



Evaluation of Scanning Electron Microscopy (SEM) Test and Flavonoid Nanoparticles from Herbal Dreg as an Additive in Layer Chicken Feed

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Abstract. Feed additives are a safer alternative feed option to use compared to synthetic additives. This research aims to evaluate the morphological characteristics and flavonoid content of herbal dreg nanoparticles that can potentially be used as feed additives for laying hens. The methods used in this research include Scanning Electron Microscopy (SEM) to analyze the morphology of herbal dreg nanoparticles and the total flavonoid content determined using Ultraviolet-Visible (UV-Vis) spectrophotometry with aluminum chloride as a reagent. The results of the SEM analysis show that the herbal dreg nanoparticles have a suitable size and shape for application in feed, with a uniform size distribution due to their high fiber content. The measurement of total flavonoid content at 12.555 parts per million (ppm) with 2.39% weight/weight (w/w) indicates that the herbal dreg contains flavonoids at a low concentration due to the high content of dry weight. This research concludes that herbal dreg nanoparticles have the potential to serve as a natural and effective feed additive, which can enhance the health and productivity of laying hens, as well as reduce dependence on antibiotics.

Keywords: herbal dreg, nanoparticles, SEM, flavonoids, laying hens.

1 Introduction

Feed additives have become a significant concern in the livestock industry to improve feed quality. Feed additives derived from natural sources such as herbs are increasingly in demand because they are considered safer and environmentally friendly than synthetic additives. Flavonoids as one of the bioactive compounds widely found in plants have various health benefits including antioxidant, anti-inflammatory, and antibacterial properties [1]. Using flavonoids as feed additives can help improve chicken health, enhance production performance, and improve egg quality. However, the bioavailability of flavonoids in feed is often a challenge so methods are needed to enhance the absorption of these compounds by the chicken body. Nanotechnology offers an innovative solution to enhance flavonoid bioavailability through nanoparticle synthesis. [2] Particle size standards generally range from 1 to 100 nm which allows them to be more easily absorbed by the digestive system.

Morphological analysis of nanoparticles using Scanning Electron Microscopy (SEM) will provide important information about the size and shape of the nanoparticles produced. [3] The working principle of Scanning Electron Microscopy (SEM) involves using an electron beam focused on the sample's surface. The interaction between the electrons and the sample atoms produces a signal that can be detected. These signals are then converted into images that provide detailed information about the morphology and composition of the material at a microscopic scale. This research is expected to significantly contribute to developing better quality and sustainable layer feed and optimally utilise waste from the herbal medicine industry.

2 Materials and Methods

2.1 Materials

The material used in this study is herbal dregs produced from the traditional herbal medicine-making process. This herbal drug is a waste often discarded, even though it has excellent potential as a source of nutrients. To maximize its benefits, the herbal dregs sample was processed into nanoparticles with a size of 100 mesh. This processing aims to increase the surface area of the particles to increase the availability of nutrients when used as a layer feed additive. Thus, using herbal medicine pulp in the form of nanoparticles is expected to positively contribute to the health and productivity of laying hens.

2.2 Methods

Scanning Electron Microscopy (SEM) Test. SEM test was conducted to analyze the morphology and size of herbal pulp nanoparticles. The procedure starts with the herbal dregs sample that has been processed into nanoparticles, dried, and then coated with a conductive layer using Auto Fine Coater JEOL JEC-3000FC. Next, the coated samples were observed with a JEOL JSM-6510LA Scanning Electron Microscope (SEM) at various magnifications to obtain a clear picture of the morphology and size distribution of the nanoparticles. The SEM images were then analyzed to determine the nanoparticles' size, shape, and morphological distribution.

Flavonoid Content Test. Flavonoid content test in herbal pulp nanoparticles was conducted using the Ultraviolet-Visible (UV-Vis) spectrophotometric. The procedure started with 0.5 grams of herbal pulp nanoparticles dissolved in 10 ml of methanol and incubated for 30 minutes to ensure optimal dispersibility. After that, the solution was filtered to separate the solids from the filtrate. [4] The resulting filtrate was added with 0.1 ml of 10% AlCl_3 solution and 0.1 ml of 1M sodium acetate, followed by 2.8 ml of distilled water to create ideal reaction conditions. This mixed solution was incubated for 30 minutes to allow the reaction to proceed correctly. After incubation, the absorbance of the solution was measured using a Ultraviolet-Visible (UV-Vis) spectrophotometer at a wavelength of 510 nm. The results of this measurement were used to

calculate the total flavonoid content, expressed in ppm (parts per million), providing information on the flavonoid potential in the herbal pulp nanoparticles.

