STUDY ON MATHEMATICAL MODEL IN SIMULATING CYMBOPOGON WINTERIANUS ESSENTIAL OIL EXTRACTION BY STEAM DISTILLATION

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Abstract

The main objective of this study is to improve the mathematical modelling of Cymbopogon winterianus essential oil extraction by steam distillation proposed by Cassel and Vargas by minimum 5% error reduction. Two process variable of steam distillation which are extraction time and raw material state (dry or natural) has been optimized by using factorial experimental planning to obtain high yields of citronella essential oil from twig and leaves of lemongrass species Cymbopogon winterianus (C.winterianus). The optimal condition for maximum yield (0.942%) were found to be an extraction time, 4 hr, state, natural plant. The study of Cassel and Vargas was subsequently continued with five proposed kinetics model of the extraction process. The modelling of the extraction process is optimized by using one adjustable parameter of the model and the adequacy of the fit of the models to the experimental data are analyzed by using three statistical criteria that are correlation coefficient (r) ,the root mean square error (RMSE) and the mean relative deviation modulus (E). The result has shown that the mathematical model developed by Ana based on mass transfer fundamentals is the optimum mathematical model for the extraction of Cymbopogon winterianus essential oil by steam distillation.

Keywords: Essential Oils, Cymbopogon winterianus essential oil, Optimization of mathematical model of extraction of citronella essential oils

1. Introduction

Cymbopogon winterianus is commonly known as Citronella. Citronella Grass and Java Citronella grass is a lemongrass species that is believed to have originated from Cymbopogon nardus that often referred to Ceylonese, a Sri Lankan commercial citronella. Cymbopogon winterianus was named after the Winter whom presented the plant as a separate species in 19th century. It is later than introduced to Indonesia and commercially known as Javanese citronella. The plant later was further introduced to India in 1959 [1].

Essential oils are subtle, natural, aromatic and volatile compounds which are extracted from the flower, seeds, leaves, stems, bark and roots of herbs [2]. As agreed by Tajidin et al (2012), essential oils are natural products which can be extracted from plants. They were formed through mixture of varied and complex volatile chemical compounds with high proportion of terpene

Manuscript History:
Received 4 August, 2015, Revised 21 March, 2016, Accepted 22 March, 2016, Published 31 March, 2016

e-ISSN 2289-7771