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TESTING BIOSEL-SR2020 TO REDUCE PHYSICAL-CHEMICAL CONTENTS IN FAECAL SLUDGE TREATMENT INSTALLATIONS IN PUULONGGIDA AND POTENTIAL AS AN ORGANIC FERTILIZER INGREDIENT

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ABSTRACT

Testing BIOSEL-SR2020 to Reduce Physical-Chemical Contents in Faecal Sludge Treatment Installations in Puulonggida and Potential as An Organic Fertilizer Ingredient. To improve environmental health and address the issue of domestic fecal sludge waste, it is essential to treat the waste using an environmentally friendly organic oxidizing material, BIOSEL-SR2020. This study examines the effect of adding BIOSEL-SR2020 to reduce the physicochemical content of fecal sludge at the Puulonggida sludge treatment plant (STP) in Kendari City and its potential as a component of organic fertilizer. The environmental condition of Puulonggida STP shows that the air quality around the STP is excellent. The area is far from residential zones and features numerous trees, which help transform the toxic gases produced by septage treatment. The application of BIOSEL-SR2020 to septage solids significantly alters and enhances the chemical elements in the septage. Oxide composition data, such as MgO, Al2O3, SiO2, and CaO—soil components—indicate that BIOSEL-SR2020 application significantly improves chili plant growth compared to commercial organic fertilizer and untreated samples. Furthermore, treating fecal sludge liquids with BIOSEL-SR2020 affects the pH, maintaining a standard range of 7.06 - 7.13. The Dissolved Oxygen (DO) value increases slightly, and the fecal liquid's salinity indicates no mineral salts. BIOSEL-SR2020 also demonstrates antibacterial properties, reducing bacterial colonies by an average of 26%. The most prevalent bacteria, Klebsiella sp., and Pseudomonas sp. are effective in decomposing fecal organic matter at the Puulonggida STP. In conclusion, BIOSEL-SR2020 effectively enhances the physicochemical properties of fecal sludge and holds potential as a mixture in organic fertilizers, significantly benefiting plant growth and environmental health.

INTRODUCTION

The environment is the most important aspect of living things' survival on earth's surface [1, 2]. Pollution of environmental conditions affects the biota and fauna around the pollution site and its surroundings. Environmental pollution disrupts the ecosystem's equilibrium due to the homeostatic nature of large environments, which refers to their capacity to endure a range of systemic changes. [3]. However, iHowever, the critical conditions that occur undoubtedly surpass the capabilities of the environment, leading to high levels of environmental pollution within an ecosystem [4]. tal pollution is defined as a condition that occurs because the environment can no longer withstand changes in unfavorable environmental conditions. This is due to the entry or introduction of hazardous materials or organic or inorganic waste into environmental bodies (soil, air, and water), which are sub-components of abiotic components. The imbalance between waste production and processing leads to a decrease in nature's carrying capacity for waste disposal, a condition commonly referred to as anthropogenic activities related to waste pollution. [6].

The Indonesian government continues to strive to increase the capabilities and capacity of available space to deal with domestic waste, whose presence continues to increase every day. As the population increases, the amount of waste produced increases [7]. Particularly, Indonesia monitors domestic waste and fecal sludge management efforts from district to provincial levels to prepare and manage fecal sludge treatment plants (IPLT). The Public Settlements Public Works Service (PUPR) persistently monitors and schedules services for the community to handle household, industrial, and tourism fecal sludge. The goal is to anticipate and reduce the impact of environmental pollution caused by fecal sludge [8].

The IPLT then decomposes the collected fecal sludge to produce environmentally safe materials by breaking down organic and inorganic materials. However, the data presented by Hidayat et al. and Ikhsani et al. show that the organic, inorganic, and microbiological content of fecal sludge is very high and difficult to handle [9, 10]. Several commonly used methods, including aeration, flocculation, filtration, and adsorption, still have various obstacles and very expensive operational costs. We have widely used techniques for administering addictive substances like Effective Microorganism-4 (EM-4) to reduce fecal sludge waste levels, and they have proven to be quite effective in accelerating the decomposition process of biotic materials in fecal sludge. [11].

To address the issue of domestic fecal sludge waste and improve environmental health, we must treat the waste using an oxidizing organic material, specifically the environmentally friendly BIOSEL-SR2020. This material is considered biodegradable, serves in chemical waste processing, introduces a new approach to processing dissolved organic waste, and comes at a minimal cost. This material is made by indigenous people from Southeast Sulawesi and is claimed to contain mangrove plant extracts. It has the ability to be used for plantations, agriculture, animal husbandry, and to overcome fecal sludge pollution. [12].

