum ether, methanol using Soxhlet apparatus for 24 h, and extract was condensed to remove the solvent.[11] The petroleum ether and methanol extracts were subjected to preliminary phytochemical analysis tests to determine the group of secondary metabolites present in the powder followed by the method of Harborne.[12] The Fourier transform-infrared (FT-IR) spectrum analysis carried out in petroleum ether and methanol extracts.

Antioxidant analysis of *D. viscosa*

2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity

The antioxidant activity of the methanolic and ethanolic extraction of *D. viscose* was measured the method described by Brand Williams *et al*.[8]

RESULTS

Preliminary phytochemical analysis in leaves of *D. viscosa*

Preliminary phytochemical study on *D. viscosa* was carried out to find out the presence of phytochemical constituents *D. viscosa* is a small shrub, which is distributed in throughout India. The plants were also screened for antioxidant responses. In this phytochemical evaluation, initially, physical constants were evaluated for its presence as well as for its quantity. The petroleum ether and methanolic extracts were found to contain flavonoids, saponins, glycosides, steroids, and phenolic compounds. In the present study, leaves were collected for the preliminary phytochemical analysis FT-IR, and antioxidant work of the plant leaves was undertaken. The phytochemical constituents are mainly responsible for the medicinal properties of the plant. The leaves were extracted with Soxhlet apparatus using petroleum ether and methanol. The result is shown in the table. The compounds such as alkaloids, flavonoids, glycosides, steroids, phenols, tannins, saponins, and resins are the preliminary phytochemical present in this plant leaves. Maximum amount of all the compounds in leaves was present in methanolic extracts that the petroleum ether extracts. In leaves of *D. viscosa* showed more amount of phenolic content in Methanolic extract when compare to the other compounds [Table 1].

FT-IR spectrum analysis of *D. viscosa*

Result obtained shows that the *D. viscosa* leaf extract yield was higher when methanol was used as the extracting solvent; however, petroleum ether extract yield was the second methanol was used as the extracting solvent. On the hand, the result also indicated that there was variation in yield with other solvent used for extraction. The differences in the extract yields from the extracted plant materials in the present analysis might be attributed to the different availability of extractable components, resulting from the varied chemical composition of plant. The FT-IR spectroscopic analysis showed the presence of phytoconstituents. The FT-IR gives broad peaks at petroleum ether 3576, 3495, 3441, and 3205/cm. The Methanolic extract of D. viscosa showed 3687/cm, 3630/cm, 3529/cm, 3459/cm, 3190/cm, and 3143/cm which indicated the presence of OH stretching. The peak obtained at petroleum ether 3950 and 3344/cm. The Methanolic extract of D. viscosa showed stretch with 3390/cm which indicated the presence of N-H stretching. It gives a strong peak at petroleum ether 3896, 2920, and 2854/cm in methanol 2970 and 2854/cm which indicated the presence of C-H stretching. The peak obtained at the petroleum ether 1917 and 1720/cm. Methanol 3919, 3888, 3811, 3784, 3749, 1654/cm. The peak obtained at the petroleum ether 1917, 1720/cm methanol 3919, 3888, 3811, 3784, 3749, 1654/cm which indicated the presence of C=O stretching. The peak obtained at petroleum ether 3668, 1168, 1037/cm. Methanol 1215, 1145 /cm. Which indicated the presence C-N stretching. The peak obtained at petroleum ether 2360, 2306, 2129/cm. Methanol 2565, 2357/cm. Which indicated the presence of C≡N stretching. The peak obtained at petroleum ether 3722, 1257/cm. Methanol 157/cm which indicated the presence of N-O stretching. The peak obtained at petroleum ether 3792/cm. Which indicated the presence of N-H bend. The peak obtained at petroleum ether 3140/ cm. Methanol 3340, 3309/cm which indicated the presence of - C≡C=H stretching The peak obtained

at methanol 1076, 1006/cm. Which indicated the presence of =C-H bend. The peak obtained at petroleum ether 2773, 2708, 2619/cm. Methanol 2684, 2638/cm which indicated the presence of H-C-O stretching. The peak obtained at petroleum ether 2233/cm. Methanol 2333, 2303, 2256, 2160, 1963, 1917, 1886, 1843, 1806/cmwhich indicated the presence of -C≡C stretching. The peak obtained at petroleum ether 1558/cm which indicated the presence of C-C stretching. The peak obtained at petroleum ether 137, 729/cm. Methanol 1365/cm which indicated the presence of C-H rock. The peak obtained at petroleum ether 1257/cm. Methanol 1527 cm. which indicated the presence of N-O synthetic stretching. The peak obtained at petroleum ether 875, 786/cm methanol 798, 756/cmwhich indicated the presence of C-CL stretching. The peak obtained at petroleum ether 1454/cm. Methanol 1435/cm which indicated the presence of C-H bend [Table 2].

