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Essential Oil from Lemongrass Extracted by Supercritical Carbon Dioxide and Steam Distillation

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This study compares the composition of essential oil extracted from lemongrass leaves and stems using supercritical CO_2 (SC CO_2) and steam distillation. In the process using SC CO_2 extraction in a Supercritical Fluid Extraction System (SFE), the temperature of extraction was varied from 35–50 ^{0}C, while the pressure applied was 9.1–11.1 MPa. The flow rate of CO_2 to the reactor was maintained at 0.5 m^3 h^{-1}. Steam distillation was conducted using a standard bench scale setup. The extracts from both methods were analyzed by gas chromatography - mass spectrometry (GC-MS) and the variations of the composition were reported. The study showed that better oil quality in terms of composition was produced from the air dried raw materials than from direct heat drying. The essential oil extracted from air dried lemongrass leaves by SFE process contained 94.4% citral, 1.14% myrcene and 0.5% limonene, showing a composition similar to the reference standard.

In contrast, the oil from the air dried lemongrass stems fell short in terms of purity. SFE was found to be a superior process than steam distillation, producing better quality essential oil containing 90% Citral.

Key Words: essential oil, lemongrass, Supercritical Carbon Dioxide Extraction

INTRODUCTION

The Supercritical Fluid Extraction (SFE) process is a powerful technique developed in the field of separation technology. It has become popular as attested by the numerous studies and investigations in recent years, especially on its probable industrial application (Sovova' et al. 1994; Brunner et al. 2005). It is the preferred choice for separating products with high value added. The process operates at low temperature, produces extracts free from solvent contamination, prevents thermal decomposition especially of the oil's light components, has high product recovery and the facility does not require a large area compared with the conventional methods of separation such as solvent extraction or distillation (Bravi et al. 2002; Angela et al. 2003). SFE is non-toxic, non-explosive and the CO_2 solvent used is relatively cheap.

SFE was used in the past to extract essential oil from different feed materials such as palm kernel (Hassan et al. 2000), hiprose seeds (Reverchon et al. 2001), sunflower seeds (Kiriamiti et al. 2001), chamomile (Povh et al. 2001) and hazelnut (Ozkal et al. 2004 unpublished).

Lemongrass (*Cymbopogon citrates*) is a herb that grows in most tropical countries. It belongs to the genus *Cymbopogon* of aromatic grasses and contains essential oil with fine lemon flavor. Its major constituent is citral which is more than 75% by weight of the essential oil (Lewinsohn et al. 1998; Henrique et al. 2001). Citral is the name given to a natural mixture of two isomeric acyclic monoterpene aldehydes, geranial (*trans* citral, citral A) and neral (*cis*-citral, citral B) at the ratio of 4:1 by weight.

Essential oil from lemongrass revitalizes the body, clears headaches due to jetlag and relieves the body from stress and nervous exhaustion (Marongiu et al. 2006). It is known to treat respiratory infections such as sore throat, laryngitis and fever. It is also used as food additive and is a popular food flavoring among Asians.

Not so many studies have been done about the extraction of lemongrass essential oil; most of them applied steam distillation (or hydro-distillation) process. Lewinsohn et al. (1998) mentioned the use of hydro-distillation by extracting citral from fresh leaves and was later identified by GC technique. Henrique et al. (2001) extracted essential oil from lemongrass leaves by dense carbon as well as SC CO_2; the GC technique was also used to identify the components. Dariva et al. (2006) applied high pressure CO_2 in extracting essential oil from lemongrass using molecular sieve and characterized the extract obtained.