Laboratory testing is necessary for organic oxidizing agents to effectively treat various types of waste. Several web articles state that using BIOSEL-SR2020 can increase soil fertility and ward off microorganisms [12]. Research has not yet explored the use of BIOSEL-SR2020 material for treating fecal sludge waste. So, the main goal of this study is to test the BIOSEL-SR2020 material to see how well it can lower the chemical and physical levels of fecal sludge waste at the Puulonggida IPLT in Kendari City and see if it can be used as an organic fertilizer. Other researchers in environmental health studies will later use physical studies, like the analysis of the air quality around the IPLT, and chemical studies to examine the impact of BIOSEL-SR2020 on the composition of fecal sludge.

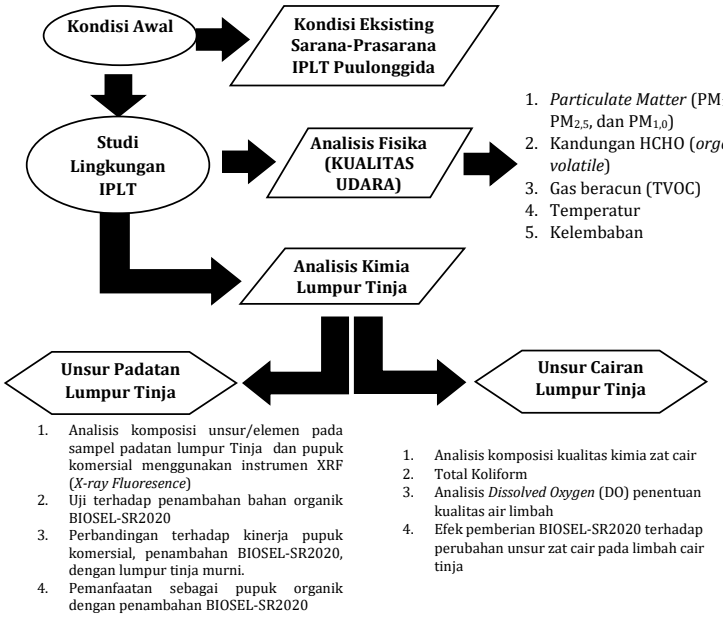
MATERIALS AND RESEARCH METHODS

We used a field survey method to test the environmental quality of IPLT and conduct laboratory tests to observe changes in chemical composition caused by the effects of BIOSEL-SR2020 on fecal sludge. The research was conducted at IPT Puulonggida, Kendari City, Southeast Sulawesi.

The survey aims to map the condition of the Puulonggida IPLT, specifically focusing on the grouping of processing ponds. The IPLT has four main sludge processing ponds and two sludge solids storage tanks. The IPLT tests physical properties by randomly sampling every corner of the processing pond and measuring air conditions, including organic matter evaporating total volatile organic compounds (TVOC) and formaldehyde (HCHO) emitted from fecal sludge processing.

Picture*1*. SR2020 Biocell product made in Southeast Sulawesi

Testing of fecal sludge composition, microorganisms, and potential as organic fertilizer is carried out by laboratory standards. Fecal sludge composition testing where semi-dry solids are taken randomly then sieved using a 200 mesh sieve. The results obtained were dried and tested using an X-Ray Fluorescence (XRF) instrument. Potential fertilizer levels were tested, where 2 kg of coarse fecal solids were taken and tested at the East Java Agricultural Technology Assessment Center (BPTP). These results were compared with regular fertilizer samples and those given BIOSEL-SR2020. Meanwhile, testing for microorganisms from fecal sludge is carried out in liquid conditions. Samples are taken in dark bottles and placed in an ice box. Then the liquid sample is prepared and filtered and placed in an ampoule bottle which is then tested in the microbiology laboratory of the Sepuluh Nopember Institute of Technology (ITS). In general, the implementation of the research can be seen in the flow diagram in Figure 2.

