



## Chemical Characteristics and SEM Analysis of Compost from Cassava Peel Waste and Cow Manure: Production by Pendawa I Farmer Group, Candi Rejo Village

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**Abstract.** Cassava peel waste and cow dung in the Pendawa I Farmer Group, Candi Rejo Village, Sibiru-biru District, are managed into compost which can be reused for cultivated plants. However, it is necessary to analyze the chemical characteristics of the compost produced by good compost according to SNI 19-7030-2004. The purpose of this activity is to determine the chemical characteristics and SEM analysis of compost made from cassava skin waste and cow dung produced by the Pendawa I Farmer Group. carried out for 4 weeks. The materials used were 100 kg of cassava skin waste, 200 kg of cow dung, water, molasses, and enough EM4 as an activator. Parameters observed included compost pH, total N (%), total P<sub>2</sub>O<sub>5</sub> (%), K<sub>2</sub>O (%), C-organic (%), CEC (me/100), compost moisture content (%), C/N ratio, and micronutrients which include Ca (%), Mg (%), Fe (%), Mn (%), Cu (ppm) and Zn (ppm). As well as SEM (Scanning Electron Microscope) analysis with 2500x magnification. The results of compost analysis show that the final chemical characteristics of the compost have pH (6.50 : neutral), N-total (1.37% : very high), Total P<sub>2</sub>O<sub>5</sub> (0.48% : very high), K<sub>2</sub>O (0.25% : high), C-organic ( 25.06% : very high), CEC (125.05 me/100 : very high), compost moisture content (20.15%), C/N ratio (18.29), Ca (0.10%), Mg (0.30%), Fe (0.97%), Mn (0.09%), Cu (7.43 ppm) and Zn (46.64 ppm). Based on the results of laboratory analysis, the results of the chemical analysis of the compost are by following SNI 19-7030-2004 so that farmers in the Pendawa I Farmer Group can continue to produce the compost.

**Keyword:** Chemical Characteristics, SEM, Cassava Peel Waste, Cow Manure, Compost

**Abstrak.** Limbah kulit singkong dan kotoran sapi di Kelompok Tani Pendawa I, Desa Candi Rejo, Kecamatan Sibiru-biru, diolah menjadi kompos yang dapat digunakan kembali untuk tanaman budidaya. Namun, diperlukan analisis karakteristik kimia dari kompos yang dihasilkan untuk memastikan bahwa kompos tersebut sesuai dengan standar SNI 19-7030-2004. Tujuan dari kegiatan ini adalah untuk menentukan karakteristik kimia dan analisis SEM dari kompos yang dibuat dari limbah kulit singkong dan kotoran sapi yang diproduksi oleh Kelompok Tani Pendawa I, selama 4 minggu. Bahan-bahan yang digunakan meliputi

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100 kg limbah kulit singkong, 200 kg kotoran sapi, air, molase, dan EM4 secukupnya sebagai aktivator. Parameter yang diamati meliputi pH kompos, total N (%), total P<sub>2</sub>O<sub>5</sub> (%), K<sub>2</sub>O (%), C-organik (%), CEC (me/100), kandungan air kompos (%), rasio C/N, dan mikronutrien yang meliputi Ca (%), Mg (%), Fe (%), Mn (%), Cu (ppm), dan Zn (ppm). Selain itu, dilakukan analisis SEM (Mikroskop Elektron) dengan perbesaran 2500x. Hasil analisis kompos menunjukkan bahwa karakteristik kimia akhir dari kompos memiliki pH (6,50: netral), N-total (1,37%: sangat tinggi), Total P<sub>2</sub>O<sub>5</sub> (0,48%: sangat tinggi), K<sub>2</sub>O (0,25%: tinggi), C-organik (25,06%: sangat tinggi), CEC (125,05 me/100: sangat tinggi), kandungan air kompos (20,15%), rasio C/N (18,29), Ca (0,10%), Mg (0,30%), Fe (0,97%), Mn (0,09%), Cu (7,43 ppm), dan Zn (46,64 ppm). Berdasarkan hasil analisis laboratorium, hasil analisis kimia kompos sesuai dengan standar SNI 19-7030-2004 sehingga petani di Kelompok Tani Pendawa I dapat terus memproduksi kompos.

**Kata Kunci:** Karakteristik Kimia, SEM, Limbah Kulit Singkong, Kotoran Sapi, Kompos

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## 1 Introduction

Compost is a fertilizer made from organic waste which is rich in carbon and nitrogen elements. Naturally, organic waste will experience decay and decomposition by hundreds of types of microbes (bacteria, fungi, doubts) and various types of small animals that live in the soil. This natural process is used to process organic waste into fertilizer.

Compost is a complete source of macro and micromineral nutrients although in relatively small amounts (N, P, K, Ca, Mg, Zn, Cu, B, Zn, Mo, and Si). In the long term, applying compost can improve pH and increase crop yields on acid soils [1].

