



## The Processing of Industrial Tofu Dreg Waste into Animal Feed in Sumurrejo Village Semarang

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### Abstract

Sumurrejo Village has various business potentials that can drive the community's economy, especially tofu' and tempeh' Micro, Small and Medium Enterprises, and dairy farming. The tofu industry is also negatively impacted because its waste causes environmental pollution problems. Environmental pollution is caused by unpleasant odors, organic matter content, and the potential for decay. The solution to this problem is to process the tofu dregs into animal feed. Tofu dregs that are highly nutritious, consisting of 8.66% protein, 3.79% fat, 51.63% water, and 1.21% ash, can increase the added value of tofu dregs by processing them into animal feed through a mixing and fermentation process with other additives. These resulting tofu dregs feed tested on chickens. Chickens given tofu dregs showed a better body weight gain than chickens fed regular feed by an average of 17% per day. In the tofu industry in Sumurrejo Village, people can improve the environment because tofu dregs waste can provide cheap, nutritious, safe animal feed and support livestock growth.

*Keywords: organic waste, tofu dreg, animal feed, nutrition, fermentation*

### INTRODUCTION

Tofu is famous and favorite food in Indonesia since it is healthy, nutritious, and affordable. In line with these conditions, the tofu industry is multiplying in Indonesia and generally exists in the scale of household businesses or Micro, Small, and Medium Enterprises (MSMEs). One of the tofu MSME centers in Semarang is located in Sumurrejo Village, Gunungpati District, Semarang. Sumurrejo Village is one of the leading sub-district pioneers in Gunungpati District because this sub-district has various potentials capable of driving the community's economy, especially the entrepreneurship of soybean processing (tofu and tempeh), as well as dairy and

cattle farming. Apart from dairy farming, Sumurrejo Village is a thematic village of processed soy foods: tofu and tempeh. Several UMKM producers of tofu and tempeh using soy-based raw materials, and their production is overgrowing and can improve the community's economy.

The tofu industry's development positively impacts food production centers' development fulfillment of the community's food products' needs. On the other hand, the tofu industry's existence also negatively impacts the waste that causes environmental pollution problems. One of the debris generated by tofu MSMEs in the Sumurrejo area is the dregs waste. In the tofu

industry, the tofu dreg waste generated is commonly 25-35% of the tofu products yielded (Nurhayati et al., 2019). A large amount of tofu dreg waste will become environmental pollution if it is not processed and appropriately utilized because of its foul smell, organic matter content, and putrefaction potential (Sari and Syamsudin, 2019).

Another problem in Sumurrejo Village is the increasing price of animal feed, such as concentrate, corn, soybean meal, and fish flour. Therefore, it gives the farming development hard times because animal feed is one of the main determinants of livestock production costs. Various efforts need to be made to overcome this obstacle by looking at the surrounding environment's potentials. One cheap and good quality animal feed source is tofu dreg waste. Therefore, one of the efforts to overcome the two problems in the Sumurrejo Village area is to use tofu dreg waste as an alternative material for producing animal feed.

Waste is all substances discharged after primary use or the production process of chemical products, mining, refining, agriculture, and worthless food-manufacturing materials. Tofu dreg is solid waste that has a distinctive smell of soybeans. It also consists of carbohydrates, fats, and proteins (Damanik et al., 2018). The solid waste of tofu manufacturing in the water is suspended and deposited solid. Based on its chemical composition, solid tofu waste has high protein content. It was reported that the content of tofu dreg is 9% protein, 4% fat, 52% water, and 1% ash. The protein quality in tofu dreg is higher than in soybeans because tofu dreg protein has a higher biological value than soybean protein in its raw state. The tofu pulp is a result of cooked soybeans. Tofu pulp also contains micro and macro mineral elements: Fe 200-500 ppm, Mn 30-100 ppm, Cu 5-15 ppm, Co less than one ppm, and Zn more than 50 ppm. Tofu dreg can be processed into animal feed. It was reported that the growth of livestock-fed tofu pulp-based feed was fast (Sari et al., 2016).

The drawback of tofu dreg as an animal feed ingredient is its high water and crude fiber (Anggraeni et al., 2013). Fresh tofu dreg has 84.5% water of its weight. Increased moisture can shorten its life shelf. The wet tofu dreg cannot be stored for a long time and will become acidic and

rotten in 2-3 days. A drying process can overcome this condition. Dried tofu dreg contains around 10.0 - 15.5% water so that the shelf life is longer than fresh tofu pulp (Herlinae et al., 2017). The high crude fiber makes it difficult for the animal feed to be digested by ducks, and the high-water level can shorten its shelf life. One way to reduce the crude fiber level is by fermentation. Fermentation technology can improve animal feed quality, especially the one with high natural fiber and anti-nutrition. Fermentation can enhance the digestibility of fodder by simplifying the substances using the enzymes produced by microbes.

