



Isolation and Characterization of Quercetin from *Bambusa arundinacea*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Flavonoids are natural antioxidants that are formed from plants and found in meals such as fruits and vegetables. They have the capacity to bind to free radicals. Because of its abundant prevalence in foods, Quercetin, which belongs to the flavonol subclass of flavonoids, has gotten a lot of attention. Quercetin is also found in *Bambusa arundinacea*. The plant was obtained and authenticated. Further the isolation procedure was done and was analyzed via TLC, FT-IR, and UV, ¹H NMR, Mass and XRD Analysis. The results obtained from the above parameters showed the resemblance with standard quercetin. Thus it was concluded for the presence of quercetin from *Bambusa arundinacea*.

Keywords: Quercetin; *Bambusa arundinacea*; TLC, FT-IR, and UV, ¹H NMR; Mass; XRD.

1. INTRODUCTION

Quercetin is a flavonol, one of the six subclasses of flavonoid compounds [1]. Flavonoids are the

plant compounds having similar flavone backbone. They also occur as either glycosides (with attached sugars [glycosyl groups]) or as aglycones (without attached sugars) [2]. The

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IUPAC nomenclature for quercetin is (3,3',4',5,7-pentahydroxyflavanone (or its synonym 3,3',4',5,7-pentahydroxy-2-phenylchromen-4-one). This means that quercetin has an OH group attached at positions 3, 5, 7, 3', and 4' (Fig. 1). Quercetin occurs abundantly in many ethnic plants [3]. Quercetin has importance in terms of ethno pharmacology such as its use as antioxidant, anticancer and neuroprotective [4]. It has been reported as an efficient free radical scavenger (antioxidant) [3]. In clinical trials (phase-I), quercetin has been reported to exhibit inhibitory effect on tyrosine kinase which suggests that it has antitumor therapeutic potentials. Evidences have shown for the presence of quercetin in *Bambusa arundinacea* [5]. Thus in the present it was aimed for the Isolation and characterization of Quercetin from *Bambusa arundinacea*.

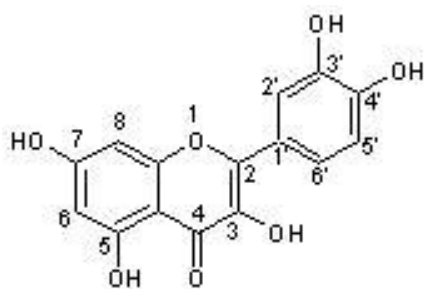


Fig. 1. Structure of quercetin

2. METHODS

2.1 Collection, Identification and Authentication of Plant Material

The plant *Bambusa arundinacea* was collected in the month of June from Yamuna biodiversity park, New Delhi. The formal authentication and identification was done in department of botany Ch. Charan Singh University, Meerut. The roots were allowed to air dry, away from sunlight. The dried material was grounded coarsely to a powder and transferred to labeled brown bottles until required.

2.2 Extraction Procedure

2.2.1 Isolation of Quercetin from *Bambusa arundinacea*

The coarsely powdered leaves of *Bambusa arundinacea* was subjected to hot extraction

process with ethanol (95%) for seventy two hours. The combined extracts were concentrated in rotary vacuum evaporator. A dark brown extract (125 g) obtained was chromatographed over silica gel (100-120 mesh) in a column using various solvents in order of increasing polarity. Elution of the column with petroleum ether: chloroform (1:1) gave 120 mg yellowish crystal of compound, which were recrystallized from pure chloroform (Fig. 2) [6,7].

3. RESULTS

3.1 Comparison between Isolated and Standard Quercetin parameters

Isolated and standard Quercetin is compared on different parameters like melting point, appearance, refractive index, density and UV absorbance. It was observed that all the parameters of isolated Quercetin resembles with standard Quercetin sample. Isolated Quercetin shows maximum absorbance at 210 nm which is similar to standard Quercetin reference.