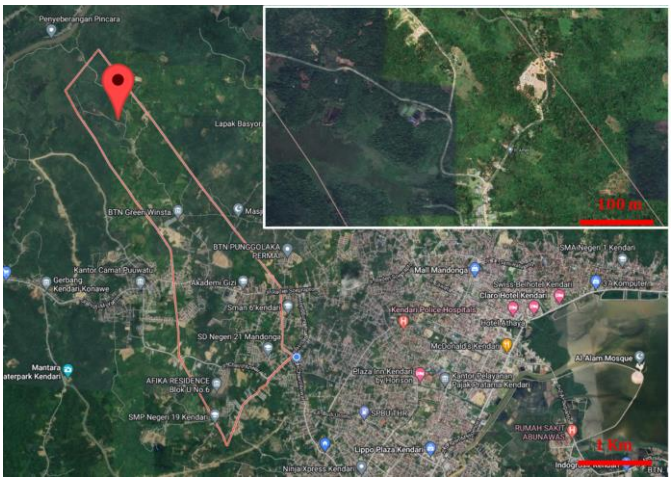


Picture*2*. Flow diagram of the research implementation process

RESULTS OF RESEARCH AND DISCUSSION

General description of the Puulonggida IPLT

The Pulonggida Fecal Sludge Treatment Plant (IPLT) is located in Watulondo Village, Puuwatu District, Kendari City. The plant is situated on Jalan Pulonggida, 4 km away from the Trans-Sulawesi Road axis, and its coordinates are 3°56'25"S–122°27'49"E (Figure 3). Based on BMKG data (2021), we calculated the average climate elements for 2020, which included a temperature of 27.33 °C, humidity of 86.03%, wind speed of 0.83 m/sec, air pressure of 1009.72 mb, rainfall of 193.08 mm, number of rainy days of 20.50, and solar radiation of 4.87% [13]. These weather conditions and topography significantly impact the current conditions of the Puulonggida IPLT, which is responsible for proExamining the current state of the IPLT building, which is the subject of this research, is crucial as it serves as a primary tool for classifying the environmental health areas surrounding the Puulonggida IPLT.Puulonggida IPLT area.



Picture3. Geographical description of the Puulonggida IPLT location, Kendari City

The Puulonggida IPLT's waste water infrastructure and facilities system (Figure 4) falls under the communal system category, centralizing the fecal sludge disposal process for the benefit of Kendari City's residents. The Kendari City PUPR Service also offers door-to-door services for residential sludge suction to the community, making this operational unit a significant achievement in evaluating IPLT performance in accordance with standard operating procedures (SOP). The condition of IPLT management throughout Indonesia is referred to in the detailed technical planning guidelines for the Ministry of PUPR's 2017 fecal sludge processing installations [14].

Picture*4*. Existing condition of the Puulonggida IPLT, Kendari City; (a) Initial collection tank, (b) solid waste separation tank, (c) Liquid wastewater separation tank, (d) Administrative office facilities

In general, the Kendari City IPLT currently manages 80 m^3/day of fecal sludge per day. Door-to-door service by service officers is based on an on call system and requires state civil servants (ASN) to set an example in managing fecal sludge management in each house. The services provided to the people of Kendari City are spread across various sub-districts such as Puuwatu, Mandonga, Kadia, Wua-Wua, West Kendari, Kendari, Anduonohu, and Kambu. The number of septic tanks available to fulfill built capacity will also be taken into account as in Kendari City[14]. IPLT condition and specifications can be seen in Table 1.

Table1. Puulonggida IPLT specifications, Kendari City

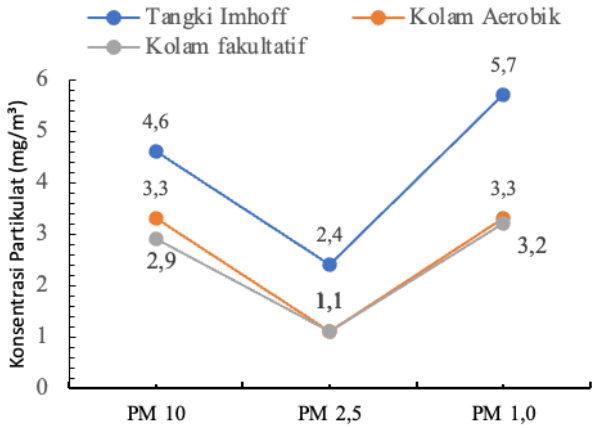
Condition	**Description / specifications**
Development Year	2008
Present condiition	The Imhoof construction is 3 m high, so currently the Imhoff is used as a sludge receiver before it is forwarded to the processing unit.
Address	Puulonggida Village, Puuwatu District
Installed capacity	80 m3/day
Used Capacity	35 – 40 m3/day
Technology used	Stabilization Pond (Anaerobic Pond – Faculative Pond – Maturation Pond)
Mud Separation System Unit	Imhoff tanks and processing units
Manager	Environmental Service (2019 transition to Kendari City PUPR Service)

The IPLT area study has the potential to impact environmental pollution in both air and water environments [15]. Several cases of fecal waste pollution are caused by organic and inorganic chemicals such as evaporation and water pollution, namely contamination of waters by the presence of the bacterial microorganism E. coli. This condition is an early detection of poor sanitation, where E. coli bacteria act as an indicator of fecal contamination from humans and animals. Not only that, but other pathogenic bacteria also play an important role in providing

indicators of unfavorable environmental conditions. The presencLarge amounts of domestic waste, such as fecal waste from bathing, washing, and toileting activities, and industrial waste directly disposed of in water bodies, contribute to the presence of microorganisms in waters. of nitrogen in nature is higher than the amount of oxygen, which is the concrete basis for the performance of microorganisms in fixing or decomposing fecal waste to produce nitrate compounds through the stages of forming ammonium and nitrite, which are toxic or poisonous to waters. [16].