To date, people do not understand the economic potential of tofu waste as a raw material for affordable, high quality, highly nutritious, and safe fodder for livestock. Therefore, to overcome the environmental problems caused by the disposal of tofu waste and the high price of animal feed, community service activities aimed to increase the added value of tofu waste by making it into fodder were conducted in Sumurrejo Sub-District. This skill practice was performed to address environmental problems and provide fodder that was affordable, nutritious, safe, and supports livestock growth. Aside from having a positive impact on ecological hygiene, this community service activity was also valuable to empower people to become economically independent. These activities have innovative skills in making fodder using tofu waste and encouraging (Bell et al., 2014) the development of livestock in the Sumurrejo Village area. The community service activities included: 1) providing knowledge to the community about the composition and economic potential of tofu pulp waste, 2) skills training for the community regarding processing tofu waste into fodder, 3) providing skills on the application of tofu pulp-based fodder for livestock.

## METHOD

This community service activity offered a solution to increase the added value of tofu waste to become fodder by skills training for the community on appropriate technology to process tofu waste. Knowledge and skills training is needed by the community in applying tofu dregs-based feed for livestock. The right technology used for this community service activity was a

simple fermentation technique to process tofu pulp into fodder (Trisnadewi et al., 2015). The fermentation technique applied in this community service activity was the fermentation method using tempeh yeast. Besides, a simple drying technique with a manual oven aims to preserve.

**Materials**

Materials needed in making animal feed prepared are 5 kg (Formula A) and 3 kg (Formula B) of tofu pulp, 250 g of tempeh yeast, 50 g of Amidion feed supplement mineral.

**Procedures**

Tofu dregs were put into the pan for steaming. Steam the tofu dregs for 30 minutes. Then the tofu dregs are cooled and placed on the floor covered with a carpet or banner. Masking tape or tempeh yeast and minerals is smeared on top of the cold tofu dregs, then stir all the ingredients until blended. After ingredients were mixed, the tofu dregs are put in a bucket or plastic drum to ripen for 2-3 days until they smell good as a sign of the completion of the fermentation process. The tofu dregs dried by putting them in the oven. This drying aims to extend the life of the tofu pulp shell by two months.

**RESULT AND DISCUSSION**

The community service team and field assistant attended the internal coordination meeting to determine fodder formulation from tofu dreg waste and livestock testing methods (chickens). The community service team collected tofu dreg waste Tofu MSME, who was the partner of this activity. This waste would be processed into alternative fodder, highly nutritious, and stored for a long time.

**Method Of Making Animal Feed From Dregs**

The method used to process tofu pulp into fodder in this community service activity was fermentation using tempeh yeast. Fermentation is crucial since it can increase the nutrients of the ingredients. As a result of the biosynthesis of vitamins, essential amino acids, and proteins, were increase the quality and digestibility of protein (Oboh and Elusiyan, 2007). Besides, fermented ingredients are easily digested, and the amino acids and vitamins are increased. Increasing protein (amino acids) can be achieved by fermentation using a microbial activity that acts as probiotics. In this work, tofu dreg waste's fermentation process helped extend the fodder's shelf-life produced from tofu waste. Furthermore, additive materials were also added to optimize the process and increase the fodder's nutrients. The ingredients used were salt, sugar, vitamin B12, molasses, garlic, and various natural sources of essential oils.

In general, animal feed manufacturing using tofu pulp included formulating, fermentation, and drying. There were two types of formulas made in the manufacture of fodder, as listed in Table 1. This formulation was suitable for fodder for chickens (*Kampong Chicken*).

**Table 1.** Formulation of Animal Feed from Tofu

Component	Dreg Waste			
	Formula A	%	Formula B	%
Tofu pulp, g	5000	94	3000	91
Tempeh yeast, g	250	5	250	8
Supplement, g	50	1	50	1



**Figure 1.** The mixing process of making pulp tofu  
 (a) reduction of water content, (b) steaming, and (c) mixing of yeast, vitamins, and tofu



**Figure 2.** The yeast fermentation making animal fodder anaerobic process and (b) molding and oven waste

Animal feed formulation was carried out and followed by a 3-day fermentation process and oven drying. The supplement was added at the formulation stage to improve its nutrition (Tempeh yeast). During the fermentation, the valuable compounds, single-cell protein, and biopolymer was formed. This fermentation process was also needed to reduce the fiber level in tofu pulp so that the fodder produced would be easily digested by livestock. Besides, fermentation can improve the color, smell and remove the toxic material (Mulia et al., 2015).

Drying was performed in an oven to help the fodder dried faster than processing it using sunlight. Drying aimed to make the fodder more durable, not easily damaged or moldy, and could last up to 2 months. The series of activities to make animal feed are 1) initially, prepare the tofu dreg waste, 2) then squeeze the tofu dreg to reduce the water content, 3) steam the tofu dreg for 30 minutes, 4) cool the tofu pulp in an open place, 5) add 50 grams of supplement and 250 grams of tempeh yeast, 6) stir and mix until ingredients were blended, 7) put in a bucket and close tightly 8) let it fermented in a closed bucket for three days until the smell was good, 9) move the fermented fodder into a baking sheet, 10) dry the fodder using the oven for 6 hours, and it was ready to be used as fodder, especially for chickens (*kampong chicken*). Some of these activities can be described as shown in Figure 1 and Figure 2. Making fodder was recorded in a video that was

used as a learning media for the community training about the process of making fodder using tofu dreg waste.