3.2 Comparison between TLC of Isolated and Standard Quercetin

Thin layer chromatography of isolated and standard Quercetin was compared with each other in order to confirm the identity of isolated Quercetin. It was observed that both samples show R_f value 0.7, thus it confirms the identity of isolated compound.

3.3 Characterization of Isolated Quercetin

3.3.1 FT-IR spectroscopy

FT-IR spectra of quercetin is shown in Fig. The characteristic stretch C=O for quercetin occurs at ν : 1665 cm⁻¹. The C-O-H deformation mode was observed at ν : 1320 cm⁻¹ for quercetin. The slight shifting of stretching bands of C-O-C and C=O at ν : 1012, 1262 cm⁻¹ and ν : 1560 cm⁻¹. The O-H frequencies appeared in the range at ν : 3398-3335 cm⁻¹.

3.3.2 UV-visible spectroscopy

In UV-Visible spectra of quercetin, two absorption bands were observed at 377 nm (band I-cinnamoyl system) and 232 nm (band II-benzoyl system) like other flavanoids.

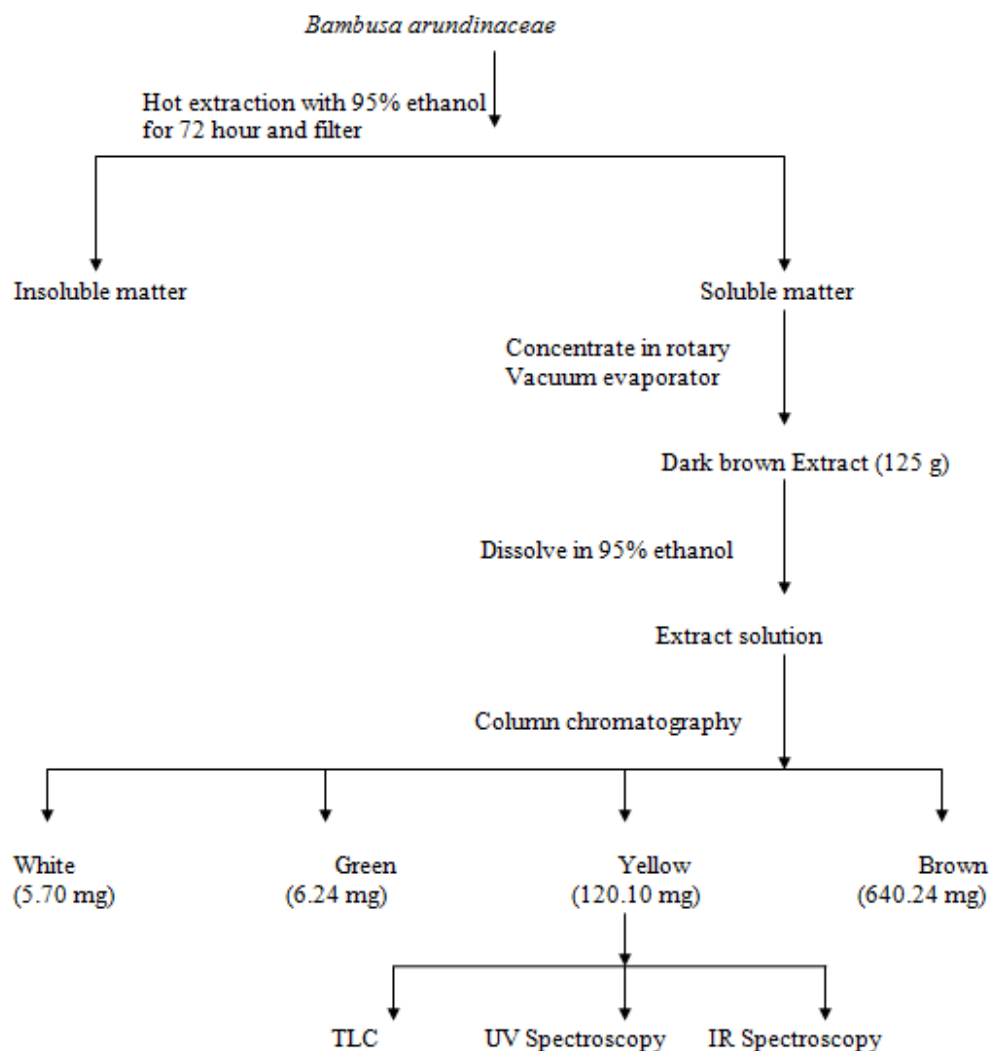


Fig. 2. Isolation procedures

Table 1. Comparative study between isolated and standard Quercetin parameters

Identification test	Isolated Quercetin	Standard Quercetin
Melting Point	316 °C	316.5 °C
Appearance	Yellowish powder	Bright Yellow to greenish
RI	n_D^{20} 1.765	n_D^{20} 1.767
Density	1.8 gm/cm ³	1.8 gm/cm ³

Table 2. Thin layer chromatography of Isolated compound and Standard Quercetin

Sample	A (Isolated Compound)	B (Standard Quercetin)
R _f Value	0.7	0.7
Mobile Solution	Chloroform : Methanol : Toluene (7:2:1)	
Stationary Phase	Silica Gel G F ₂₅₆	
Visualization	Vanillin Sulphuric Acid	