Antioxidant activity of *D. viscosa*

The antioxidant activities of *D. viscosa* leaf extract of methanol and ethanol extracts were assessed by DPPH activity. The DPPH activity of different concentrations methanol and ethanol extract (50–250 µg/ml) along with standard ascorbic acid is presented in the table. With the increasing concentrations, positive scavenging activity was noted. The percentage of scavenging activity is increasing with the increasing concentration in both the extracts. Among the five different concentration (50–250 µg/ml) of both extracts tested, the higher percentage of inhibition (90 ± 0.83) was observed in 250 µg/ml of ethanol extract followed by (67 ± 0.46) 250 µg/ml of methanol extract against the standard ascorbic acid (93 ± 0.40) followed by percentage of inhibition (88 ± 0.45) 200 µg/ml of ethanol extract and (63.8 ± 0.69) of methanol extract observed in 200 µg/ml against the standard ascorbic acid (90 ± 0.44) 200 µg/ml. From the result, when compare the scavenging activity, percentage of the ethanolic extract shows higher antioxidant activity [Table 2].

Table 1: Preliminary phytochemical analysis in leaves of ***Dodonaea viscosa***

Name of the secondary metabolite	Petroleum ether	Methanolic solvent
Alkaloids	_	_
Flavonoids	++	++
Saponins	_	++
Glycosides	++	++
Steroids	+	_
Phenols	+++	+
Tannins	_	_

++: Highly present, +: Present, _: Absent

DISCUSSION

Preliminary phytochemical analysis in leaves of *D. viscosa*

In phytochemical studies, it has evaluated in all extracts remarkable presence of steroids, flavonoids, tennis, and alkaloids. Others metabolites and bioactive compounds were identified such as saponosides and tannins. They are present in petroleum ether/methanol extracts, while they are absent in the other extracts [Table 1]. The presence of flavonoids in all extracts is likely to be responsible for the free radical scavenging.[6] All *D. viscosa* effects observed. Flavonoids are phenolic compounds and plant phenolics are a major group of compounds that act as primary antioxidants or free radical scavengers. All thymus satureioïde extracts were also revealed to contain steroids, which are known to produce an inhibitory effect on inflammation,[6] and alkaloids that have been reported to exert analgesic, antispasmodic, and antibacterial activities.[6] The phytochemical screening results of the extracts are consistent with the results reported by for *Thymus vulgaris* from Egypt. Arunprasath and Gomathinayagam[2] reported that maximum amount of all the

Table 2: Antioxidant DPPH activity of ***Dodonaea viscosa*** leaf extracts in different concentrations

Sample	0% of inhibition					Comparison of activity
	50 µg/ml	100 µg/ml	150 µg/ml	200 µg/ml	250 µg/ml	Ethanol>methanol
Ethanolic extract	81±0.58	83±0.67	85±0.89	88±0.45	90±0.83	
Methanolic extract	58.7±0.79	59.4±0.58	60±0.70	63.8±0.69	67±0.46	
Ascorbic acid	83±0.55	86±0.77	88±0.63	90±0.44	93±0.40	

DPPH: 2,2-diphenyl-1-picrylhydrazyl

compounds such as alkaloids, flavonoids, glycoside, steroids, phenols, tannins, saponins, and resins in leaves was present in methonolic extract that the petroleum ether extract.

FT-IR spectrum analysis of *D. viscosa*

FT-IR spectroscopic analysis in the different solvent extracts of *D. viscosa* has revealed the existence of various chemical constituents [Figures 1 and 2]. The absorption bands, the wavenumber (cm^{-1}) of prominent peaks obtained from absorption spectra, were described. FT-IR spectrum can be used to confirm the functional constituents present in the medicinal plant materials and also to evaluate the qualities of phytoconstituents.[23] The result of the present study FT-IR spectral analysis of *D. viscosa* spectrum reveals the presence of petroleum ether (35), methanol (43) peaks, which functional groups are present in large quantity. Many researchers applied the FT-IR spectrum as a tool for distinguishing the medicinal plant based on their chemical constituents.[3] Florence and Jeeva;[9] Florence *et al.* (2015); Lincy *et al.*;[19] and Joselin *et al*., 2013[17].