Analysis of Physical Conditions (Aspects of Air Quality)

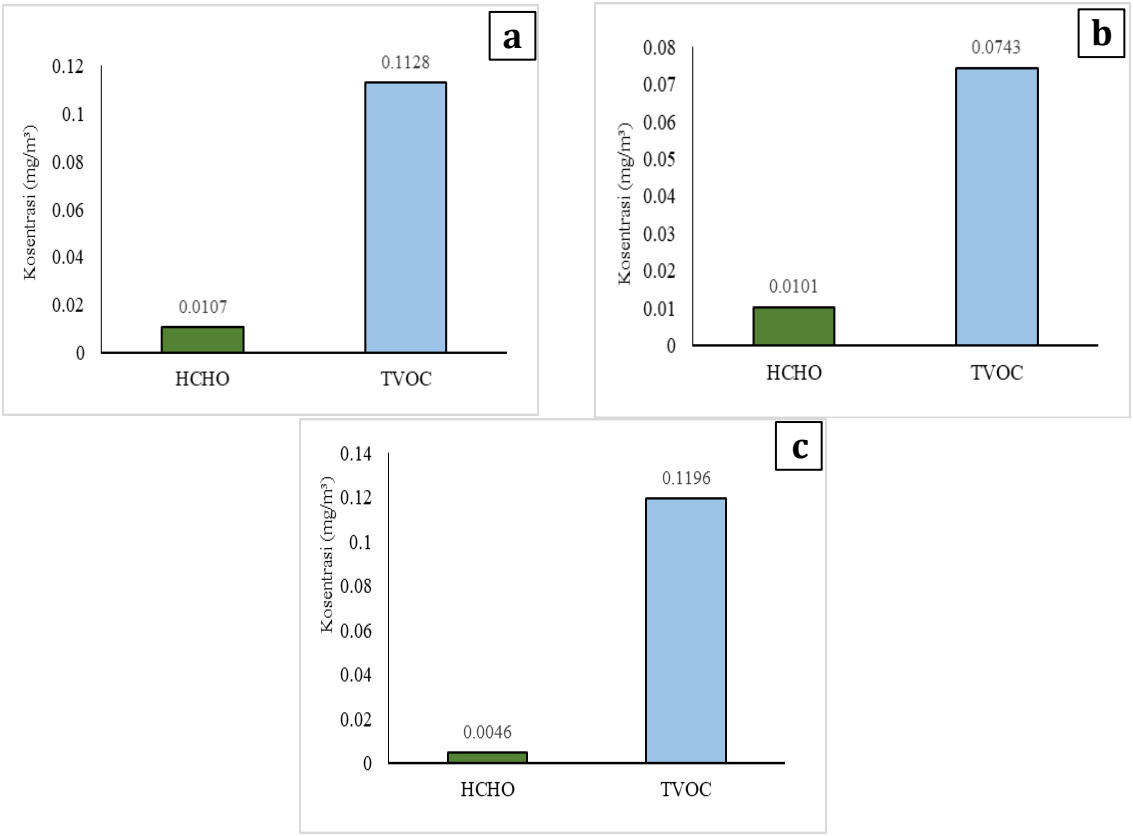
We conducted this research to determine and describe the ambient air quality in the Puulonggida IPLT area, Kendari City. DWe carried out data collection activities for particulate matter concentrations of PM10, PM2.5, and PM1.0. The PM10 study serves as the primary parameter for analyzing environmental conditions, as it identifies the presence of flying particles with a size of 10 microns, PM2.5 particles with a size of 2.5 microns, and PM1.0 particles with a size of less than 1.0 microns [17]. We conducted PM concentration measurements from morning to evening, assuming the Ambien Particle Counter could represent 24-hour measurements.The Imhoff tank area, aerobic pool, and facultative pool were the air quality sampling locations.