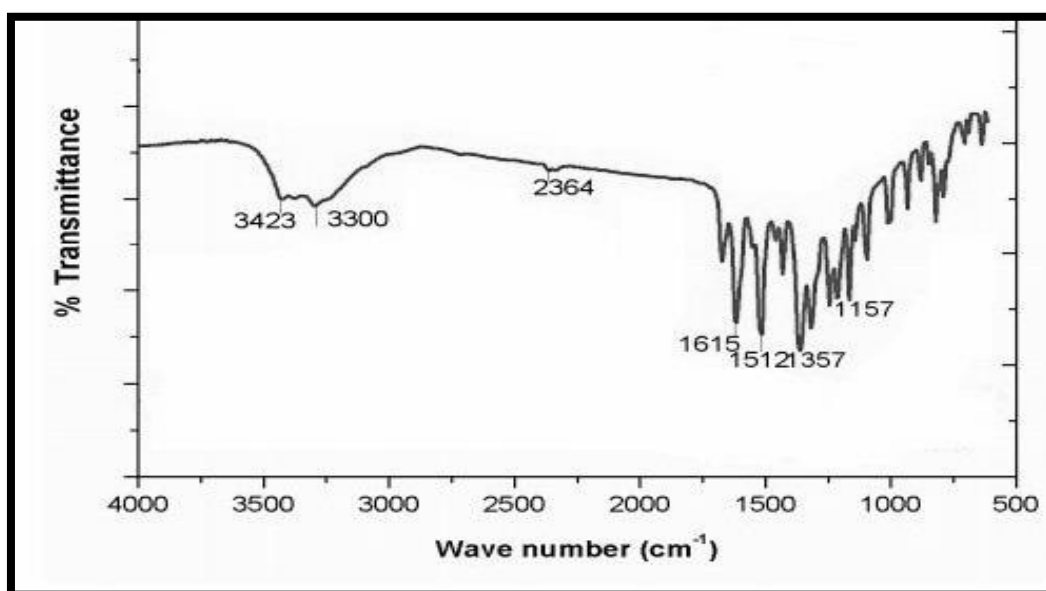


Fig. 3. FTIR Spectra of Quercetin

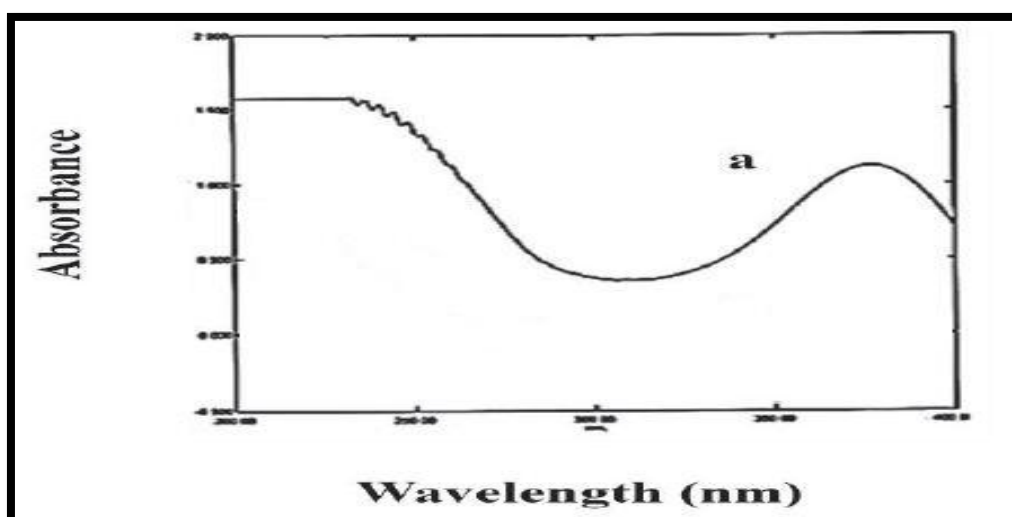


Fig. 4. UV Spectrum of Isolated Quercetin

3.3.3 ¹H NMR spectroscopy

¹H NMR (DMSO-d₆) for quercetin δ ppm: 12.47 (1H, S, and 5-OH), 10.73 (1H, S, and 7-OH), 9.54 (1H, S, and 3-OH), 9.31 (1H, S, and 4'-OH), 9.26 (1H, S, and 3'-OH), 7.66 (d, J H2'/ H6' = 4Hz, 1H, 2'-H), 6.87 (d, J H5'/ H6' = 8Hz), 6.39 (d, J H8/ H6 = 2Hz, 1H, 8H), 6.17 (d, J H6/ H8 = 2Hz).

3.3.4 Mass spectroscopy

The molecule was found to have a molecular weight of 302.23 m/z [M+2]. Based on the

number of Protons and Carbon atoms and the exhibited chemical coupling represented by the peak shifts, isolated compound was supposed to have a molecular Quercetin.

3.3.5 XRD analysis

The XRD pattern of Isolated quercetin shows diffraction peaks at $2\theta = 35.7, 38.9$ and 58.5 matched with the standard quercetin values.