Waste classified as organic waste is waste that can decompose due to the natural decomposition process by bacteria. Generally, organic waste is waste that comes from nature, such as leaves, fruits, animal dung, tea or coffee grounds, eggshells, and so on [2].

The composting process requires microbes for the decomposition process. In order for microbes to live and reproduce, carbon elements are needed as an energy source for microbes and nitrogen elements for microbial growth. These elements are obtained from organic waste. So, it is necessary to ensure that the organic waste that will be used in composting has balanced elements of carbon and nitrogen [3].

Carbon-rich organic waste generally has characteristics of dry, rough, or fibrous and brown in color, for example, dry leaves and grass. While the characteristics of nitrogen-rich waste are green in color and contain water, for example, vegetables, fruits, and tea and coffee grounds.

Compost is good for use for various reasons such as not damaging the environment, does not require a lot of money, the manufacturing process being easy and the ingredients are not difficult to find. Organic matter (compost) is one of the elements that make up soil fertility and to produce fertile soil, it is necessary to add organic matter [4].

Cassava skin waste and cow dung in the Pendawa I Farmer Group, Candi Rejo Village, Sibiru-biru District, are organic wastes that can be managed into compost which can be reused for cultivated plants. With the help of the USU service team, the composting process must be carried out properly and with the right composition so that a good chemical character of the compost can be produced.

For this reason, an analysis of the chemical characteristics of the compost produced by the Pendawa I Farmers Group in Candi Rejo Village, Sibiru-biru District was carried out so that it was adjusted to SNI 19-7030-2004 standards and SEM analysis to see the surface morphological structure of the compost with a magnification of 2500x.

## 2 Method

The 2022 Regular Year Mono Service activity in the form of making compost from cassava peel waste and cow dung has been carried out at the Pendawa I Farmer Group in Candi Rejo Village, Sibiru-biru District, Deli Serdang Regency from September to November 2022.

### a. Preparation of Tools and Materials

In this stage, the Pendawa I farmer group prepared ingredients in the form of 100 kg of cassava skin waste, 200 kg of cow dung, water, molasses, and enough EM4 as an activator.

### b. Composting Process

The method used is composting using the conventional method which is carried out at home by simple composting in the Pendawa I Farmer Group (Figure 1.) The ratio of carbon-rich material: nitrogen-rich material (2:1), namely cow manure: cassava peel (200kg : 100kg). Composting is done in 4 weeks.

### c. Parameters Monitoring

The parameters analyzed at the end of composting included the chemical characteristics of the compost, namely compost pH, N-total (%), Total P<sub>2</sub>O<sub>5</sub> (%), K<sub>2</sub>O (%), C-organic (%), CEC (me/100), compost moisture content (%), C/N ratio, and micronutrients which include Ca (%), Mg (%), Fe (%), Mn (%), Cu (ppm) and Zn (ppm). As well as SEM (Scanning Electron Microscope) analysis with 2500x magnification.



**Figure 2.** The composting process is carried out by the Pendawa I in Candi Rejo Village

### 3 Result and Discussion

The 2022 regular-year mono community service activity in the form of making compost from cassava skin waste and cow dung has been completed at the Pendawa I Farmer Group, Candi Rejo Village, Sibiru-biru District, Deli Serdang Regency. The composting activity was attended by 10 members of the farmer group consisting of the group leader, group secretary, and members of the farmer group. The practical activity of making compost was assisted by the dedicated team lecturer and 5 students from the Faculty of Agriculture.

The composting process is carried out by chopping the cassava peel waste to make it smaller in size and facilitating the decomposition process. The chopped cassava peel waste is then mixed with cow dung in a ratio of 2:1. After that, a little molasses was added as a microbial food ingredient and enough EM4 as a composting activator. After that, the compost is covered using a tarpaulin. Composting was carried out for 4 weeks. The compost-turning process is carried out every week so that the composting heat is evenly distributed and the decomposition process is homogeneous.

Parameter observations were carried out by the Pendawa I Farmer Group every day including measuring temperature and humidity using a thermometer and hygrometer that had been provided by the service team. The results of the measurements will be reported by the Pendawa I farmer group to the service team through the Field Agricultural Extension on duty in Candi Rejo Village.

After the fourth week, samples of mature compost were taken with the characteristics of the temperature starting to decrease according to the ambient temperature, visually the characteristics of mature compost were blackish brown, odorless, and crumbly textured. Furthermore, the compost samples were brought to the laboratory for chemical character analysis which included macro and micronutrients and SEM analysis with 2500x magnification.