### Testing of Animal Feed From Tofu Dreg Waste As Chicken Feed

Tofu dreg waste can be applied as animal feed. It was also reported that the supplementation of tofu dreg waste to the feed could increase the animal body weight (Afzalani et al., 2017). In this work, the dried fodder was tested on medium-aged chickens. As a comparison or control, pur (commercial fodder) sold on the market was also tested. The comparison of the weight gain of chickens fed by fodder made of tofu pulp of formula A, formula B, and commercial chicken (pur) was presented in Figure 3.

Formulas A and B show an increase in chicken body weight. The provision of formula A resulted in a rise of 13%, and formula B increased by 16% in chicken weight compared to pur fodder. Formula B shows the increase in chicken weight is higher than A by an average of 6% for 1 to 5 days. On the first day of feeding, chickens gain the highest weight compared to food on the next day (up to 5 days). On days 2 to 5, an average of 6% decreased from the previous weight gain. Recommendation: chicken feed is excellent, making chickens gain weight at least 17% compared to commercial pur chicken feed. Food types should be varied alternately so that the chicken does not get bored of consuming it.

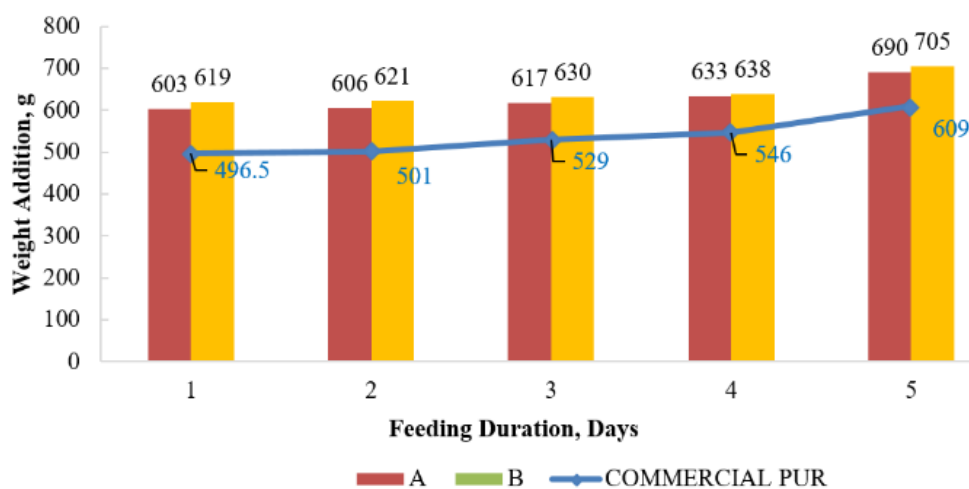


Figure 3. The weight gain of chickens fed by fodder of tofu pulp of formula A, formula B, and commercial chicken.

This research is also in line with the results of the combination of tofu dregs fermentation and commercial feed with a ratio of 60% and 40%, which can increase weekly body weight gain (Husnaeni et al., 2019). Supported also by the livestock given 70% concentrate containing tofu dregs with 30% fermented soybean pods has a good performance in terms of final body weight, daily body weight gain, dry matter intake, and feed efficiency (Priyanto et al., 2017). On this occasion, the team also supported MSMEs by providing tofu waste-based fodder products, chicken, and equipment types to make fodder from tofu waste, consisting of ovens, pans, and others. Tofu manufacturers attentively listened to and participated in this training activity and even expected the follow-up activity in the form of testing the nutrients of feed, training on large-scale fodder production, packaging, branding, and marketing. The community service team welcomed this expectation by planning a service program for the following year to continue this community service.

The application of tofu dreg waste as animal feed is a strategic method to increase the waste's economic value. Mufarida and Probowulan (2019) also suggested an alternative for product diversification in the tofu industry. It was too urgent to reduce the tofu waste concerning the environmental issue since the tofu industry is among the big waste producers. It resulted in 25-35% waste of tofu product.

## CONCLUSION

Using tofu dreg waste as fodder through a fermentation process runs well with cooperation between MSME actors and universities. Increasing public knowledge about the negative impact of tofu waste and the economic potential of tofu dreg waste through the lecturing method, advancing MSME actors' skills to know about appropriate technology to process tofu dreg waste into animal feed. Increasing the community's knowledge and skills about applying tofu dregs-based feed for livestock can be successful. It was found that chickens fed a combination of year's dregs had a weight gain of 15-24% heavier than chickens fed commercial feed. Farmers can save on animal feed and can practice it themselves.

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