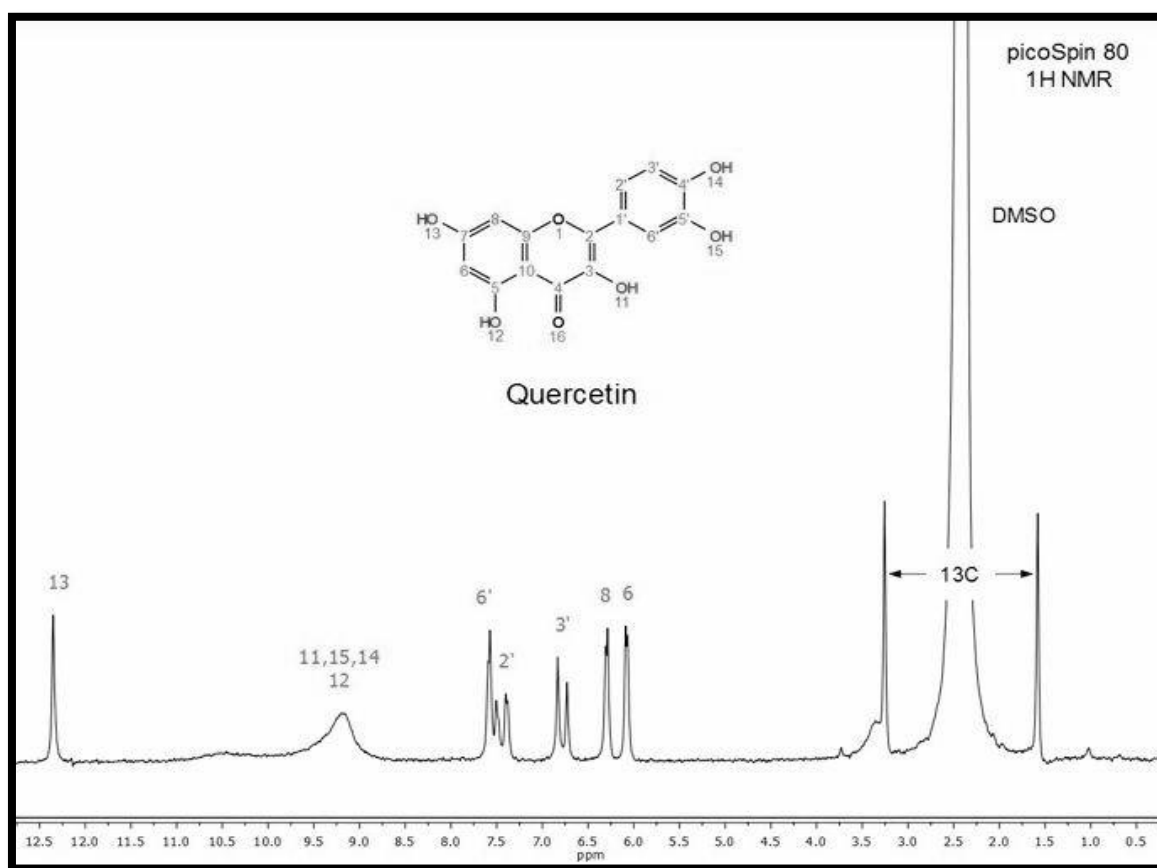


Fig. 5. ¹H-NMR spectrum of Isolated Quercetin

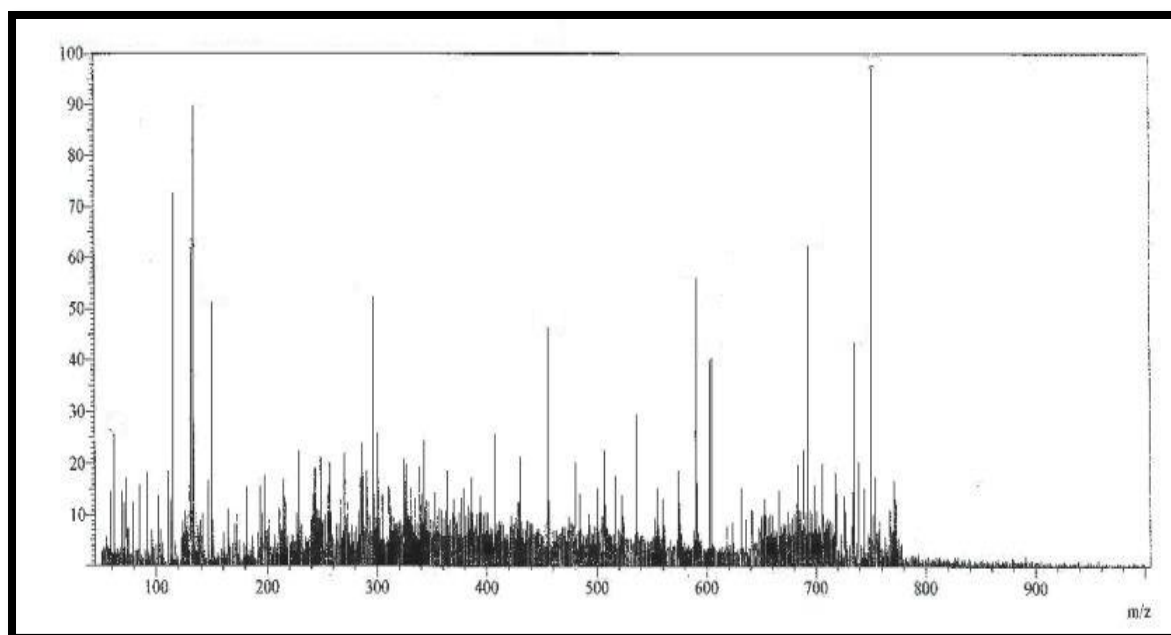


Fig. 6. Mass spectrum of Isolated Quercetin

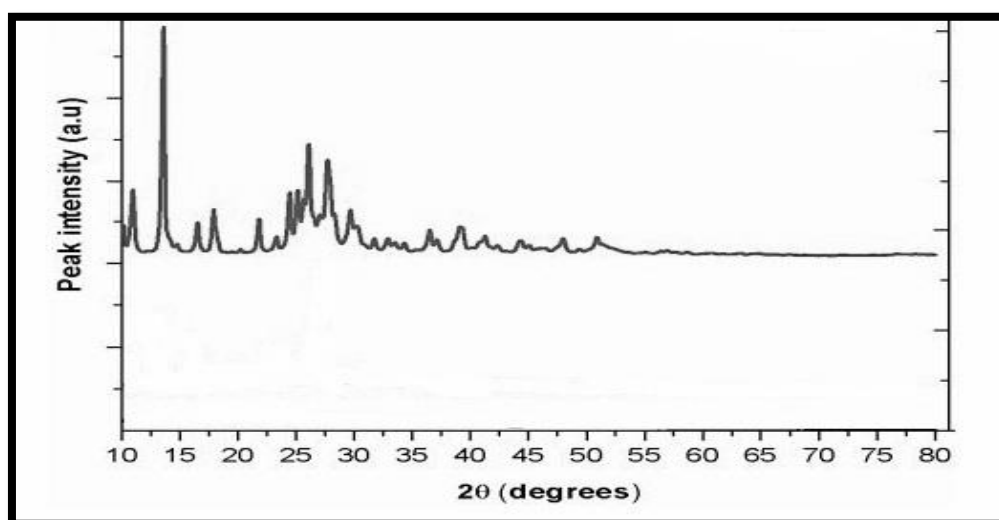


Fig. 7. XRD Spectra of Isolated Quercetin

4. DISCUSSION AND CONCLUSION

In the present study, the isolation and characterization of Isolation and characterization of Quercetin from *Bambusa arundinacea* was done. Isolated and standard Quercetin is compared on different parameters like melting point, appearance, refractive index, and density and UV absorbance. It was observed that all the parameters of isolated Quercetin resembles with standard quercetin sample. Isolated Quercetin shows maximum absorbance at 210 nm which is similar to standard Quercetin reference [8,9]. Thin layer chromatography of isolated and standard Quercetin was compared which confirms the identity of isolated compound as Quercetin. It was observed that both samples show Rf value 0.7, thus it. FT-IR spectra of quercetin is shown in Fig. 3 shows the characteristic stretch C=O for quercetin [8]. In the UV-Visible spectra of quercetin, two absorption bands were observed like other flavonoids. The results from ^1H NMR Spectroscopy showed that the molecule is quercetin. The Mass Spectroscopic analysis was found to have a molecular weight of 302.23 m/z [M+2]. The peak shifts showed that isolated compound was supposed to have a molecular Quercetin. In the XRD Analysis, the XRD pattern of Isolated quercetin shows diffraction peaks at $2\theta = 35.7, 38.9$ and 58.5 matched with the standard quercetin values [10]. Thus in the present study it was concluded that the compound isolated from *Bambusa arundinacea* was quercetin which was characterized with the standard.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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