Data Analysis. SEM analysis and flavonoid assay data were analyzed descriptively and quantitatively to evaluate the morphological characteristics of nanoparticles and flavonoid content in herbal medicine pulp used as a feed additive for laying hens. petelur.

3 Results and Discussion

SEM analysis showed that the nanoparticles had an irregular morphology with varying sizes. The interactions between the nanoparticles indicate successful coating, as seen in Figure 1. This size indicates that the process successfully converts the herbal pulp into smaller nanoparticles, which can increase the efficiency of their use in feed applications. Smaller particles can be more easily broken down by digestive enzymes and absorbed by intestinal cells. Finer particles can support nutrient utilization efficiency and improve the health and production performance of laying hens.

The particle morphology in the SEM images shows that most of the nanoparticles have irregular shapes, although some appear round. This irregular shape could be due to the intensive grinding process, which breaks the particles into smaller sizes and changes their shape. In the oxidation process, localized growth and flaking of the oxide layer occurs [5]. The oxidation was analyzed by SEM testing to observe the microstructure of the oxide layer and the possibility of revealing the processes that occur during oxidation. This morphological diversity is essential because it can affect how particles interact with biological systems, including absorption and distribution in the livestock body [6].

Further analysis of the SEM images showed that the size distribution of the nanoparticles was reasonably even. This means that no too large or small particles dominate, which may contribute to the increased bioavailability of active compounds in the feed. High bioavailability is essential to ensure that the nutrients and bioactive compounds in herbal medicine pulp can be adequately absorbed by the livestock's body, thus providing optimal health benefits. Overall, the SEM observations showed that processing herbal medicine pulp into nanoparticles successfully produced particles of suitable size and morphology, which could increase their potential use as an effective feed additive [7].

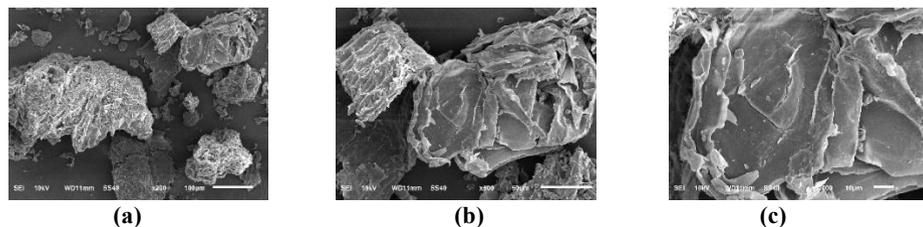


Fig. 1. SEM morphological analysis of herbal dregs with magnification (a) 200x; (b) 500x; (c) 1000x.

Analysis of flavonoid content in herbal pulp nanoparticles showed that the total flavonoid content was 12,555 pm or 2.37% w/w. The total flavonoids of herbal medicine is 2.37% w/b. This total flavonoid content is similar to herbal medicine preparations in general. This value means that the activity is relatively low. However, it should be noted that in the use of herbal medicine, consumption is carried out routinely, which is in line with the philosophy of herbal medicine, which emphasizes the provision of sustainable effects through long-term use. [8] Flavonoids detected in herbal dregs, including essential compounds such as quercetin, have potential as powerful antioxidants. [9] Quercetin is known for its ability to protect body cells from free radical damage, which may contribute to the health of farm animals. The results of this analysis indicate that herbal medicine pulp is a rich source of flavonoids, which are beneficial as antioxidants and may also play a role in boosting the immune system of livestock. Flavonoids in animal feed can help reduce oxidative stress, often due to environmental factors or disease, thereby supporting livestock health and productivity. These findings confirm the importance of herbal medicine pulp as a high-potential source of nutrients and provide a scientific basis for its use in animal feed to improve livestock health and performance.

4 Conclusion

The conclusion of this study emphasized that the processing of herbal medicine pulp into nanoparticles successfully produced particles with suitable size and morphology, which could increase their potential use as an effective feed additive for laying hens. The total flavonoid content detected in the herbal pulp nanoparticles was 12,555 pm or 2.37% w/w, indicating that herbal pulp is a rich source of flavonoids, which have potential as antioxidants and may contribute to the health of farm animals. This study provides a scientific basis for using herbal medicine pulp in animal feed to improve the health and performance of laying hens. It supports the development of higher quality and sustainable feeds.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

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