"SOLARSTREAM PURITECH:

Advanced Solar-Powered River Water Filtration"

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RESEARCH ABSTRACT

Farming is a cornerstone of Laos' economy, engaging approximately 60–70% of the population, with subsistence agriculture dominating rural livelihoods. Rice, the primary crop, occupies 80% of cultivated land and is predominantly rain-fed, making it highly susceptible to climate variability. Other significant agricultural outputs include maize, cassava, fruits, vegetables, and high-quality coffee, particularly from the Bolaven Plateau. Livestock farming also plays a vital role, with cattle and buffalo raised for both meat and labor. Despite its importance, Laos' agricultural sector faces serious challenges, especially its reliance on rainfall and limited access to clean water resources.

Clean water is essential for sustainable agriculture, influencing crop yields, livestock health, and soil integrity. Contaminated water introduces harmful chemicals and pathogens that threaten food safety, reduce productivity, and degrade environmental quality. Multiple pollution sources—including industrial discharge, agricultural runoff, untreated sewage, and urban waste—contribute to the growing problem of water contamination, especially in rural areas.

To address these challenges, this research highlights the Solar Stream Puritech system, a solar-powered, eco-friendly water purification solution capable of delivering safe water directly from natural sources. By integrating renewable energy with filtration technology, this system offers a scalable approach to improving agricultural resilience, public health, and environmental sustainability in remote Laotian communities. The study underscores the critical role of clean water access in achieving food security and promoting sustainable rural development.

SOLAR STREAM PURITECH:

Advanced Solar-Powered River Water Filtration

I. INTRODUCTON

Farming plays a crucial role in Laos' economy, employing around 60-70% of the population, with the majority of the farming being subsistence-based. Rice is the staple crop, covering about 80% of the cultivated land, and most rice farming is rain-fed. In addition to rice, Laos also grows other important crops like maize, coffee, cassava, and various fruits and vegetables. The Bolaven Plateau in southern Laos is especially known for its high-quality coffee production, which is exported worldwide. Livestock farming, including cattle, buffalo, pigs, and poultry, is also common in rural areas, with cattle and buffalo being raised for meat and labor. However, farming in Laos faces several challenges, such as its reliance on rainfall, which makes agriculture vulnerable to climate change,

Clean water is a vital resource for agricultural farming, playing a crucial role in crop production, livestock health, and overall food security. Water is used for irrigation, soil nourishment, and maintaining healthy farm animals, ensuring sustainable and productive farming practices. Clean water is essential for farming as it directly affects crop growth, livestock health, and overall agricultural productivity. Crops rely on clean water for photosynthesis, nutrient absorption, and proper development, while contaminated water can introduce harmful chemicals and pathogens, reducing both quality and yield. Similarly, livestock need clean drinking water to stay healthy, as polluted sources can lead to diseases that lower meat, milk, and egg production. Soil health also depends on clean water, as polluted irrigation can alter soil pH, harm beneficial microorganisms, and reduce fertility. Moreover, contaminated water can spread bacteria, fungi, and viruses that threaten both crops and animals, making disease prevention a critical aspect of farming. Sustainable agriculture relies on clean water to maintain long-term productivity and environmental balance, as polluted water sources can lead to land degradation and reduced farming potential. From an economic perspective, access to clean water improves market value, reduces dependence on costly treatments, and enhances profitability. Ultimately, ensuring clean water for agriculture is vital for food security, economic stability, and sustainable farming practices.