Picture5. Concentration of dust particulates in each measurement area

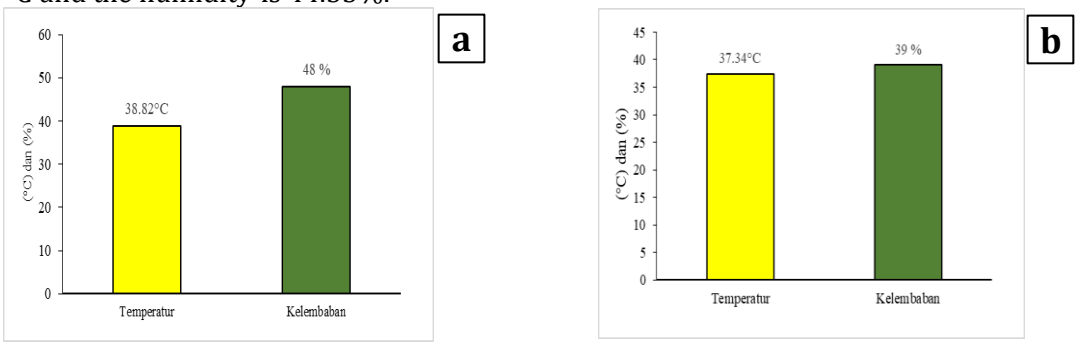
Figure 5 shows that the concentration of particulates is highest in the Imhoff pool area, compared to the aerobic pool and facultative pool. This indicates that the Imhoff tank is likely to contain particulates or bioaerols such as pathogenic bacteria, filamentous fungal spores, viruses, endotoxins, or other metabolite products. Apart from that, other physical factors, such as wind speed or humidity, greatly influence the concentration of dust particles.

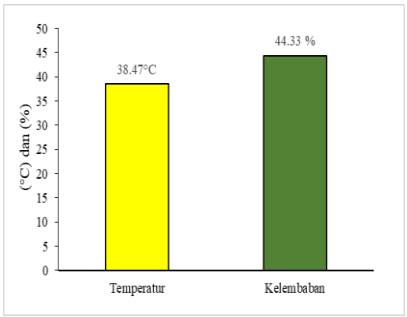
Burning plant residues produces Formadehyde (HCHO), a natural compound [18]. At room temperature, HCHO is a colorless gas with a sharp, irritating odor that is highly reactive and flammable. We conducted observations of HCHO and TVOC concentrations in the Imhoff tank area, aerobic pond, and facultative pond at ILPT Puulonggida Kendari City (Figure 6). The Imhoff pond had the highest HCHO concentration, measuring 0.017 mg/m3. Meanwhile, the Imhoff tank area had the highest TVOC concentration, at 0.1128 mg/m3. The following is an overview of HCHO and TVOC concentrations at ILPT Puulonggida Kendari City.



Picture*6*. Concentrations of HCHO and TVOC in Aerobic Ponds in the Puulonggida IPLT environment (a) Imhoff Tank, (b) Aerobic Pond, (c) Facultative Pond

Meteorological conditions, among others, influence the presence of air pollutants in the environment. This condition can either inhibit or increase pollutants such as temperature and humidity. Air temperature can influence atmospheric turbulence and chemical reactions. Air temperature and the presence of pollutants in the air simultaneously affect health [19]. Observations of meteWe conducted observations of meteorological conditions in the Imhoff tank area, aerobic pool, and facultative pool at ILPT Puulonggida Kendari City. (Figure 7) in the Imhoff pool is 38.82°C with a humidity 48%; in the aerobic pool, the temperature is 37.34°C and the humidity is 39%; and in the facultative aerobic pool, the temperature is 38.47°C and the humidity is 44.33%.





Picture7. Conditions of Temperature and Humidity in the Puulonggida IPLT environment (a) Imhoff Tank, (b) Aerobic Pool, (c) Facultative Pool

Analysis of Chemical Conditions of Fecal Sludge

Table 2 reveals that the chemical content of nickel metal in fecal sludge solids falls short of the Minister of Agriculture Decree 209/Kpts/SR/320/3/2018 quality standard. The nickel contentComparing the nickel content in fecal sludge to commercial fertilizer reveals a condition below 0.01%, which qualifies it for the nickel metal content analysis category (20). ls cobalt (Co), magnesium oxide (MgO), aluminum oxide (Al2O3), silicon oxide (SiO2), chromium (III) oxide (Cr2O3), and manganese (II) oxide (MnO) have relatively the same content. We can categorize this composition as suitable for comparison with commercial fertilizers on the market. Whereas cobalt hasThe content of cobalt is extremely low, falThis condition is consistent with the composition of Fe and Cr2O3 content in solid fecal sludge and commercial organic fertilizer.

