Available online at www.sciencedirect.com
ScienceDirect
Talanta 70 (2006) 286–292
Talanta
www.elsevier.com/locate/talanta

Influence of different extraction methods on the yield and linalool content of the extracts of *Eugenia uniflora* L.

Mário S. Galhiane [a], Sandra R. Rissato [a,*], Gilberto O. Chierice [b], Marcos V. Almeida [c], Letícia C. Silva [a]

[a] *Department of Chemistry, Paulista State University (UNESP), P.O. Box, 473, 17033–360, Bauru (SP), Brazil*
[b] *Department of Chemistry, University of São Paulo (USP), São Carlos (SP), Brazil*
[c] *Department of Bioengineering, University of São Paulo (USP), São Carlos (SP), Brazil*

Received 3 November 2005; received in revised form 14 February 2006; accepted 14 February 2006
Available online 3 April 2006

Abstract

This work has been developed using a sylvestral fruit tree, native to the Brazilian forest, the *Eugenia uniflora* L., one of the Mirtaceae family. The main goal of the analytical study was focused on extraction methods themselves. The method development pointed to the Clevenger extraction as the best yield in relation to SFE and Soxhlet. The SFE method presented a good yield but showed a big amount of components in the final extract, demonstrating low selectivity. The essential oil extracted was analyzed by GC/FID showing a large range of polarity and boiling point compounds, where linalool, a widely used compound, was identified. Furthermore, an analytical solid phase extraction method was used to clean it up and obtain separated classes of compounds that were fractionated and studied by GC/FID and GC/MS.

Keywords: *Eugenia uniflora* L.; Extraction; Gas chromatography; Linalool

1. Introduction

The development of organic chemistry took place along with the study of plants, mainly in the 19th century, when the first studies on plants were scientifically recorded. This ended up in the isolation of some plants active principles, then, known as medicinal ones. Out of these studies, some efficient active principles were obtained, and even today, are employed in the treatment of certain diseases, e.g. morphine, quinine, camphor and cocaine [1,2].

Nature, in general, has yielded most known organic substances. Therefore, it is the vegetal kingdom that has contributed, in a more meaningful way, to the supply of useful substances for the treatment of human diseases [3]. The fantastic variety and complexity of plant bio-synthetized special metabolites, would have formed and evolved as a defense mechanism of these plants to environmental conditions, rich in microorganisms, insects, animals and also to adaptation and regulation conditions [4]. Thus, plants comprise an enormous laboratory of organic synthesis, as a result of millions of years of evolution and adaptation on Earth.

In the 1900s, the advent of antibiotics produced through microbe fermentation and the remarkable development of synthetic pharmacologicals, soon after World War II, markedly reduced the use of medicinal plants and consequently, the investment in pharmacologicals deriving from plants. In the last decades, a great change in the paradigm of western societies has caused plant products to play, once again, an important role in great populations of developed and developing countries.

Holding an extremely profitable market, the phytopharmacologicals have relighted the interest of the pharmaceutical industry in products coming from a vegetal origin. Around 1990, it was estimated that about 80% of the world population sought, in the plants, the main source of medicine [5]. It is proved, today, that a great part of the world population, mainly those from developing countries, uses as medicine, extracts or portions deriving from plants.

For some authors, out of the 200,000 species which might exist in Brazil, at least half may have some therapeutical property, but less than 1% of these, has been, so far, the object

* Corresponding author. Tel.: +55 14 3103 6135; fax: +55 14 3203 2856.
E-mail address: srissato@fc.unesp.br (S.R. Rissato).

0039-9140/$ – see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.talanta.2006.02.040

of suitable studies. Many substances, coming exclusively from Brazilian plants, have been patented by foreign companies or governmental organs [6].

Essential oil or simply essence, are volatile oils of diverse chemical composition, which derive from vegetal materials, giving them their main odors [7,8]. The manufacturers of perfume, cosmetics and food aromatizing, nearly absorb the totality of natural essences and respective derivatives a fact that justifies the high technical level reached in their preparation and the elevated economic value which they represent. Paint and varnish industries consume important amounts of some essences and they are utilized in medicine, in the formulation of antiseptics, antispasmodics, inhalants, analgesics [7]. Furthermore, the essential oils are, almost always, bacteriostatic and often bactericide. [9].