Water contamination occurs when harmful substances enter water bodies, making them unsafe for consumption and damaging ecosystems. One major source is industrial waste, where factories discharge pollutants like heavy metals, chemicals, and toxins into rivers, lakes, and oceans. Agricultural runoff also plays a significant role, as pesticides, fertilizers, and animal waste wash into water supplies. Sewage and wastewater, if not properly treated, introduce bacteria, viruses, and other pathogens, leading to serious health risks. Oil spills contribute to contamination by releasing petroleum products into oceans and freshwater sources. Household waste, including improperly disposed cleaning chemicals, pharmaceuticals, and plastics, further pollutes water systems. Urban runoff from roads, parking lots, and construction sites carries contaminants into nearby water bodies, while mining activities release heavy metals and acids that degrade water quality. Additionally, radioactive waste from nuclear plants and medical facilities can leak into water sources, posing long-term health risks. Landfills and improper waste disposal sites leach toxins into both surface and groundwater. Even air pollution contributes to water contamination, as acid rain and airborne pollutants settle into water bodies, altering their chemistry. These various sources of contamination pose severe threats to human health and aquatic ecosystems, highlighting the importance of pollution prevention and effective water treatment.

Access to clean and safe water is essential for human health, agriculture, and environmental sustainability. However, many communities, especially in remote areas, struggle with water contamination and lack of proper filtration systems. A Solar Stream Puritech offers a sustainable and eco-friendly solution to purify water directly from rivers, using solar energy to power filtration processes. This system provides an efficient and cost-effective way to remove impurities, bacteria, and harmful contaminants, ensuring safe usable water while reducing dependence on non-renewable energy sources. By integrating solar power with water filtration, this innovation promotes sustainability, enhances public health, and supports rural and disaster-stricken communities.

II. OBJECTIVES

This research aims to address the pressing need for clean and sustainable water sources in agricultural communities, particularly in rural areas of Laos. Given the critical role of clean water in farming and the challenges posed by water contamination and limited infrastructure, this study focuses on developing and evaluating a solar-powered water purification solution. The specific objectives of the research are as follows:

1. To develop Solar Stream Puritech to filter river water without using electricity.
2. To assess the efficiency of the filtration system.
3. To examine the feasibility of using the Solar Stream Puritech in the community.

III. METHODOLOGY

1. Design and Development

The SolarStream Puritech integrates the solar panel, solar panel controller, power supply inverter, water pumps and a multi-stage filtration that includes filter screen, filter cloth, rocks, pebbles, sand and activated carbon.

When river water pump turns on the river water will be pump up going to the unclean water storage container with screen filtration to filter debris, branches, leaves and other floating material from the river water.

When filtration power button turn on the water from the unclean water storage container will be pump up to the water sedimentation tank going to the first filtration chamber that consist of rock, pebbles, and sand then proceed to the second sedimentation and filtration tank that consist of activated carbon and pebbles and next water will pass the third filtration that includes filter cloth and final water will be sock to a clean water storage container for watering the plants, washing clothes, washing dishes and other use of clean water.