**Figure 2.** Photo with the community service team with the Pendawa I farmer group in the process of making compost

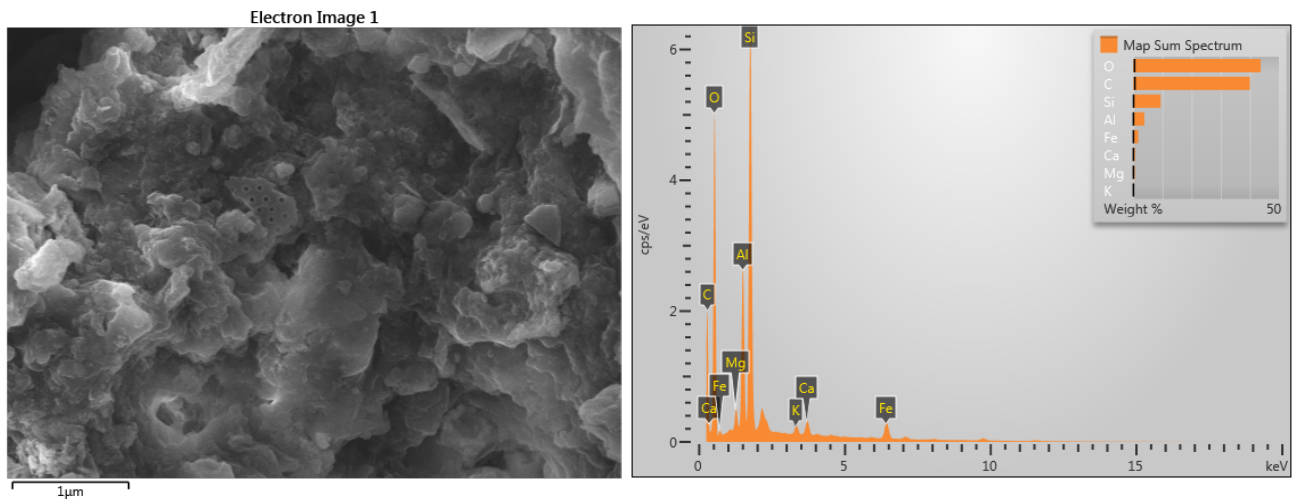
Based on the results of nutrient analysis of compost made from cow dung and cassava peels, the following data is generated.

**Table 1.** Chemical characteristics of compost from cassava peel and cow manure

Parameters	Method	Result	Category	SNI 19-7030-2004
Nitrogen (%)	Volumetry	1.37	Very high	Min 0.40
Total P <sub>2</sub> O <sub>5</sub> (%)	Spectrophotometry	0.48	Very high	Min 0.10
K <sub>2</sub> O (%)	AAS	0.25	High	Min 0.20
C-Organic (%)	Gravimetry	25.06	Very high	27 – 58
Ca (%)	AAS	0.10	Moderate	Max 25.50
Mg (%)	AAS	0.30	High	Max 0.60
Cu (ppm)	AAS	7.43	Sufficient	Max 100
Fe (%)	AAS	0.97	Sufficient	Max 2.00
Mn (%)	AAS	0.09	Sufficient	Max 0.10
Zn (ppm)	AAS	46.64	Sufficient	Max 500
pH	Potentiometer	6.50	Neutral	6.80 – 7.49
CEC (me/100)	Volumetry	125.05	Very high	-
Water content (%)	Oven	20.15	-	Max 50
C/N Ratio	-	18.29	-	10-20

Based on Table 1, the chemical character categories of compost made from cassava peels and cow manure comply with the Indonesian National Standard on solid organic fertilizer standards (SNI 19-7030-2004). For this reason, the Pendawa I Farmer Group can produce this compost on a large scale as additional input for farmer groups and can be used for cultivation plants themselves.

In addition, the results of the Scanning Electron Microscope (SEM) analysis of compost can be seen at 2500x magnification (Figure 3).



**Figure 3.** SEM results of compost of cassava skin waste and cow manure (2500x)

#### 4 Conclusion

The compost produced from cassava skin waste and cow dung carried out by the Pendawa Farmers Group I has chemical characteristics of pH (6.50: neutral), N-total (1.37%: very high), Total P<sub>2</sub>O<sub>5</sub> (0.48%: very high), K<sub>2</sub>O ( 0.25% : high), C-organic (25.06% : very high), CEC (125.05 me/100 : very high), compost moisture content (20.15%), C/N ratio (18.29), Ca (0.10%), Mg (0.30%), Fe (0.97%), Mn (0.09%), Cu (7.43 ppm) and Zn (46.64 ppm). Based on the results of laboratory analysis, the results of the chemical analysis of the compost are by following SNI 19-7030-2004 so that farmers in the Pendawa I Farmer Group can continue to produce the compost. The obstacle encountered during the composting process was the absence of a cassava husk waste-chopping machine, so it had to be done manually. It is hoped that in the following year the service team can continue the service in the Pendawa I farmer group by assisting with a chopping machine.

#### 5 Acknowledgment

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