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Research Paper

Geomembrane Filter Thread Technique's Potential to Increase Salt Production in Jeneponto Regency

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Abstract
The problem of salt production byJeneponto Regency is influenced by the traditional way of making salt. The introduction of GFTT (Geomembrane Filter Thread Technique) as a salt-making technology is an effort to increase salt production in the Jeneponto district, both in quality and quantity. This activity was carried out in Biring Parang Jaya Village, Jeneponto Regency. Activities are carried out by applying threaded techniques to salt ponds, making filter devices on salt ponds, and installing geomembranes as salt tablets. Based on the application of technology, the salt produced by GFTT has better quality and quantity than traditional salt. Salt produced by GFTT is classified as high grade with 99.96% NaCl and 0.04% moisture content.

Keywords
Jeneponto Regency, Filter Thread, Geomembrane, Salt Production, Salt Pond

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1. INTRODUCTION

Salt is an essential need of people in Indonesia for both household and industrial use. Salt is one of the potential coastal commodities in the Indonesian agricultural sector. The need for good quality salt in Indonesia still relies on imports from abroad (Susanto et al., 2015; Sasongko et al., 2021). This is because the quality of the salt is still mainly managed traditionally by using direct sunlight. Thus, to meet the good quality of salt, it must be reprocessed to be used as salt for consumption and industry (Hamid and Aldianto, 2014). Increasing the productivity and quality of salt is the main program to meet the national salt demand, which is increasing yearly.

As a maritime country, Indonesia has the potential to become the largest salt producer, with a sea area of 2/3 of the total area of Indonesia. With such a vast sea, Indonesia has a reasonably high mineral potential, so it is possible to obtain large amounts of salt (Sumada and Dewati, 2018; Syam and Patandean, 2018; Titu-Eki and Kotta, 2021). Jeneponto Regency is one of the areas in South Sulawesi that produces salt, has reliable marine and coastal potential, and has not been managed optimally. Several considerations underlie the development of salt pond business in Jeneponto Regency, among others: 1) Jeneponto Regency is one of the regencies in Indonesia which has ± 600 Ha of potential land for the development of ponds and salt industry.

The need for salt in the community continues to increase every year. However, this increase in demand is not followed by an increase in the quantity and quality of local salt production. For 2000 the domestic salt in Indonesia needs both for consumption and industry, projected total estimated projections 2,100,000-2,200,000 tons while the production of salt is only about 300,000-900,000 tones (Sulistyaningsih and Alighiri, 2018). The quality and quantity of salt produced is influenced by several factors, namely weather conditions that affect crystallization, the area of salt ponds, and the expertise of farmers in producing salt. Meanwhile, Indonesia requires quality industrial salt with a NaCl content of more than 96% (Bambang, 2019; Lestari et al., 2019). In Indonesia, many farmers still use a traditional way of making salt, namely using soil as a salt table, causing the salt produced to be dirty. The low quality of salt is due to inadequate technology, lack of facilities and infrastructure (Rusdi, 2018; Thys, 2003; Apriani et al., 2018).

The same case also occurred in Jeneponto Regency. Lack of training on proper salt making makes the quality and quantity of salt production in Jeneponto Regency tend not to increase. This also affects the income of salt farmers in Jeneponto Regency. Lack of training on proper salt making makes the quality and quantity of salt production

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The most basic effort that can be taken to overcome salt production problems is to increase salt farmers' expertise. It can be done through counseling and training on how to make good salt to produce high-quality salt in large quantities. The expertise of farmers will affect the quality of salt production in Jeneponto Regency. Therefore, it is hoped that counseling and training on the use of GFTT (Geomembrane Filter Thread Technique) so can increase the expertise of farmers, which ends in increasing the quality and quantity of salt production in Jeneponto Regency.

GFTT stands for Geomembrane Filter Thread Technique. GFTT is a form of applying two technologies simultaneously, thread filter technology and geomembrane. GFTT is the modified technology of salt production integrating geomembrane technology through the serial plots. The main principle of FTT is the evaporation process of seawater flowed through the serial plots in the salt tables. In addition, natural materials are added as filters to purify seawater (Susanto et al., 2015). The advantages of implementing FTT are the productivity could attain 80 ton/ha/cycle, the color of salt product is white and pure, the purity of salt (NaCl) and price are higher than traditional process products (Bramawanto et al., 2016). Geomembrane is a layer of HDPE sheet that is spread on salt land and serves as a waterproof barrier between the soil and other parts (Guntur et al., 2018; Abdelaal et al., 2019). Each technology has its constraints. For example, the use of Ramsol material can only bleach salt crystals, and costs are required to procure Ramsol (Gozan et al., 2021).