Figure 1.1

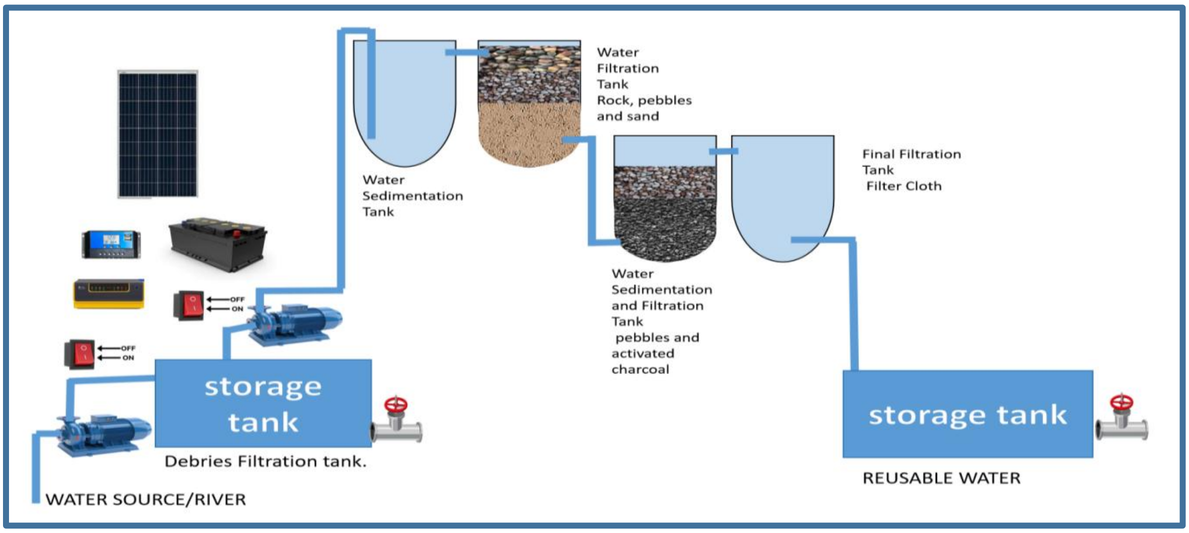


Figure 1.1 Shows the Solar Stream Puretech Design Layout

Figure 1.2

Figure 1.2 Shows the Solar Stream Puritech Actual Design

2. Testing and Analysis

To test the efficiency of the Solar Stream Puritech. The researchers evaluate the result by comparing the water from unclean water storage to the clean water storage in terms of Ph level, Turbidity, color and odor.

5 out of 5 testing shows that Solar Stream Puritech reduce turbidity, improves Ph level and also produces a clean and odorless water.

Figure 2. 1

Figure 2.1. Show the Ph Level Tester and Arduino Turbidity Sensor as the tools used to assess the Ph Level and Turbidity of the water.

Figure 2.2

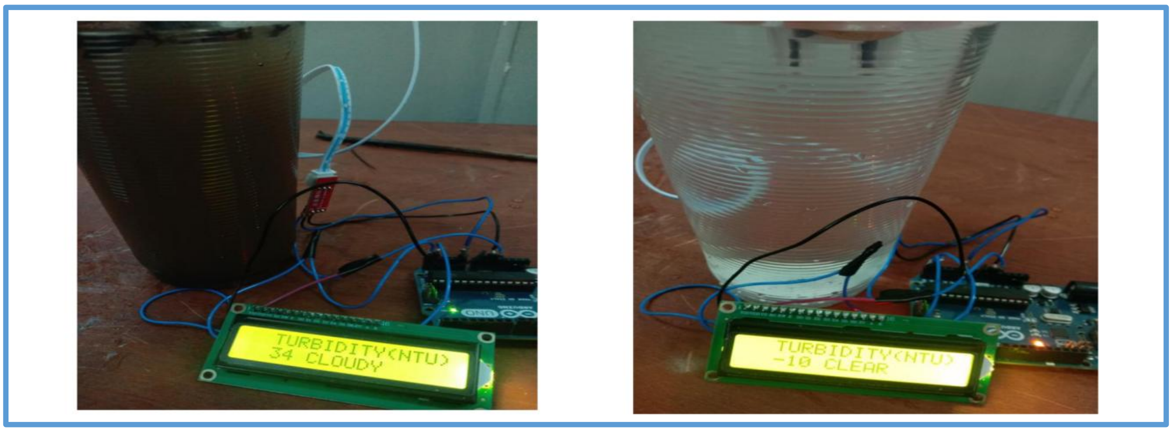


Figure 2.2. shows the Turbidity Test 1.

