Tibuana
Journal of applied Industrial Engineering-University of PGRI Adi Buana

p-ISSN 2622-2027
e-ISSN 2622-2035

CLASSIFICATION OF THE QUALITY OF HONEY USING THE SPECTROFOTOMETER AND MACHINE LEARNING SYSTEM BASED ON SINGLE BOARD COMPUTER

Sagita Rochman[1], M Nushron Ali Mukhtar[2]
Electrical Engineering[1], Industrial Enginering[2]
Universitas of PGRI Adi Buana Surabaya[1,2]
Email *: sagita_rochman@yahoo.co.id[1], nushron_am@yahoo.com[2]*

Abstract

Honey is a natural sweet substance produced by bees with nectar flower ingredients containing various nutrients such as carbohydrates, proteins, amino acids, vitamins, minerals, plant pigments and aromatic components. Honey consists of water (17%), fructose (38.2%), glucose (31.3%), other disaccharides (5%), melezitose (<0.1%), erlose (0.8%) , other oligasakarida (3.6%), minerals (0.2%), amino acids (0.3%). It also contains anti-microbial substances, which can prevent some disease on human. Because it has a high economic value and contains unique substances, honey is often falsified. Honey can be faked in various ways by mixing natural artificial sweetener components or by giving the sugar (sucrose) into the honey, so it is dangerous if given to infants or people suffering from diabetes mellitus. The design of this research used spectrofotometer methode and pattern recognition algorithm (machine learning) system for classifying honey quality. It is based on honey having a chromophore group responsible for absorbance, electronic transition and color giver. We can also knowing the type of honey by using pattern recognition algorithm support vector machine.In this research is used three types of honey to using a spectrophotometer at a wavelength of 500 nm, the absorbance obtained in randu honey type of 0.523-0.654, coffee honey for 0.735-0.824, and rubber honey by 0.947-1.043.

Keywords: *Honey Quality, Machine Learning, Single Board Computer, Spectrophotometer.*

1. INTRODUCTION

Honey is nectar or sugar exudate from plants collected by honey bees, processed and stored in Apis Mellifera honeycomb. The main components of honey are fructose, glucose, a little bit of sucrose, minerals, vitamins, and various enzymes. Its high nutritional content causes honey to be consumed regularly, both by adults, children, and babies.

Honey has a variety of minerals and vitamins. In general, the mineral content in honey is around 1.03 grams / 100 grams of honey. Honey has complete mineral elements namely Potassium, Magnesium, Calcium, iron, Zinc, Manganese, Cuprum, Aluminum, barium, Boron, Bromide, Cadnium, Chlorine, Cobalt, Fluoride, Iodine, Lithium, Molybdenum, Nickel, Rubidium, Silicium, Strontium , Sulfur, Vanadium and Zinkronium. The vitamin content in honey is also quite complete. Vitamins contained in honey are Vitamin A, Vitamin B (B1, B2, B6, Niacin and Pantothenic Acid), Vitamin D, Vitamin E, Vitamin K and some provitamins (Purbaya, 2007).

Because it has economic value that is quite high and contains unique substances, there is often a forgery of honey. Honey forgery can be done by dilution using water so that the nutrient content in honey will be reduced as well as the risk of bacterial contamination. In addition, counterfeiting can be done by adding artificial sweeteners so that it is dangerous if given to babies or people suffering from Diabetes Mellitus.

According to the Indonesian National Standard SNI 3545-2013, sucrose levels in honey are still allowed to reach 5% and the permissible water content is a maximum of 22%, so limiting the circulation of honey products on the market will reduce the number of people with diabetes mellitus in Indonesia. Where according to the International Diabetes Federation (IDF) data, Indonesia is classified into the top 10 diabetes mellitus sufferers.

p-ISSN 2622-2027
e-ISSN 2622-2035

Anwar Sadat (2013), utilizes the dielectric constant of a capacitor to measure the level of forgery in honey. From the data obtained, it can be concluded that the higher the level of forgery of honey, the greater the dielectric constant in other words, the greater the value of capacitance. However, the disadvantage of this method is that this system requires direct contact with honey samples and the system cannot identify the type of honey.

Benedetti (2004) uses electronic-nose and neural network recognition algorithms to identify types of Chinese honey. From the data obtained, the system can be used to identify or characterize types of honey. However, the weakness of this system requires taking a long sample of honey because it uses a gas sensor series.

Therefore in this study a spectroscopy system with a pattern learning algorithm based on Single Board Computer (SBC) will be designed. So that it can realize a tool system that can measure the quality level of honey bees and can classify honey types accurately.

2. RESEARCH METHODS

The system designed consists of two main parts, namely a data acquisition system and a data processing system. In the data acquisition system (spectrophotometer) there are light sources, samples, monochromators and cameras, while in the data processing system there are Intel® Edison Modules and monitors as user interfaces and machine learning algorithms. In the data acquisition system, the camera functions as an image taker, then the image will be processed with the Intel® Edison Module to be identified and the results displayed through the monitor. The next step is analyzing the results of testing the entire system. The final stage is writing a paper and publication.

