

UNIVERSITI TEKNOLOGI MARA

**WHITE ROOT DISEASE
AUTO-DETECTION SYSTEM FOR
RUBBER TREES BASED ON
DYNAMIC ELECTRO-BIOCHEMICAL
LATEX PROPERTIES**

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Thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Electrical Engineering

June 2019

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results 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

White root disease also known as *Rigidoporus lignosus* is one of the most serious diseases in rubber plantation in Malaysia that originally infects on the root surface of the rubber tree. This fungus penetrates the wood tissue and cause the root to rot and eventually kill the tree. It is too difficult and expensive to treat trees that have been infected by root disease. Although there are many types of measurement techniques involved in detecting and classifying the root disease, it is shown that this measurement process is time consuming, has low percentage in accuracy, as well as costly. So, prevention is important compared to treatment because of the constraint of money and time. This research proposes an Auto-Detection System which has the ability of detecting the disease with high accuracy, low cost and in a short period of time by developing an Auto-Detection System that could classify between healthy rubber trees and white root disease infected rubber trees. In general, there were four objectives involves in this research which are using available measurement technique to obtain information on latex properties, statistical analysis as a way of showing that the information obtained are normally distributed and can be discriminated, artificial intelligent as for generating classification models and lastly using GUI for the development of the Auto-Detection System. In the beginning, 600 samples of latex from healthy rubber trees and white root disease infected rubber trees were taken from the RRIM station in Kota Tinggi, Johor. These samples were measured based on its relative permittivity, capacitance and protein concentration. All of the measurement inputs from the experiment were tested for the data distribution and discrimination between the conditions of the latex using statistical analysis. Based on the statistical results, all of the measured data were normally distributed and can be discriminated since the significant value for normality test for all measured data were greater than 0.05 and paired sample t-test showed significant value less than 0.05. These measurement input were then went through the process of classification in ANN to generate the most optimized models by using LM and SCG algorithm. There were seven optimized models selected out of 336 models generated from the classification process. All of the accuracy from the selected most optimized models was greater than 80%. The selected most optimized models were then used to classify between healthy trees and white root infected trees based on single input, double input and triple input categories. The lowest total percentage for accuracy verification test results is 83.3% from single input properties while the highest total percentage for accuracy verification test results is from triple input properties at 96.7%. In conclusion, the developed system has shown positive results in achieving the main objectives of the research which was to develop an Auto Detection System to identify white root disease infected rubber trees and the development of prototype cylindrical capacitance unit. From there, this would consequently help to increase the yield of natural rubber latex in the future by preventing the disease from spreading to other trees.

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