FT-IR spectroscopy has demonstrated to be a reliable and sensitive method for finding out the biomolecular composition of plant samples. FT-IR analysis of *D. viscosa* revealed that all functional groups. The study revealed that at temperatures below 200°C, hemicellulose in bamboo was decomposed and a large number of hydroxyl groups were dislocated from hemicellulose and cellulose, accompanied by the release of water; at

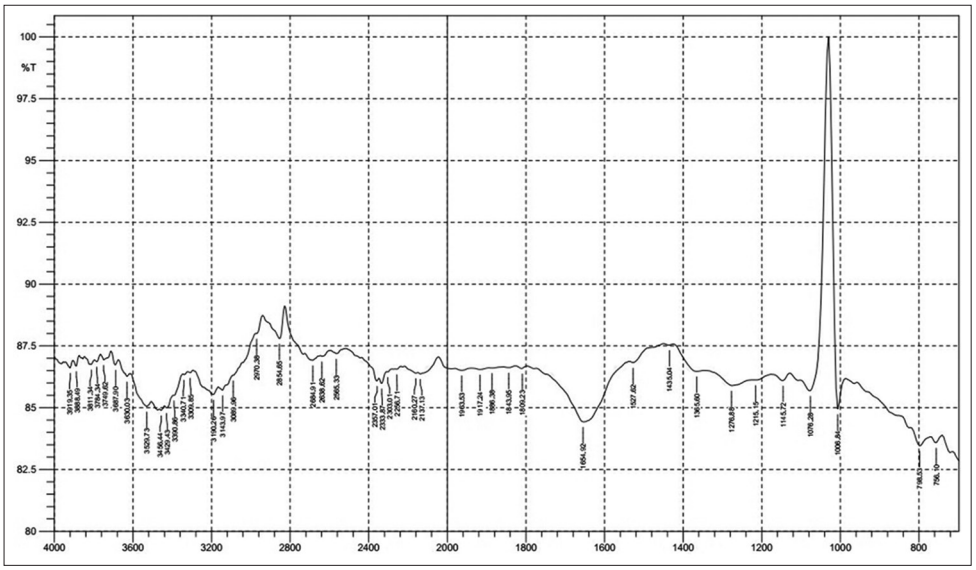

Figure 1: Fourier transform-infrared spectrum analysis in petroleum ether leaf extract of *Dodonaea viscosa*

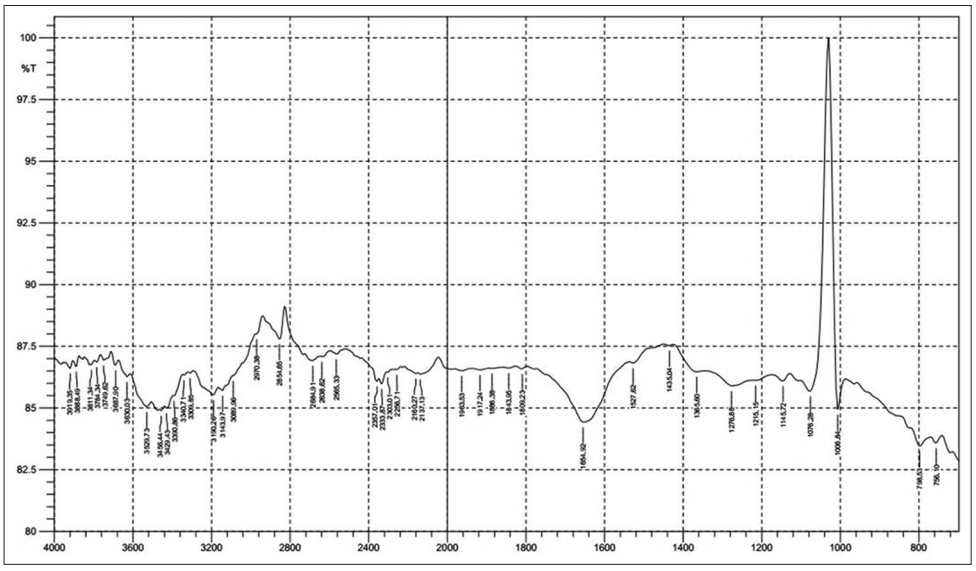

Figure 2: Fourier transform-infrared spectrum analysis in methanolic leaf extract of *Dodonaea viscosa*