Table2.Analysis of the chemical content of fecal sludge solids
by comparing commercial compost fertilizer

Chemical elements	Fecal Sludge Solids (%)	Fecal Sludge Solids + Biosell SR2020 (%)	Commercial Compost Fertilizer (%)	Ministerial Decree-Agriculture Standards 209/Kpts/SR/ 320/3/2018	Information
Nickel (Ni)	<0.01	<0.01	<0.01	*SKI	Fulfil
Iron (Fe)	2.73	2.73	1.59	*SKI	A little too much
Cobalt (Co)	<0.01	<0.01	<0.01	*SKI	Fulfil
Magnesium oxide (MgO)	0.47	0.46	0.12	min 25% of 0.12% = >0.03%	Fulfil
Aluminum oxide (Al2O3)	7.98	7.92	7.18	*SKI	Fulfil
Silicon dioxide (SiO2)	32.30	33.60	68.19	min 10% of 68.19% = >6.8%	Fulfil
Calcium Oxide (CaO)	7.78	7.93	0.61	min 40% of 0.61% = >0.25% **4-5%** (Gotaas, 1956)	Excessive
Chromium(III) oxide (Cr2O3)	<0.01	<0.01	<0.01	*SKI	Fulfil
Manganese(II) oxide (MnO)	0.09	0.10	0.14	*SKI	Fulfil
Loss on Ignition(LoI)	34.80	36.90	11.54	-	-
Total	86.18	89.67	89.40		

* The Minister of Agriculture Decree does not set the SKI Industrial Chemical Standard; instead, factories produce it as a reference standard.

After receiving the BIOSEL-SR2020 treatment, the MgO content in fecal sludge solids remains unchanged, but the chemical content remains suitable for comparison with commercial fertilizers. Commercial fertilizer has an MgO content of 0.12%, while fecal solids are 0.46%, with a difference of 0.34%, still in the very good category. Along with a value of 7.98 for untreated feces, the Al2O3 content of feces sludge solids and commercial fertilizer is about the same. Adding Biosel has lowered the Al2O3 content to 7.92%, which is a difference of 0.06%. The administration of BIOSEL-SR2020 can slightly reduce the content of dangerous metals in fecal solid samples. BIOSEL-SR2020 contains Environmentally friendly organic compounds in BIOSEL-SR2020 act as ligands, binding metal ions to reduce or secure dangerous metals in samples with high metal content. Al3+ charge, it reacts more quickly

with negative ligands. This makes Al metal the central atom and the BIOSEL-SR2020 organic material the ligand. When compared with commercial fertilizer, this result falls into the good fertilizer category because it only has a 0.74% difference from commercial fertilizer.
Sand frequently contains SiO2, a very safe element. SiO2 of more than 6.8% is very good for developing plant fertilizer because it acts as a medium to strengthen upright plants. The silica content of fertilizer should not exceed 70% because plants also need other metal ion elements to improve chemical processes. Likewise, the composition of MnO falls within the range of commercial fertilizers, with a difference of 0.04%. The Fe content slightly exceeds commercial fertilizer standards, where the micronutrient Fe has a very important role in the formation of chlorophyll and photosynthesis functions. It is also important for plants' healthy vegetative growth [21]. The Minister of Agriculture Decree does not set the SKI industrial chemical standard, but factories produce it as a reference standard, which is still acceptable as inorganic fertilizer. In this case, the Fe content is slightly higher than commercial fertilizer, with a difference of 1.14%, but still in the good category. Excessive values were observed in the CaO content of fecal sludge before and after BIOSEL-SR2020 treatment. Sutoyo (2007) asserts that feces possess a higher nutrient content (CaO and MgO) due to their connection to the bacterial fermentation process, which is a result of the additional treatment process. Therefore, the administration of BIOSEL-SR2020 plays a crucial role in the fertilizer fermentation process.
The overall analysis of the chemical content of solid fecal sludge is unique in that there is a significant difference in the LoI value between before and after the addition of BIOSEL-SR2020 compared to commercial fertilizer. We can conclude that a higher LoI value indicates a higher nutrient composition of organic matter in the sample. We use LoI analysis to ascertain the percentage of substances lost from the sample within a specific time and temperature range. We calculate the loss of fuel content (LoI) [23], which is the difference in weight before and after annealing. We classify this substance as an organic compound present in solid feces samples, and the addition of biocells can enhance the soil's nutrient content. Table 3 reveals that only the first pond exhibits salinity and salt content, as it serves as the initial holding pond for storing fecal sludge before its transportation from housing to the Puulonggida IPLT processing site in Kendari City.

