UNIVERSITI TEKNOLOGI MARA

AGARWOOD OIL QUALITY GRADING MODEL USING SELF-ORGANIZING MAP (SOM)

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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

Agarwood is known as the resin impregnated duramen of the species Aquilaria that belongs to the Thymelaeaceae family. Extracted from the stem of Agarwood is a concentrated volatile aromatic compound called Agarwood oil. It is traded based on its quality, which is proportional to its price. The standard grading of Agarwood oil quality is carried out by skilled appraiser using their sensory organs based on its substantial appearances such as colour, odour, and user impression which is defined as customer awareness or opinions. The appraiser needs to include the user impression because it can affect the price of Agarwood oil. However, this method has limitations because human sensory organs are subject to fatigue and are also restricted in terms of unbiasedness, replicability, time utilization and workforce costs. To overcome these limitations, an Agarwood oil grading model were developed based on its chemical compounds using SOM to distinguish the Agarwood oil quality up to four grades. Three stages have been completed to achieve this goal, namely determination of significant chemical compounds of Agarwood oil, designation and confirmation of Agarwood oil grades, and establishment of Agarwood oil quality grading model. First, the raw data that were obtained from GC-MS analysis were pre-processed using techniques such as missing values ratio, natural logarithm, min. max normalization, MUNGE, winsorization, PCA and Pearson's correlation to determine significant chemical compounds. Then, these compounds were used as inputs for SOM and KNN to designate and confirm the Agarwood oil grades. Using independent Agarwood oil samples, the Agarwood oil quality grading model using SOM was established. The raw data consisted of 22 samples and 103 chemical compounds. At the end of pre-processing techniques, three chemical compounds in particular α-agarofuran, β-agarofuran and 10-epi-φ-eudesmol were determined. In the designation and confirmation of Agarwood oil grades, SOM obtained average silhouette indexes between reasonable and excellent and KNN achieved 100% accuracy, precision, sensitivity and specificity for k=1 to k=2. In the establishment of Agarwood oil grading model, SOM and KNN attained silhouette indexes of excellent and 100% accuracy, precision, sensitivity and specificity for k=1 to k=5 respectively. This thesis shows that the Agarwood oil quality grading model using SOM is able to determine significant chemical compounds that can be used for Agarwood oil grading and capable to distinguish the Agarwood oil quality into two to four grades based only on β-agarofuran, α-agarofuran and 10-epi-φ-eudesmol.

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