200–250°C, cellulose in bamboo was drastically decomposed, whereas the net structure of lignin was stable, with the exception of the dislocation of methoxyl groups from lignin; at 250–400°C, the net structure of lignin collapsed, and above 400°C, more positions in aryl groups were substituted determined the structure and thermal property of alkaline hemicelluloses from steam-exploded *Phyllostachys pubescens* using FT-IR analysis. In a related study, phyllostadimers A and B, two bis-lignans in which the two lignan units are directly connected by a C–C bond, were isolated from stems of bamboo, *Phyllostachys edulis*, of these, compound phyllostadimer A significantly inhibited liposomal lipid peroxidation.[22] Plants have been a source of novel drugs as plant-derived medicines have made significant contributions toward human health as per the method of Florence *et al.,*[10] Joselin *et al.,*[14] and Sakthidevi *et al*. (2014). Antimicrobial properties of plants are due to various chemical compounds including volatile oils, alkaloids, tannins, and lipids present in the tissue.[14,24] Tanaka *et al.*[24] examined the antibacterial activity of *P. pubescens* (moso bamboo) shoot peel against *Staphylococcus aureus*, and suggested the possibility of deriving effective antibacterial compounds from bamboo shoot peel that are mostly discarded at present. The antibacterial activity is due to the active constituents, stigmasterol and dihydrobrassicasterol.[25] The leaf decoction of *D. strictus* is used as an abortifacient; the siliceous matter present in the leaves is used as a tonic and astringent by the Adi tribes of Arunachal Pradesh, India.

Antioxidant activity of *D. viscosa*

Antioxidants due to their scavenging activity are useful for the management of those diseases. DPPH stable free radical method is a sensitive way to determine the antioxidant activity of plant extracts.[16,18] Ascorbic acid acting as a chain-breaking antioxidant impairs with the formation of free radicals in the process of formation of intracellular substances throughout the body, including collagen, bone matrix, and tooth dentine.[4,1] The quantitative determination of ascorbic acid in plant extracts shows that they are good source of ascorbic acid. Antioxidant activity of the antioxidants is concerning with those compounds capable of protecting the organism system against the potential harmful effect of oxidative stress.[8]

Superoxide anion is one of the most representative free radicals. In cellular oxidation reaction, superoxide radicals have their initial effects magnified because they produce other kinds of cell-damaging free calls and oxidizing agent, for example, radio hydroxyl radicals. The phenolic compounds are one of the largest and most important group of plant metabolites groups of plant metabolic.[21] Flavonoids are effective antioxidant and show strong anticancer activities. The leaves of *D. viscosa* revealed that the presence of 3-D-galactoside of quercetin is a triterpenoid compound leads to anticancer activities. The plant extracts were also revealed to contain saponins, tannins, and steroids which are known to produce inhibitory effect on inflammation, ulcerated tissues just Gafner *et al*.[11] Steroids have been reported to have antibacterial properties.[7] Scavenging activity for free radicals of DPPH has been widely used to evaluate the antioxidant activity of natural products from plant and microbial sources. Plant extracts from 26 medicinal plants listed in Table 2 were prepared for investigation of their antioxidant activities. As the data shown in Table 3, the inhibitory effect of the five test plant extracts on DPPH radicals followed dose-dependent manner.

REFERENCES

1. Aqil F, Ahmad I, Mehmood Z. Antioxidant and free radical scavenging properties of twelve traditionally used Indian medicinal plants. Turkish J Biol 2006;30:177-83.
2. Arunprasath A, Gomathinayagam M. Qualitative study of *Costus speciosus* (Koen ex. Retz.) Sm. and its potentiality against human pathogenic microbes Int J Pharm Biol Arch 2014;5:93-8.
3. Asha V, Jeeva S, Paulraj K. Phytochemical and FT-IR spectral analysis of *Caralluma geniculata* Grev. et Myur. an endemic medicinal plant. J Chem Pharm Res 2014;6:2083-208.
4. Beyer RE. The role of ascorbate in antioxidant protection of biomembranes: Interaction with vitamin E and coenzyme Q. J Bioenerg Biomembr 1994;26:349-58.
5. Brand-Williams W, Cuvelier ME, Berset CL. Use of a free radical method to evaluate antioxidant activity. LWT Food Sci Technol 1995;28:25-30.
6. Chatoui K, Talbaoui A, Aneb M, Bakri B, Harhar H, Tabyaoui M. Phytochemical screening, antioxidant and antibacterial activity of *Lepidium sativum* seeds from Morocco. J Mater Environ Sci 2016;7:2938-2946.
7. Epand RF, Savage PB, Epand RM. Bacterial lipid