Table3.Testing the quality of fecal sludge processing water

Tub	Before Treatment			After Addition of Biosel-SR2020			Salinity Standard (%)
	pH	DO (mg/L)	Salinity (‰)	pH	DO (mg/L)	Salinity (‰)	
Container	7.3 ± 0.3	2.95 ± 0.1	0.1 ± 0.01	7.35 ± 0.13	2.975 ± 0.75	<0.01± 0.01	Fresh Water = 0.0-3.0
Aerobics	7.2 ± 0.13	0.65 ± 0.54	0.05 ± 0.05	7.35 ± 0.13	0.475 ± 0.36	<0.01± 0.01	
Facultative	6.67 ± 0.15	2.55 ± 0.70	<0.01± 0.01	6.7 ± 0.14	2.875 ± 0.76	<0.01± 0.01	Brackish Water = 3.0-30
Maturation	7.05 ± 0.07	1.35 ± 0.35	<0.01± 0.01	7.1 ± 0.15	1.25 ± 0.07	<0.01± 0.01	
Average Cumulative Value ($\bar{X}$)	**7.06**	**1.95**	**1.5**	**7.13**	**1.98**	**<0.01**	Salt Water = 30-40

The evaporation process and water holding capacity also influence the salinity level. Various aerobic, facultative, and maturation ponds produce salinity, which decreases with the amount of water in the IPLT storage pond. However, high rainfall can also influence other factors (24). High rainfall conditions influence the IPLT system's water holding capacity, resulting in reduced or low salinity levels. Salinity is one of the parameters used in determining the quality of both surface water and groundwater. Salinity is the level of salinity or dissolved salt

content in water in grams per liter of sea water. After administering BIOSEL-SR2020, the salinity of the fecal sludge water samples in the initial holding tank dropped to less than 0.1%. SeveResearchers categorize water or waste according to salinity parameters, dividing it into fresh water with a salinity value of less than 0.5, brackish water with a salinity between 0.5 and 30, salt water with a salinity between 30 and 50, and extremely salty water or sea water with a salinity exceeding 40. rding to this theory, the fresh water category includes fecal sludge. The addition of BIOSEL-SR2020 changes the sample's solubility level and increases organic matter.

Microbiological Analysis of Fecal Sludge

Microbiological analysis data from fluid samples determined by varying the comparison between samples without and given Biosel showed that there was a decrease in data indicating that giving Biocell material could reduce bacterial growth in fecal water samples. The results of the analysis can be seen in Table 4.

Table4.Results of total bacterial analysis from stool samples

Component	Before treatment TPC (CFU/mL)	After administration of BIOSEL-SR2020 TPC (CFU/mL)	Decline Percentage (%)
Control (BIOSEL-SR2020)		3.8×1010	
Container	5.8×1010	3.5×1010	40%
Aerobics	6.3×1010	5.0×1010	20%
Facultative	5.6×1010	4.6×1010	17%
Maturation	6.3×1010	4.5×1010	28%
Average ($\bar{x}$)	6.6×1010	4.4×1010	26%

According to Table 4, the control condition, which contains a 2:1 Biosel solution, has a decomposing bacteria content of 3.8 × 1010. ThisThe fecal fluid, which received an additional Biosel solution, demonstrates a noteworthy decrease in bacterial levels, nearly reaching the control value. all, this analysis data indicates that Biosel's performance is very good in controlling and reducing pathogenic bacteria in fecal water samples. The identified genus indicates the type of bacteria that grows in a fecal water sample containing Klebsiella sp. and Pseumonas sp. (Table 5).

5% of normal human feces contain the bacteria Klebsiella bacteriasp. This bacteria decomposes through a facultative anaerobic process [23]. Its presence in normal humans is in the intestinal digestive system, which supports decomposition or breaking down the remaining organic material consumed. However, when it is outside normal intestinal tissue, it is pathogenic and can cause infection of external tissue. Moreover, Klebsiella sp. generates endotoxin, a complex polysaccharide present in the cell walls of gram-negative bacteria, leading to leukopenia, fever, hypotension, capillary bleeding, and circulatory collapse [25]. Meanwhile, soil and solid waste frequently harbor the pathogenic gram-negative bacteria Pseudomonas sp. This type of bacteria, Pseudomonas sp., breaks down hydrocarbon materials, which is why they are called hydrocarbonoclastic bacteria. They do this by using carbon dioxide (CO2) from the air to increase the composition of plant nutrients in feces through a carbon decomposition cycle. The role of the rhizobacteria PseudThe ability of the rhizobacteria Pseudomonas sp. to produce hormones, antibiotics, siderophores, HCN, enzymes, fix nitrogen, and dissolve phosphates contributes to the growth anThese results demonstrate that bacteria play a crucial role in degrading organic material from feces, breaking down hydrocarbons to make them safe for use as organic fertilizer.

