



Straightforward thin-layer chromatography–densitometric method for the determination of phyllanthin in *Phyllanthus niruri* from different phytogeographical zones

Kartini Kartini¹ · Alfi Syahr Wijayati¹ · Nikmatul Ikhrom Eka Jayani¹ · Finna Setiawan¹ · Ryanto Budiono²

Received: 11 June 2023 / Accepted: 10 October 2023
© Akadémiai Kiadó, Budapest, Hungary 2023

Abstract

Phyllanthus niruri contains various lignan compounds, whose concentrations vary depending on several factors. This study was intended to determine the phyllanthin content of *P. niruri* obtained from various locations in Indonesia by using thin-layer chromatography (TLC)–densitometry to evaluate the effect of geographical factors on their quality. The TLC system comprised silica gel 60 F₂₅₄ for the stationary phase, toluene–ethyl acetate–formic acid (15:10.5:1.5, V/V) for the mobile phase, and documentation under ultraviolet (UV) 254 nm light without chemical reagents. This developed method meets the specificity requirement, as marked by the identical UV spectrum between the phyllanthin sample and the standard ($\lambda_{\max} = 279$ and 230 nm). Further, it shows good linearity for phyllanthin concentrations in the range of 2.36–11.8 $\mu\text{g}/\text{band}$ ($r = 0.9924$), with LOD 0.532 $\mu\text{g}/\text{band}$ and LOQ 1.612 $\mu\text{g}/\text{band}$. It also has good intraday and interday precision, as indicated by RSD of 8.87–9.43 and 6.94%, respectively. Eight of the 15 analyzed samples (collected from Batu, Blitar, Kediri, Nganjuk, Jember, Mojokerto, Banyuwangi, and Surabaya) contained only a trace amount of phyllanthin. In contrast, the other seven had varying levels of phyllanthin (1.376–4.130 mg/g dried herbs). Using the Tawangmangu sample as the reference, these seven samples can be grouped into two: significantly lower phyllanthin contents (Tulungagung) and very significantly lower phyllanthin contents (Lumajang, Bangkalan, Pasuruan, Sidoarjo, and Gresik). It can be concluded that TLC–densitometry designed in this research is a straightforward method that, at the same time, meets the validation parameters. Therefore, it can be repeated to analyze phyllanthin in *P. niruri* of different phytogeographical origins.

Keywords *Meniran* · *Phyllanthus niruri* · Phyllanthin · Phytogeographical origins · Thin-layer chromatography–densitometry

1 Introduction

Phyllanthus niruri L. (gale of the wind or *meniran* in Indonesia) is commonly found in the tropics, including Southeast Asia, South India, and China [1, 2]. In Indonesia, this plant is a major component of *jamu*, Indonesian traditional herbal drinks, to alleviate gout, arthritis, high blood pressure, hemorrhoids, high cholesterol, and urinary tract stones, and for physical fitness. Different studies revealed the activities of

P. niruri extract and its chemical compounds as antidiabetic, hypolipidemic, cardioprotective, antiviral, antibacterial, hepatoprotective, and wound healing [3–5]. Also, various clinical trials showed *P. niruri* as an immunomodulator by activating and augmenting the cellular immune system, particularly neutrophils, macrophages or monocytes, and T as well as B lymphocytes [6].

Aside from being safe and efficacious, herbal products should meet quality requirements. For this reason, the crude drugs used as the ingredients are standardized. Several determining factors for crude drug quality include the environment, soil type, and climate of where the source plant grows, seed quality, age at harvest, and postharvest handling (*e.g.*, drying) and storage [7]. The quality of a crude drug can be evaluated from its chemical fingerprint and marker compound using several methods, one of which is thin-layer chromatography (TLC)–densitometry.

✉ Kartini Kartini
kartini@staff.ubaya.ac.id

¹ Department of Pharmaceutical Biology, Faculty of Pharmacy, University of Surabaya, Surabaya, Indonesia

² Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Surabaya, Surabaya, Indonesia