A Study on ANN Performance Towards Three Significant Compounds of High Quality Agarwood Oil

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Abstract — **This study demonstrated the application and the performance of the artificial neural network (ANN) as classification tool for luxury oil which is agarwood essential oil. For the scope of this research, the compounds of agarwood essential oil were obtained from FRIM and BARCE (UMP). The 103 compounds data is pre-processed through a pre-processing technique known as principal component analysis (PCA) and Pearson's correlation. It was found that three compounds were significant and they were high quality; β-agarofuran, α-agarofuran, and 10-epi-ϒ-eudesmol. The significant compounds were continued to be fed into ANN as input data meanwhile the output data categorized as low and high quality of the agarwood essential oil. The Scaled Conjugate Gradient (SCG) was employed as the default classifier algorithm during network training. Three layers of ANN architecture were used and 1 to 10 hidden neurons were varied in a hidden layer. The performance of the ANN was measured using the mean squared error (MSE), epochs and their execution time and the confusion matrix. The work was performed using Matlab R2017a. The finding shows that SCG-ANN successfully classified agarwood essential oil with the best performance at 3 hidden neurons. This research is significant for future work, especially on the classification of the agarwood essential oil field.**

Keywords—agarwood essential oil, pre-processing, SCG-ANN, MSE, confusion matrix.

I. INTRODUCTION

In South Asia country such as Malaysia, India, Indonesia and Thailand, the main genus that produces agarwood is Aquilaria Malaccensis [1], [2]. Agarwood is dark resinous heartwood from plant family Thymelaeaceae that known with many given names as Jinkoh, Oud, Kanankoh, Kyara and Kalambak [1]–[5]. Agarwood essential oil is from a resin content that produced from matured agarwood [6]. The matured agarwood is induced according to several factors such as from animal grazing, microbial invasions, insect's assaults and lightning strike [2], [6].

The agarwood oil is known as a luxury essential oil as its have many special benefits. The production of resin content of agarwood oil may lead to the application of manufacturing soap, perfumes and essences [1], [7]. Next, agarwood is widely used in Middle East for special ceremonies especially on wedding and for muslim, the agarwood essential oil is used as perfumes for prayers known as 'minyak attar' [7]. The ethnics from Malaysia; 'Orang Asli' used agarwood as their spiritual purposes while 'Orang Penan' used agarwood as medicational for stomach aches and fevers [8].

The grading of agarwood essential oil is one of the important issued as there is no standard grading was found [1], [9]. Different countries come with different grading technique. Such as Malaysia and India, they used the grouping technique with A, B, C and D as group A with the highest quality meanwhile group D as low quality [2], [10]. A researcher from China performed an experiment for grading agarwood using sinkage method; fully sink (high quality) and float (low quality), respectively [9], [11]. Back to years ago, grading agarwood is using the physical properties of agarwood using human expertise according to color and odor [12]. The technique is not recommended as it contains more disadvantages [12], [13].

In recent years, most of the researcher grades using intelligent techniques based on chemical properties of agarwood essential oil [14]. This study purposed an artificial neural network (ANN) with Scaled Conjugate Gradient (SCG) as an intelligent grading technique to classify agarwood essential oil. The ANN network has been known as well-known classification techniques among the researcher in any area of studies [15]–[18]. It applied the