Improvement of Agarwood Oil Extraction by Heat Transfer Control in Multiple Hydrodistillation Systems

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Abstract

Quantity of oil, and chemical composition of the Agarwood essential oil should be evaluated to determine the performance of an extraction system. The aim of this work was to investigate the effects of heat transfer control (HTC), applied at three hydrodistillation systems simultaneously, on the quantitative and qualitative characteristics of extracted essential oil from inoculated Agarwood, compared to a conventional hydrodistillation (HD). The extractions by conventional and HTC-ed HD procedures were done by supplying heat from liquefied petroleum gas (LPG); the ratio of the raw material to be extracted and the solvent was 0.1 $g \cdot mL^{-1}$ and the extraction time was 72 hours. The compositions of the extracted essential oils (using HTC-ed HD and conventional HD) were assessed using gas chromatography with flame ionization detector (GC–FID). The results of the extraction processes show that the extraction of inoculated Agarwood essential oil by HTC-ed HD is faster and produces higher yields compared to the extraction by conventional HD method. Further, the testing of the chemical properties of the Agarwood oil shows that essential oil obtained by HTC-ed HD has better quality compared to the oil obtained by conventional HD. The implementation of optimum thermal management in HTC-ed HD technology in Agarwood essential oil production industry is therefore of great importance.

Keywords: Thermal management; Hydrodistillation; Heat transfer; GC-FID; Agarwood

1. Introduction

Agarwood (Gaharu in Malay, Oudh in Arabic or Jinkoh in Japanese) is a resinous heartwood, abundantly used, prominent incense of the Orient [1]. Essential oil extracted from aromatic plants is a valuable commodity for domestic and export which is in high demand by various industries for their primary and secondary products, such as the cosmetics and perfume industries, the food and beverages industries, as well as in manufacturing of medicine/ pharmaceuticals [2].

Agarwood gains economic interest has always been due to its pathological heavy and dense resin-impregnated wood, which is generated in the stem tissues as a response to wound [3]. Over half-century ago, Indian chemists separated a very complex mixture of agarwood and characterised two major sesquiterpenes, agarol [4] and agarospirol [5] from an agarwood originating from *Aquilaria agallocha* family [6]. The identification of the components of complex mixtures of terpene compounds in the oil determines the quality grade of the extracted oil for use as medicinal, aromatic, cultural and religious purposes [7, 8].

. It is reported by Kusuma and Mahfud [9] the consumption of essential oil or fly oil increases annually in the range of 8–10% worldwide. Such a trend is driven by the demands for essential oil used for the perfume industry, cosmetics, and healthcare [10]. Furthermore, the essential oil based products