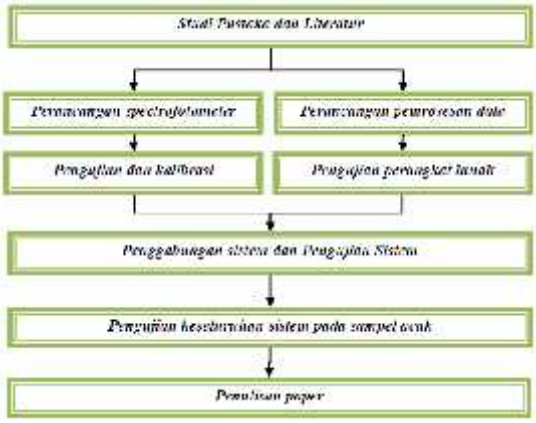

Figure 1. Research Flow

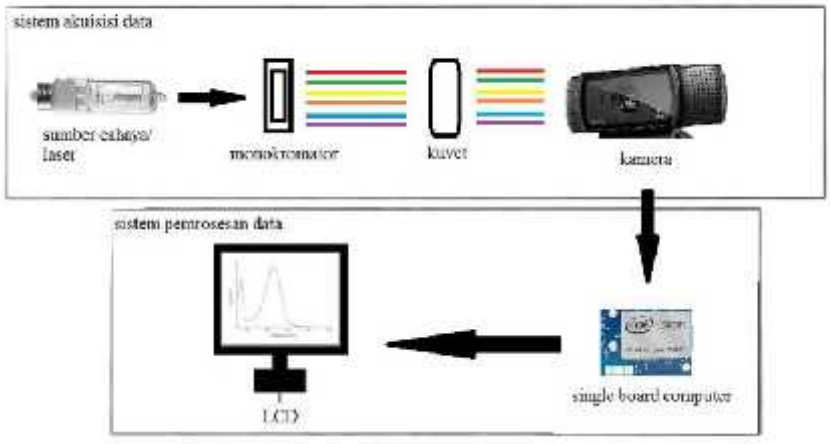

Figure 2. Illustration of the research plan

2.1 System Design

In this study will be designed two systems (polarimeter system and electronic nose system) that will be integrated into one. Figure 2 is an explanation of the design of the system:

2.2 Designing a Data Acquisition System

At this stage of the research a visibles-spectrophotometer system will be designed, in the light source section tungsten halogen lamps with visible light wavelengths are 380-700nm.

p-ISSN 2622-2027
e-ISSN 2622-2035

Whereas in the monochromator section a grating spectrospoce is used which functions to turn polycromatic light into monochromatic. The principle works the same as the prism. Then for the type of cuvette used is a cuvette made from plastic material so that light can be passed through the wavelengths of visible light. In the detector section, a High Definiton (HD) camera is used to capture the light that has passed through the cuvette to calculate its absorbance value.

2.3 Designing a Data Processing System

In this research phase, a system that can process image data originating from a data acquisition system will be designed to be incorporated into a support vector machine pattern recognition algorithm and display it into a monitor. Before image data is processed into a pattern recognition algorithm, the data acquisition system must be calibrated first.

2.4 Calibration

The calibration process aims to determine the scale of the wavelength and absorbance value precisely so that the data to be processed by the pattern recognition algorithm is precision data. For the calibration process, some monochromatic lasers are used, namely lasers which only have a specific wavelength. Then the wavelength is converted to pixels. Furthermore, the pixel data is used as a reference for the wavelength of a light.

2.5 System Testing

At this stage both systems are tested and analyzed, both data acquisition systems and data analysis systems. This is done so that the pattern recognition algorithm of a honey sample does not occur errors, both in hardware and software. Testing is done by training the data of a honey sample and then re-testing it to identify the type of quality of the honey sample.