The main principle in the salt-making technique is the evaporation of seawater with the help of sunlight flowing through radiant plots in the aging process (Bozkurt and Karakilcik, 2015; Lad et al., 2015; Wang et al., 2018). The advantage of geomembranes is that the absorption of heat from the sun is more intense as a result of the black color effect on the geomembrane material, the raw material for making salt in the form of seawater is not easily absorbed into the bottom of the salt pond land which is usually only in the form of compacted soil, the crystallization process is faster, so that efficient in terms of production time, the salt produced is whiter and cleaner because it is not contaminated with soil (Apriani et al., 2018; Sulistyaningsih and Alighiri, 2018; Lestari et al., 2019; Tuomela et al., 2021). DestinationThe implementation of this activity is to determine the potential of GFTT (Geomembrane Filter Thread Technique) in overcoming the problem of salt production in Jeneponto Regency. This program aims to strengthen the local economy and spur growth in salt production from the Biring Parang Jaya Salt Farmers Group through production growth and quality improvement.

2. EXPERIMENTAL SECTION

2.1 Materials

This program is carried out by the Biring Parang Jaya salt group, Jeneponto Regency, which is intended for salt farmers. The survey includes measurement of water/saltwater temperature and air temperature, physical observations, and interviews. Physical observations were carried out to inventory land area, measure plots and bands as a constituent of pond composition, and collect information about conditions around ponds that could potentially affect the salt-making process. The time used for this activity is 4 months.

2.2 Methods

2.2.1 Structure of Salt Pond Filter Thread Technology (FTT)

Filter Thread Technique (FTT) is a salt pond management system that focuses on modifying pond land and controlling seawater quality into the brine. The structure and composition of the FTT salt pond are shown in Figure 1. It can be seen in the figure that the FTT salt pond is composed of 3 main components, namely two reservoirs, two condensers, and three crystallizers. Equipped with brine channels (pre-crystallizers) and bunds.

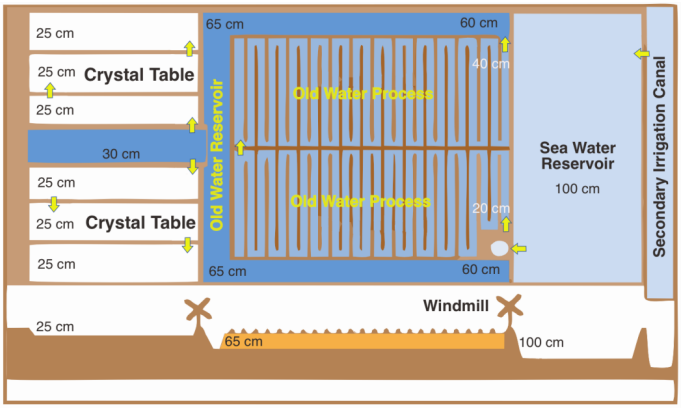

Figure 1. Design of Salt Pond Filter Thread Technology

The functions of each pool are as follows:

- Reservoir ponds or also called reservoirs, dams, and bozeem serve as a starting place to accommodate seawater with a concentration of 1-5°Be and deposit organic material.
- Condenser ponds are plots (pools) where the aging process of seawater with the evaporation of sunlight. In the FTT system, the purification pool is made in a series of plots (threads) such as channels of uniform size with a width of not more than 3 m. In this purification pond, the aging of seawater from a concentration of 5 to a density of 25°Be occurs. Old water (brine) with a concentration of 25°Be is the raw material for salt to flow into the crystal table (crystallizers).

- The brine channel (pre-crystalized) is a small channel and a map to accommodate 25°Be density brine that is ready to be crystallized.
- Crystallization tables (crystallizers) are plots where the crystallization of brine into salt crystals occurs.

In the GFTT salt ponds, there are small elongated plots connected to each other in a series, better known as screw pools. This land modification is what distinguishes GFTT salt ponds from traditional salt ponds. The principle of the GFTT system for pond management is focused on modifying pond land and controlling seawater quality to become old water with a viscosity of 25°Be. The production process will be faster and last for 13-15 days. In simple terms, a brief description of the application of GFTT in the People's Salt Business Empowerment Program, namely:

1. Main reservoir
2. Big thread
3. Reservoir pool
4. Small thread
5. Old water reservoir
6. Bitten water reservoir (for salt washing)
7. Crystallization pool
8. Old water reservoir

2.2.2 Filter Design

The design of the filter consists of a pralon pipe filled with coconut fiber, zeolite, and charcoal (see in Figure 2). The use of the net serves as a cover so that the materials in the pralon pipe do not come out when the water has flowed into the filter. Coconut fiber fibers are used to filter various small impurities from the incoming water. Zeolite stone and charcoal have been activated carbon that binds Manganese (Mg) and iron (Fe) in the water content. Zeolite and charcoal have the advantage of eliminating odors and giving a natural white effect to the resulting salt so that the quality of the salt is good.