Table5.Analyst resultssis of dominant bacteria in fecal water samples

Bacteria	Gram Paint	BAP Media	*MacConkey Media*	TSI	Sweets
*Klebsiella*sp.	Fat stem Gram negative	There is growth	Mucoid, round, shapeless, wet, red, lactose (+)	Acid/acid Gas (+), H2S (-)	Indol (-) Motility (-) Simon citrate (+) Urea (+)
*Pseudomonas*sp.	Gram negative fat rods	There is growth	Mucoid, round, wide, wet, red, lactose (-)	Alkali/alkali gas (-), H2S (-)	Indol (-) Motility (+) Simon citrate (+) Urea (-)

Potential of Fecal Sludge Organic Fertilizer

We applied fecal sludge solid sample testing on a laboratory scale to see its effectiveness on plant development. We used chili plants in this research to monitor the performance of soil samples. The research (Figure 8) reveals that three variations used commercial fertilizer, three used feces without treatment, three used BIOSEL-SR2020, and one sieved a control stool sample with the addition of Biosell SR2020. ResulThe results showed that the administered feces (BIOSEL-SR2020) performed excellently. ffect of providing Biosel can increase the nutrient content and accelerate the plant growth process. MonitWe conduct weekly (7-day) monitoring to observe the rise in plant height, thereby determining the plants' effectiveness. The research results indicate that BIOSEL-SR2020 contains organic material that enhances the nutrients in the sThe results of a study on plant height, which produced a mixture of Biocell and fecal sludge solids, confirm this (Table 6). The commercial fertilizer only increased the height of chili plants by 5.1 cm, with an average increase of approximately 1.5 cm. Compared to fecal solids without the addition of BIOSEL-SR2020, the plants demonstrate exceptional growth, as evidenced by their average height of 3.0 cm. Additionally, the addition of Biocell enhances the fertility of the plants to approximately 3.2 cm. Examining the sieve materials with and without the addition of BIOSEL-SR2020 reveals that the treatment with fecal sludge is significantly superior, even though the addition of Biosell can also enhance plant fertility. SolutionBIOSEL-SR2020 It is very appropriate to use it to advance agriculture because it can help improve land quality. Apart from that, this material can: (i) improve the physical, chemical, and biological properties of the soil; (ii) ferment organic matter; (iii) improve the nutrients and compounds needed by plants and fish from the soil; and (iv) speed up the fixation process and root nodules [29].

Picture8.Application of fecal sludge solids as organic plant fertilizer

Table6.Determining the height of chili plants in the planting process using commercial fertilizer media, solid feces, and solid feces+Biocell SR2020

Information	Variable	Week 1 (height cm)	Week 2 (height cm)	Week 3 (height cm)	Week 4 (height cm)	Week 5 (height cm)
Commercial Fertilizer	1	PLANTING PROCESS	2,3	4	4.8	5,6
	2		2	3.3	5.2	5.0
	3		2,3	3.3	5.5	5.3
Average			**2,2**	**3.5**	**5.1**	**5.3**
Fecal Solids	1		1	4.6	7.6	11.6
	2		2,2	4.7	8.3	12.6
	3		1	3.1	5.5	9.6
Average			**1.4**	**4.1**	**7.1**	**11.27**
Fecal Solids+Biosell SR2020	1		3	4.3	8.3	13.6
	2		2	3.6	5.1	10.0
	3		2.6	4.3	7.9	12.2
Average			**2.5**	**4.0**	**7.1**	**11.93**
Sifter Fecal Solids	1		-	2.5	5	6
Fecal Solids Sifter+Biosell SR2020	1		1	4	5.3	6.5

CONCLUSIONS AND RECOMMENDATIONS

The fecal sludge processing process at the Puulonggida IPLT meets general fecal sludge processing standards. Numerous IPLT fecal sludge processes throughout Indonesia classify environmental studies related to processing as normal. The Puulonggida IPLT in Kendari City disposes of waste with a good chemical content that meets the physical and chemical environmental standards. The air quality at Puulonggida IPLT, Kendari City, is excellent due to its distance from residential areas and the abundance of trees that serve as a source of CO2 gas for plant growth. By providing BIOSEL-SR2020, it can minimize unpleasant odors. In addition, administering BIOSEL-SR2020 to fecal sludge solid samples increases soil fertility because it increases organic matter in soil nutrients. The growth of the planted chili plants, which significantly outperformed commercial organic fertilizer, demonstrates this. The administration of BIOSEL-SR2020 to liquid fecal sludge proved that it has a normal pH effect of 7.06–7.13. The DO value increased slightly, and the salinity of the fecal fluid did not contain mineral salts. Besides that, BIOSEL-SR2020 worked as an antibacterial and reduced bacterial colonies by an average of 26%. The bacteria that were found in the highest numbers were Klebsiella sp. and Pseumonas sp., which break down organic substances in feces in the Puulonggida IPLT process. The use of BIOSEL-SR2020 materials in studying composition variations for several applications in the field of waste processing requires further improvement and testing.

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