UNIVERSITI TEKNOLOGI MARA

MODELLING AND CONTROL OF INDUCTION BASED STEAM DISTILLATION ESSENTIAL OIL EXTRACTION SYSTEM USING SELF-TUNING FUZZY PID CONTROL

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of the requirements for the degree of
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AUTHORS'S DECLARATION

I declare that the work in the thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Steam distillation is the most popular technique used in the industry for extraction of essential oil. The main contributing factors are the system cost, cleanliness, productivity, operational cost and the maintenance cost. In extracting the essential oils, several factors have been identified to have great influence on the extraction yields and quality. The extraction temperature is regarded as the most significant parameter that contributes to the amount of output yield and quality of oil. In conventional steam distillation system, electric heater or gas was commonly used as the heating source. However, some drawback was observed during application of electrical heater or gas and it's also lacks of temperature control in order to satisfy the essential oil extraction process requirement. Based on the literature reviews, this research proposed an application of self-tuning fuzzy PID (STFPID) integrated to the induction based steam distillation system to regulate steam temperature for the essential oil extraction process. A new method for steam distillation system had been developed by replacing induction heating system as their heating source. The modeling works have been carried out to understand the plant characteristic and behavior. The ARX structure with first order model was chosen to represent the system dynamic for simulation studies.The STFPID controller was designed for the obtained plant model. Real-time implementation of the simulated STFPID controller has been carried out and the performance of the proposed controller was evaluated. Proposed controller has been benchmarking their performance with HFPPID and PID controllers. Results shows that STFPID controller has the ability to improved process rise time, settling time and reduced process overshoot compared to HFPPID and PID controllers.

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