

Original Article

GC-MS ANALYSIS OF PHYTOCHEMICAL CONSTITUENTS IN LEAF EXTRACTS OF  
*NEOLAMARCKIA CADAMBA* (RUBIACEAE) FROM MALAYSIA

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ABSTRACT

*Neolamarckia cadamba* is one of the medicinal plants used in the treatment of various diseases traditionally. This study was conducted to identify the phytochemical constituents of *N. cadamba* leaf extracts using gas chromatography mass spectrometry (GC-MS). Solvents with increasing polarities viz. hexane, petroleum ether, chloroform, ethyl acetate and methanol were used in this study. The solvent extracts were analyzed using GC-MS and the mass spectra of the compounds found in the respective extract were matched with the National Institute of Standards and Technology (NIST) library. A total of 26 compounds were identified and the major chemical constituents were n-hexadecanoic acid (44.88%), hexadecanoic acid ethyl ester (17.96%) and octadecanoic acid ethyl ester (11.71%). Some of the identified compounds have been reported to possess various biological activities such as antioxidant, antimicrobial, anesthetic, antiseptic, antidiabetic, hypocholesterolemic and etc. The results thus concluded that *N. cadamba* leaves possess various potent bioactive compounds and is recommended as a plant of phytopharmaceutical importance.

**Keywords:** *Neolamarckia cadamba*, Gas chromatography mass spectrometry (GC-MS), Phytochemical, Secondary metabolite, Antioxidant

INTRODUCTION

Higher plants as sources of bioactive compounds continue to play a dominant role in the maintenance of human health. Plants are rich sources of secondary metabolites with interesting biological activities [1-2]. It is also the best sources for obtaining natural antioxidants for various medicinal uses such as aging and disease related to radical mechanism such as cancer [3]. *Neolamarckia cadamba* is one of the medicinal plants traditionally used by the Indian. It has been mentioned in many Indian medical literatures for the treatment of fever, anaemia, diabetes, uterine and liver complaints, menorrhagia, blood and skin diseases, diarrhoea, colitis, stomatitis, dysentery and in improvement of semen quality [4-8]. Various parts of this plant have been traditionally used to treat various diseases [9-10]. Bioactivity studies on this plant revealed its antimicrobial, antioxidant and wound healing properties, antimalarial, antihepatotoxic, hepatoprotective, analgesic, anti-inflammatory, antipyretic, anthelmintic, diuretic, laxative and antidiabetic activities [10-11]. In addition, the leaves and barks extracts of this plant showed antifungal activity against *Aspogillus fumigates* and *Candida albicans* [12]. The tribes of Ganjam district of Orissa drink the root paste duly suspended in water for antimicrobial and anthelmintic activities.

Various phytochemical compounds have been identified from *N. cadamba* using phytochemistry approaches to date. The leaf extracts of *N. cadamba* revealed the presence of various secondary metabolites and these include glycosides, alkaloids, tannins, phenolic, steroids, and flavonoids [13-14]. The bark contains alkaloids like cadambine and its derivatives, saponins, glycosides, triterpenoids, cadambagic acid, quinovic acid and  $\beta$ -sitosterol [7, 10]. Those alkaloids, steroids and flavonoids have potent antiepileptic effect in various seizure models [15]. In addition to this, saponins have also been able to modulate the neurotransmitter levels in the brain and to possess potent anti-convulsant activity [16]. The qualitative chemical tests revealed the presence of saponins, proteins, terpenes, carbohydrates and alkaloids in the bark powder of *N. cadamba* [12]. Phytochemical evaluation of methanolic extract of *N. cadamba* showed the presence of flavonoids, alkaloids, carbohydrate, proteins and glycoside compounds [17]. The flowers of *N. cadamba* yield essential oil and the main constituents of the essential oils were linalool, geraniol,

geranylacetate, linalyl acetate,  $\alpha$ -selinene, 2-nonanol,  $\beta$ -phellandrene,  $\alpha$ -bergamottin, p-cymol, curcumen, terpinolene, camphene and myrcene [18]. The seeds of *N. cadamba* are composed of water-soluble polysaccharides D-xylose, D-mannose and D-glucose in the molar ratio 1:3:5 [19]. From literature survey it was found that almost every part of the *N. cadamba* is used in the treatment of various diseases traditionally. Unfortunately, thus far there is no phytochemical study on *N. cadamba* from Malaysia. In fact, it has been selected as one of the plantation tree species in forest rehabilitation projects in Malaysia due to its short rotation period which can give early commercial returns within 8-10 years [20-23]. Therefore, the present study was carried out to determine the phytochemical constituents of *N. cadamba* leaves by using gas chromatography mass spectrometry (GC-MS). It is hoped that this study will provide another useful resource for future extraction of phytochemicals from this species which can be used as dietary supplements. To date, all published scientific findings are in agreement with the traditional use of the plant.

MATERIALS AND METHODS

Plant materials

*N. cadamba* seeds were obtained from the Seed Bank of Sarawak Forestry Corporation, Sarawak. The seeds were planted in trays of 50 holes and contained sand and compost (3:1) for one month and then planted in seed beds for the next 6 months. The leaves samples were dried in the shade in the open air condition for 6 - 12 days prior to extraction.

Sample extraction and column chromatography (CC)

About 300 g of dried leaves were ground into fine powder by using electric blender. The ground sample was percolated with methanol at room temperature for three days and filtered. The residue was extracted two more time to ensure complete extraction process. The residue was discarded and the filtrates were combined and evaporated to dryness using rotary evaporator. The crude dried methanol extract was partitioned with hexane, petroleum ether, chloroform, ethyl acetate and methanol. The entire steps were performed in three times in order to increase the effectiveness of the extraction process. All the hexane, petroleum ether, chloroform,