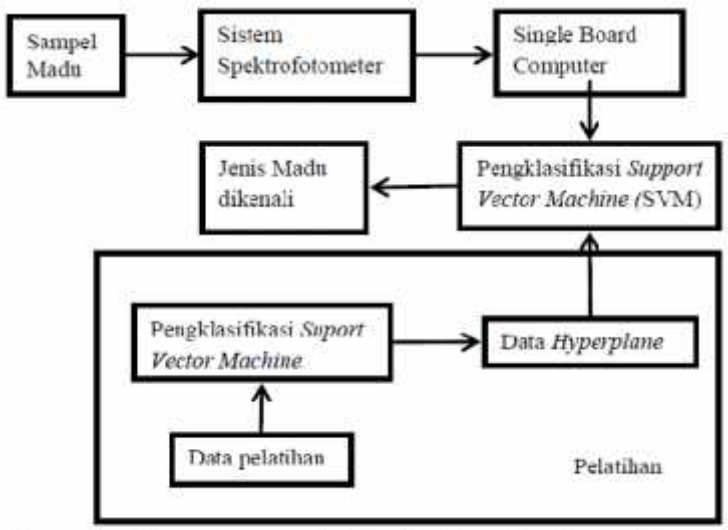

Figure 3. Testing System for Quality Identification of Honey

p-ISSN 2622-2027
e-ISSN 2622-2035

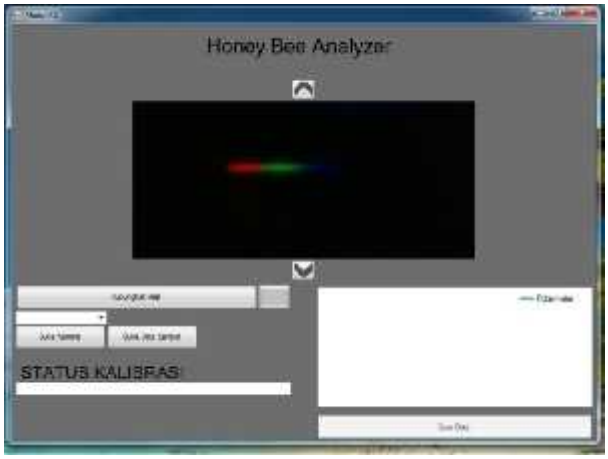

Figure 4. Display of sphyrophotometer software applications to measure absorbance and pattern recognition

2.6 Testing the entire system on honey samples

The next stage is the process of testing the entire system on random samples on the market. For evaluation, the original honey sample was mixed by adding water or artificial sweeteners and adjusting the concentration level. So that we obtain a real comparison, then from these results a statistical process is performed to present the percentage of the system's ability to identify the quality of honey.

3. RESULTS AND DISCUSSION

In the initial data collection process as a reference for data and training in pattern recognition systems, 3 types of honey are used, namely honey, coffee honey, and rubber honey. Each of the original samples of honey was mixed by adding artificial sweeteners and the concentration level was adjusted to 4 types, namely 20%, 40%, 60%, and 80%. Each absorbance data was taken by passing a light monochromator and the results were captured through a camera and processed on a single board computer and then the data obtained was recorded in a database of pattern recognition systems.

In testing three types of honey using a spectrophotometer at a wavelength of 500 nm, the absorbance obtained in the type of honey honey was 0.523-0.654, coffee honey was 0.735-0.824, and rubber honey was 0.547-0.743.

4. CONCLUSION

In this study a system has been created for classifying the quality of honey with a spectrophotometer system and pattern learning algorithms. This is based on the presence of chromophore groups which produce absorbance, electronic transitions and colorants for honey. By using a support vector machine pattern recognition algorithm system, it can be used to identify the purity level of honey sold in the market so that it can help honey consumers in choosing good products.

REFERENCES

Anonim, (2013). Standar Nasional Indonesia SNI 01-3545-2004, Pusat Standarisasi Industri. Departemen Perindustrian Indonesia.

Asri, S.A. (2011). "Aplikasi Pengenalan Wajah Dengan Menggunakan Metode Klasifikasi Support Vector Machine (SVM)". *Jurnal Logic*. Vol. 11, No. 1. Hal. 57-61.

Benedetti, S., Mannino,.S, Sabatini,.A,.G, Marcazzan,. G.,L. (2004). "*Electronic nose and neural network use for the classification of honey"* © INRA/DIB-AGIB/ EDP Sciences Apidologie 35 (2004) 1–6

Burges, C. (1998). *A Tutorial on Support Vector Machines for Pattern Recognition*. Data Mining and Knowledge Discovery. Hal. 121-167.

Hasan, N., Ejaz, N., Ejaz, W., and Kim, H.S. (2012). "Malicious Odor Item Identification using an Electronic

p-ISSN 2622-2027
e-ISSN 2622-2035

Nose based on Support Vector Machine Classification". *The 1st IEEE Global Conference on yConsumer Electronics*. Hal. 399-400.

Frianto, H.T., dan Rivai, M. (2008). "Implementasi Jaringan Syaraf Tiruan Backpropagation dan Self Organizing Map Menggunakan Sensor gas Semikonduktor Sebagai Identifikasi Jenis Gas". *Seminar Nasional Informatika*, UPN "Veteran", Yogyakarta. Hal. 219-228.

Lanzhen C, (2012). "Classification of Chinese honeys according to their floral origin by near infrared spectroscopy". Jurnal Food Chemistry 135 (2012) 338–342.

Luis G., Eduardo G B,José G, Miguel A. (2005). "Classification of honeys of different floral origins by artificial neural networks". *IEEE sensor*. Hal.1780 – 1783

Purbaya, J.R. (2007). *Mengenal dan Memanfaatkan Khasiat Madu Alami*.Penerbit Pinonir Jaya.Hasan, Bandung.

Sihombing,D. 1997. *Ilmu Ternak Lebah Madu*. Gadjah Mada Universitas Press, Yogyakarta.