Universiti Teknologi MARA

System Identification of Essential Oil Extraction System Using Non-Linear Autoregressive Model with Exogenous Inputs (NARX)

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ABSTRACT

This project explores the application of system identification using Non-Linear Autoregressive Model with Exogeneous Inputs (NARX) of an essential oil extraction system. Model structure selection was performed by applying the Binary Particle Swarm Optimization (BPSO) algorithm which been developed by (J.Kennedy and R.Eberhart, 1997). The application of BPSO for model structure selection can be described by representing each particle's position in binary value. Then, the binary value is used to select a set of regressors from the regressor matrix. The QR factorization is used to estimate the parameters of the reduced regressor matrix. The tests that been performed based on the essential oil extraction system by (Rahiman, 2009), show that the BPSO has the potential to become an effective method to determine the NARX model structure in the system identification model.

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CHAPTER ONE

INTRODUCTION

1.1 OVERVIEW

Essential oil extraction is a process of extracting the volatile component of botanical material which is known as essential oil. The extraction process force the oils out from its pocket and channelled into a collection stage for further processing. There are many methods of essential oil extraction, the most popular being steam distillation. Other methods include expression, maceration, cold pressing, carbon dioxide extraction, solvent extraction and many more.

As mentioned earlier, distillation is by far the most popular method for essential oil extraction. This is mostly used for leaves, flowers, seeds, roots, and stems. When steam distillation is used in the manufacture and extraction of essential oils, the botanical material is placed in a still and steam is forced over the material.

In extracting the essential oils, several factors have been identified to have great influence on the extraction yields and quality. One of the factors is the temperature of extraction. It does not limit to steam distillation only, but also on other extraction technique as well. Therefore, a great deal of published works on essential oil extraction have stressed on the temperature of the extraction. In industries, the distillation is most preferable due to several factors such as system cost, productivity and maintenance cost.

System identification is a technique to determine a mathematical model that is equivalent with the identified system based on the past input and past output data to represent the process dynamics [1, 2]. Based on the past input and past output data, it can predict the future output of the system. Many researches do research on different methods of extraction but none of them involved specifically on steam distillation essential oil extraction.

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