Figure 2.3

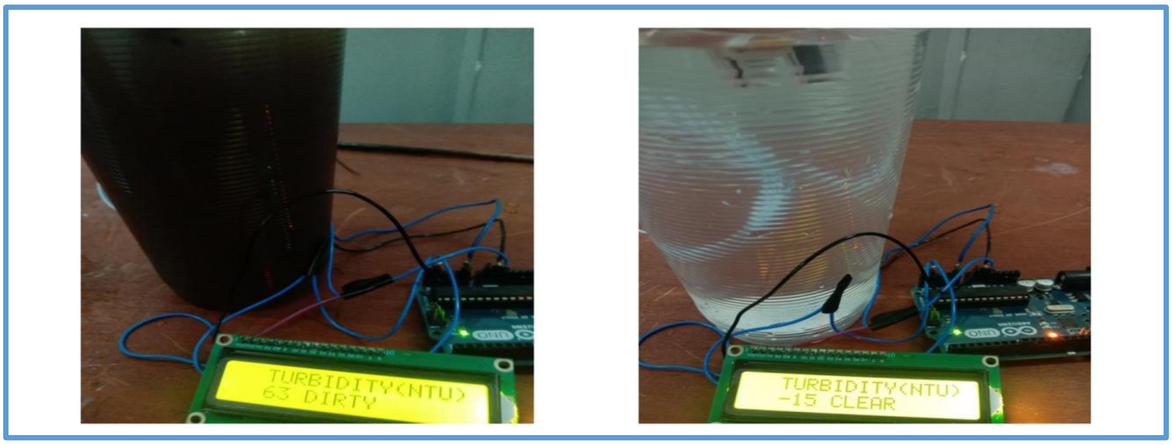


Figure 2.3. shows the Turbidity Test 2

Figure 2.4

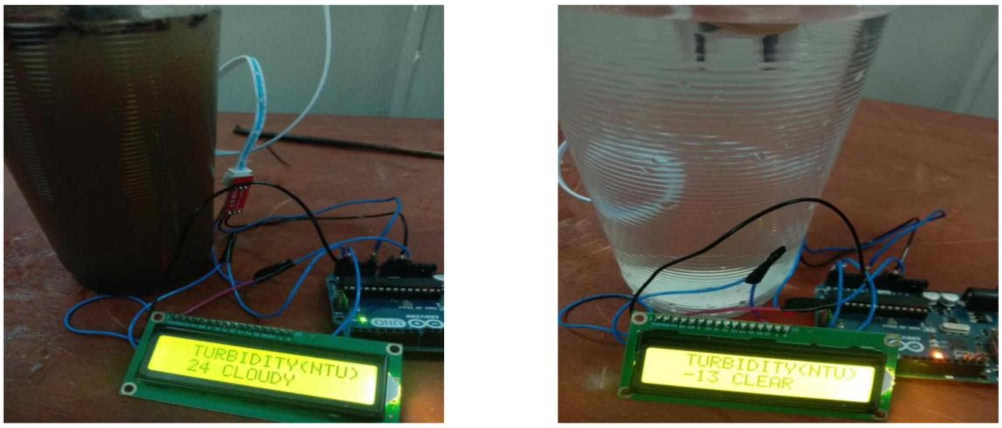


Figure 2.4 shows the Turbidity Test 3.

Figure 2.5

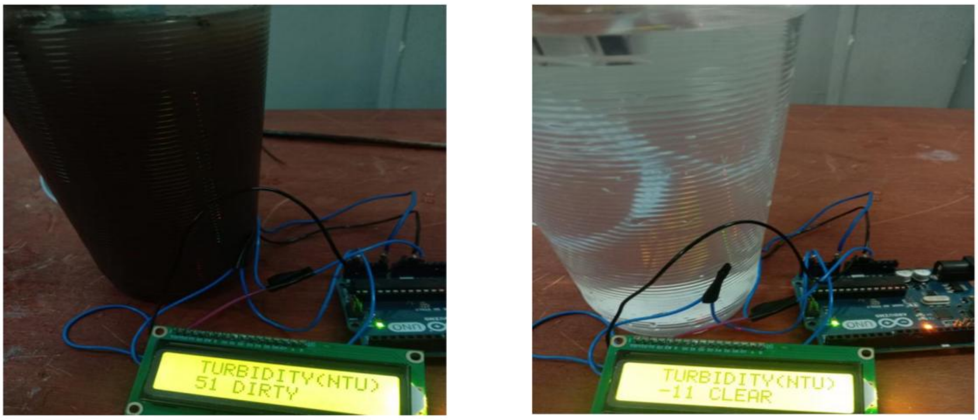


Figure 2.5. show the Turbidity Test 4.