composition and the antimicrobial efficacy of cationic steroid compounds (Ceragenins). Biochim Biophys Acta (BBA)-Biomembr 2007;1768:2500-9.
8. Fernández-Agulló A, Pereira E, Freire MS, Valentao P, Andrade PB, González-Álvarez J, *et al*. Influence of solvent on the antioxidant and antimicrobial properties of walnut (*Juglans regia* L.) green husk extracts. Ind Crops Prod 2013;42:126-32.
9. Florence AR, Jeeva S. FTIR and GC-MS spectral analysis of *Gmelina asiatica* L. Leaves. Sci Res Rep 2015;5:125-36.
10. Florence AR, Joselin J, Jeeva S. Intra-specific variation of bioactive principles in select members of the genus *Clerodendrum* L. J Chem Pharm Res 2012;4:4908-14.
11. Gafner S, Wolfender JL, Nianga M, Hostettmann K. A naphthoquinone from *Newbouldia* laevis roots. Phytochemistry 1998;48:215-6.
12. Harborne JB. Phytochemical Methods of Analysis. Vol. 64. London: Jackmann and Hall; 1973. p. 190.
13. Hérouart D, Sangwan RS, Fliniaux MA, Sangwan-Norreel BS. Variations in the leaf alkaloid content of androgenic diploid plants of *Datura innoxia*. Planta Med 1988;54:14-7.
14. Joselin J, Brintha TS, Florence AR, Jeeva S. Screening of select ornamental flowers of the family *Apocynaceae* for phytochemical constituents. Asian Pac J Trop Dis 2012;2:S260-4.
15. Kappers IF, Aharoni A, Van Herpen TW, Luckerhoff LL, Dicke M, Bouwmeester HJ. Genetic engineering of terpenoid metabolism attracts bodyguards to Arabidopsis. Science 2005;309:2070-2.
16. Koleva II, Van Beek TA, Linssen JP, Groot AD, Evstatieva LN. Screening of plant extracts for antioxidant activity: A comparative study on three testing methods. Phytochem Anal 2002;13:8-17.
17. Krishnaiah D, Sarbatly R, Bono A. Phytochemical antioxidants for health and medicine a move towards nature. Biotechnol Mol Biol Rev 2007;2:97-104.
18. Kumar PS, Sucheta S, Deepa VS, Selvamani P, Latha S. Antioxidant activity in some selected Indian medicinal plants. Afr J Biotechnol 2008;7:1826-8.
19. Lincy ML, Mohan VR, Jeeva S. Preliminary phytochemical screening, gas chromatography mass spectrum and fourier transform infrared spectroscopy analysis of aerial part of *Maerua apetala* Roth (Jacobs). Chem Sci Rev Lett 2015;4:1275-84.
20. Mahato SB, Sen S. Advances in triterpenoid research, 1990-1994. Phytochemistry 1997;44:1185-236.
21. Singh R, Singh S, Kumar S, Arora S. Evaluation of antioxidant potential of ethyl acetate extract/fractions of *Acacia auriculiformis* A. Cunn. Food Chem Toxicol 2007;45:1216-23.
22. Suga A, Takaishi Y, Goto S, Munakata T, Yamauchi I, Kogure K. Two lignan dimers from bamboo stems (*Phyllostachys edulis*). Phytochemistry 2003;64:991-6.
23. Surewicz WK, Mantsch HH, Chapman D. Determination of protein secondary structure by Fourier transform infrared spectroscopy: A critical assessment. Biochemistry 1993;32:389-94.
24. Tanaka A, Kim HJ, Oda S, Shimizu K, Kondo R. Antibacterial activity of moso bamboo shoot skin (*Phyllostachys pubescens*) against *Staphylococcus aureus*. J Wood Sci 2011;57:542.
25. Tanaka A, Shimizu K, Kondo R. Antibacterial compounds from shoot skins of moso bamboo (*Phyllostachys pubescens*). J Wood Sci 2013;59:155-9.