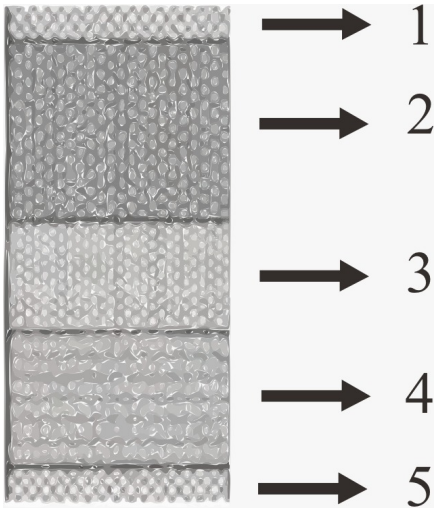

Figure 2. Filter Design

Information:

1. Net
   Net serves to keep the contents of the paralon pipe from coming out when water enters.
2. Coconut husk
   Coconut husk filters the impurities contained in the water.
3. Zeolite stone
   Zeolite stone binds the metal and the ammonium content contained in the water.
4. Coconut shell charcoal
   Coconut shell charcoal to purify water and remove odor from the water.
5. Net
   Net keeps the contents of the paralon pipe from coming out when water enters.

2.2.3 Implementation Stage

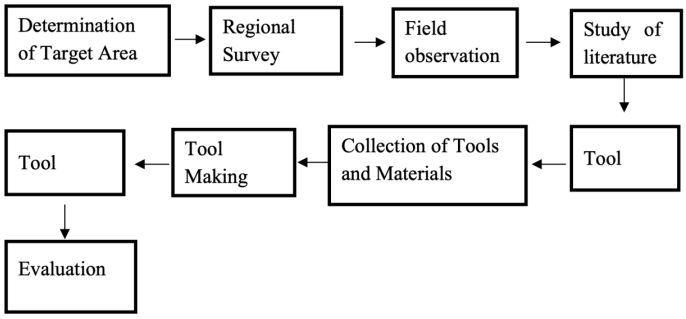

Figure 3. Flow Map Implementation Stage

The flow map in Figure 3 can be defined as follows:

1. Determination of target areas
2. Review multiple locations
3. Observation of designated salt fields
4. Assessment of Relevant Sources
5. Tool Design
6. Data collection of tool and material needs
7. Tool making
8. Testing tools

The first step will be designing the tool to be made. The next stage is collecting tools and materials according to the level of need. The selection is viewed from the price and quality of the goods used so that the results to be achieved follow the initial target and adjust the allocation of available funds. The third stage is making tools that have been designed previously. Making tools must be done carefully and using predetermined standards to produce the best tools. The next stage is socializing the program with village administrators and salt farmers. The socialization stage was carried out at partner locations, namely salt farmers as salt producers in Jeneponto Regency. The socialization will be carried out intensively, starting from tool installation, operation, and equipment maintenance. In addition, marketing

management strategies are also socialized to salt farmers to be marketed widely. The fifth stage is implementing the program that has been designed. At this stage, the working system of the tool will be assessed, both in terms of the stability of the tool, its effect on the salt crystallization process, and its influence on the quality of the salt. If the results obtained are not in line with expectations, the tool's design, manufacture, and testing will be carried out again.

3. RESULTS AND DISCUSSION

The process of producing salt for the people of Biring Parang Jaya still uses the traditional process. One way salt production can increase salt production is by using Geomembranes. The Geomembrane system salts by coating the porous soil with HDPE plastic. Salt produced from traditional table salt measuring 6×15 meters is 250 kg, while salt produced from GFTT table salt with the same pond area is 300 kg in one harvest. This shows that land productivity using GFTT is higher than the traditional method. The production quantity increased by 20%. The land modification also increases the efficiency of land use in the reservoir pond from 28% of the total pond area to 75% of the total pond volume, which can increase salt production.

Geomembrane technology is an effort to avoid direct contact between the bottom of the crystallization table (soil) and seawater which will be crystallized by coating the bottom of the crystallization table with a Geomembrane so that the quality of the salt produced is free from dirt/does not mix with the soil (Rowe and Sangam, 2002; Sumiati, 2015). In addition to geomembrane, the use of screw technology is used to speed up the aging process of water so that the crystallization process will be faster and the quality of the salt will be better. The threads are made in the form of winding plots to create a natural flow of water so that the evaporation process is assisted by sunlight and wind (Bramawanto et al., 2015; Jaziri et al., 2018).