Figure 2.6.

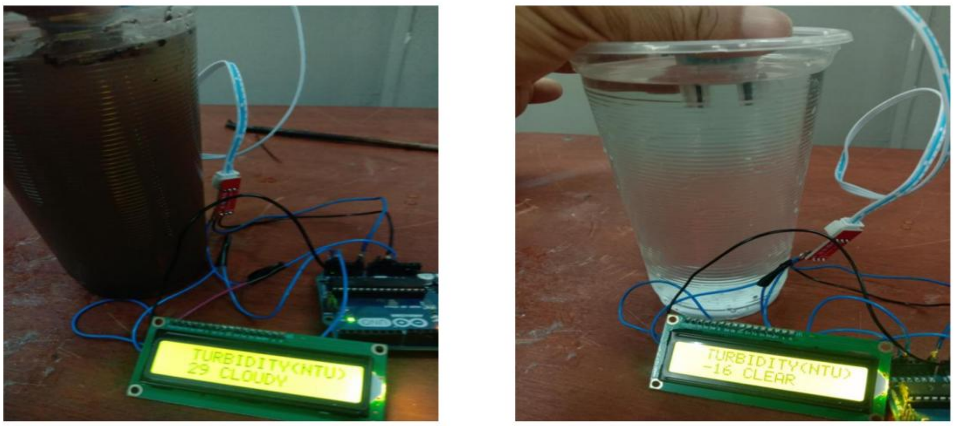


Figure 2.6. show the Turbidity Test 5.

Figure 2.7

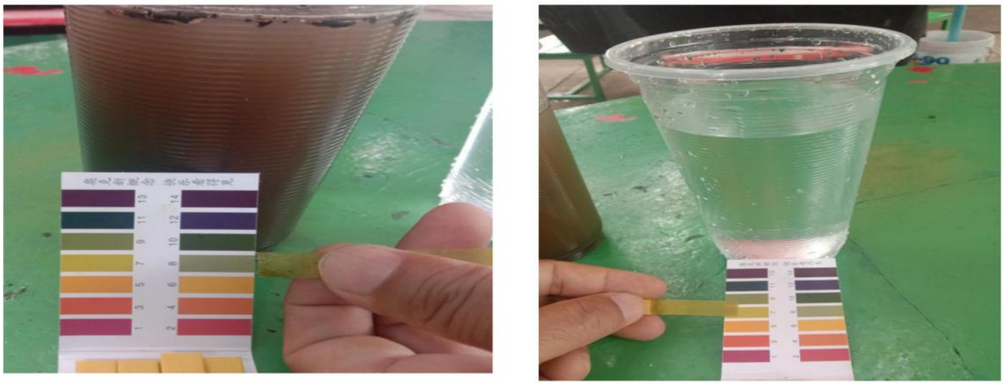


Figure 2.7. show the Ph Level test 1.

Figure 2.8.

Figure 2.8. show the Ph Level test 2.

Figure 2.9.

Figure 2.9. show the Ph Level test 3.

Figure 2.10

Figure 2.10. show the Ph Level test 4.

Figure 2. 11.

Figure 2.11. show the Ph Level test 5.

3. Feasibility Assessment

To assess the feasibility of the Solar Stream Puritech we conducted a survey with 20 respondents that are residing near a river bank.

The survey consists of 5 questions that includes 2 questions for technical feasibility, 1 question for financial feasibility, 2 questions for operational feasibility. The respondents will answer these questions in a 5-point Likert scale. 1.STRONGLY DISAGREE, 2. DISAGREE, 3. NEUTRAL, 4. AGREE and 5. STRONGLY AGREE.