The *Eugenia uniflora* L., the main object of this research, belongs to the Mirtaceae family [10]. The pitanga tree is a sylvestral fruit native to the Brazilian jungles, found in a range that reaches from the Guianas to the State of São Paulo; it does not survive in Southern States [11,12].

The leaves of the *Eugenia uniflora* L. are utilized in popular medicine, in infusion, in the treatment of fever, rheumatism, stomachic diseases, disorders of the digestive tract, hypertension, yellow fever and gout; to reduce weight, diminish blood pressure, act as a diuretic [13–16]. Studies have shown the odor of the leaves to have repellent properties [15]. In addition, the infusion of the fresh leaf and the green fruit is used to combat malaria and the aqueous extract of the dry leaf is utilized as a menstrual stimulant [14].

The present study aimed at assessing the influence of different extraction and purification methods on the yield and composition of *Eugenia uniflora* L.'s essential oil. The extracts obtained were submitted to analysis by high-resolution gas chromatography coupled to a flame ionization detector (GC/FID) and the results discussed.

2. Material and method

2.1. Samples

Fully grown leaves of *E. uniflora* were collected from plants cultivated on the campus of the Paulista State University, Bauru, SP, in April 2005. Plant materials were authenticated by Dr. Osmar Cavassan, Biology Department, where voucher specimen no. 2148 was deposited.

Fresh leaves, found in an intermediate position between the top (canopy) and the base of a tree, were randomly collected, always at the same time (7:30 AM). The samples were immediately sent to the laboratory to undergo the drying and extraction procedure.

The leaves were dried for 7 days, in a naturally ventilated site, sheltered from the sun, under a controlled temperature and powdered in stainless steel-cutting bladed mills, at 3800 RPM.

Following the grinding process, the samples were sifted in the GOWMAC system with sieve meshes varying between 1 and 50, being the intermediate portions used.

Fig. 1 presents a diagram with the main phases performed in the extraction, purification and analysis processes to obtain the essential oil of *Eugenia uniflora* L.

2.2. Extraction

Aiming at evaluating the best way to extract the essential oil from the *Eugenia uniflora* L. plant, four different extraction

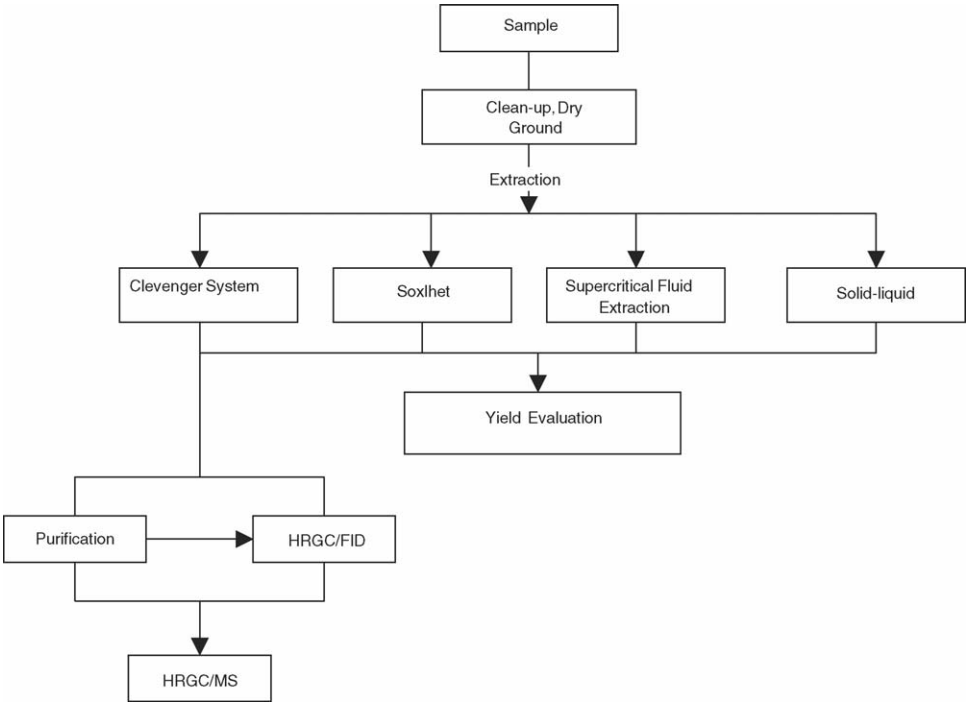

Fig. 1. Diagram of extraction, purification and analysis of *Eugenia uniflora* L. essential oil.