The application of new technology in salt production can improve the quality of salt production by applying Thread Filter Technology with Geomembrane. This technology has several advantages compared to traditional salt production systems. The color of the salt is whiter because when it is scratched on the tarpaulin (Geomembrane), the salt is washed with water in the tarpaulin media. In addition, the salt crystallization process becomes faster, and the salt crystals are more significant due to the multi-layered salt crystals formed with each addition of water from hatching every 2 days. This technology makes the selling price higher because the quality is better than the quality of salt produced with the traditional system. The observations in Figure 4 showed that the salt produced in GFTT was whiter in color compared to the salt produced by the traditional method displayed in Figure 5.

The water content and NaCl content in the salt were tested using the Gravimetric method. Salt produced in GFTT and the traditional way is to the oven for 20 minutes at 105°C. water content and NaCl content in salt can be seen in Table 1 below:

Figure 4. Salt Produced by GFTT

Figure 5. Traditional Production

Table 1. Water Content and Salt NaCl Content

Salt Type	Water Content	NaCl Level
GFTT	0.04%	99.96%
Traditional	3.78%	96.22%

Based on the observations, water content, and NaCl content, it can be concluded that the salt produced at GFTT is a type of high-grade salt. The salt produced traditionally is a type of medium-grade salt. This shows that the quality of salt using GFTT is higher than the traditional method. According to Nurkolis et al. (2021), that consumable salt is divided into 3 types: (1) food or high grade, namely high-quality consumption salt with 97% NaCl content, water content below 0.05%, pure white color, mashed crystal granules. (2) medium grade, which is middle-class consumption salt with NaCl content of 94.7-97% and water content of 3-7%; (3) low grade, namely low-quality consumption salt with 90-94.7% NaCl content, 5-10% water content, dull white color. Several methods are carried out to prove that the salt produced is of high grade, medium

Figure 6. Thread Plots in Salt Ponds

grade, or low grade.

The technique of making table salt plots for the Geomembrane Filter Thread Technique is the same as the technique for making table salt plots in traditional salt production, namely by making plots (Figure 6). The difference is that this plot is covered with plastic sheeting (Geomembrane) according to the area of the plot. So that there is no need for intensive soil processing in the salt table before the salt crystallization process. Creation and Arrangement of Secondary/Tertiary Channels The manufacture and arrangement of secondary and tertiary channels in each plot for the production process are vital. This channel acts as a regulation of the entry and exit of water from the reservoir plots to the salt table, and the disposal of water from the salt table after harvest. The function of this channel is the same as that of a traditional salt production system. Salt Crystallization Process with GFTT In principle, the process of making salt with GFTT is the same as the concept in the traditional system crystallization process. The difference is that the crystallization time is longer, which is 6-7 days before it can be harvested. With a long time, this will form large crystals and layers. In addition, in the GFTT system, before the water enters the salt table, there is a process of deposition of chemical elements such as Calcium, Magnesium, and Sulfate in the screw plot before the water enters the final purification/sparse plot with a density of approximately 19/20 Be. So that the quality of the incoming water for the crystallization process is really clean, with this GFTT and Geomembrane system, a better quantity and quality of salt is obtained compared to the traditional salt production system.

Harvesting and Post-Harvest Handling GFTT, the salt harvesting technique of the GFTT Geomembrane media system is the same as harvesting in traditional salt production, starting from flattening salt crystals and collecting those

Figure 7. GFTT Salt Harvest

crystallized on the salt table in Geomembrane media. Then it is collected/ground by scratching the salt crystals with a manual rake, namely from the edge of the salt table to the middle and vice versa, which is evenly distributed throughout the salt table. After the mounds were collected, they were allowed to stand for several hours (12 hours) from collection to reduce the water content of the salt crystals. The method of transportation can be in the form of bulk/bulk transported using a wheelbarrow or packaged and put in a plastic bag. Then it is stored in the storage warehouse at the pond location (Figure 7).

4. CONCLUSIONS

GFTT has the potential to increase salt production in Jeneponto Regency. Salt production using GFTT has increased in terms of both quality and quantity. Salt produced using the Geomembrane Filter Thread Technology (GFTT) in terms of color is much whiter when compared to salt produced traditionally. In addition, the salt produced by GFTT has a higher NaCl content than the salt produced traditionally, which is 99.96%, with a water content of 0.04%. Apart from quality, GFTT can increase the quantity of salt production, which is about 20% of the traditional salt production with the same pond area.

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