Survey

1. Solar Stream Puritech is functioning properly.
2. Solar Stream Puritech materials can be replaced easily.
3. Total cost of Solar Stream Puritech is reasonable.
4. Solar Stream Puritech can improve productivity.
5. Solar Stream Puritech can be easily operated.

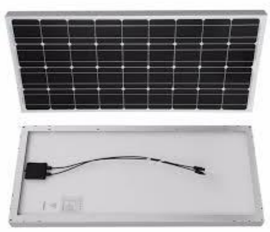
IV. SYSTEM COMPONENTS

Stream water pump

A water pump is used to move, compress, or transfer water from a lower level to a higher one. The main purpose of a water pump is to transfer water between two points.

In our system we need to have two water pumps, one is to transfer water from the river to the unclean water storage where all the debris, leaves and other floating materials from the river will be filtered.

Solar panel



A solar panel is a device that converts sunlight into electricity by using photovoltaic (PV) cells. PV cells are made of materials that produce excited electrons when exposed to light. These electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or be stored in batteries.

The solar panel will charge the 24v battery with the use of solar charger controller.

Solar charge controller

A charge controller or charge regulator is basically a voltage and/or current regulator to keep batteries from overcharging. It regulates the voltage and current coming from the solar panels going to the battery.

In our system the solar charger controller will be responsible for charging the battery.

Battery

A battery is a device that converts chemical energy contained within its active materials directly into electric energy by means of an electrochemical oxidation-reduction (redox) reaction. This type of reaction involves the transfer of electrons from one material to another via an electric circuit.

The battery in our system will power the 220v water pump with the use of inverter.

Inverter

A power inverter for home direct current (DC) from sources like batteries into alternating current (AC) that your household devices use. This magic box is handy during emergencies or off-grid adventures. It's also popular for people who need reliable backup power in places with unstable electricity.

Our system designs the 220v water pump will be powered by the 24v battery which the inverter will convert dc to ac.

Rocks

Rock is any naturally occurring solid mass or aggregate of minerals or mineraloid matter.

Rock in our system design will filter large particle from the water.

Pebbles

A pebble is a class of rock with a particle size of 4–64 mm (0.16–2.52 in).

In your system design the pebbles will filter the water from water particles that the rock cannot filter.

Sand

Sand is a granular material composed of finely divided mineral particles. Sand has various compositions but is defined by its grain size.

Sand function in our system design is to filter the smallest particles that rock and pebbles can not filter.

Activated Carbon

Activated carbon, also called activated charcoal, is a form of carbon commonly used to filter contaminants from water and air.

Activated carbon serves as anti-bacterial that removes bad odors from the water.

Filter Cloth

Filter cloth is essentially a woven or non-woven fabric. Filter cloth is used in our system design to trap solid particles suspended in water

V. RESULT AND DISCUSSION

After conducting assessment for efficiency and feasibility of the Solar Stream Puritech the following tables and figures is presented and discussed.

Figure 4. Color and Odor Assessment Result

Figure 4. Shows that there is a great change in the clarity and odor in water quality from the river before and after filtration.

Table 1. Ph Level Assessment

Number of Testing	Ph Level Before Filtration	Ph Level After Filtration
Water Test 1	8	7
Water Test 2	9	7
Water Test 3	9	7
Water Test 4	9	7
Water Test 5	9	7

Table 1. 5 out of 5 trials shows that the Ph Level of the water improves when it passes the Puretech filtration system.

Table 2. Turbidity Assessment

Number of Testing	Turbidity Level Before Filtration	Turbidity Level After Filtration
Water Test 1	34	-10
Water Test 2	63	-15
Water Test 3	24	-13
Water Test 4	51	-11
Water Test 5	29	-16

Table 2. Shows that 5 out of 5 testing trials indicates that the Puretech filtration system greatly reduces the turbidity of the water.

Table 3.1

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1. Solar Stream Puritech is functioning properly.	**0**	**0**	**2**	**5**	**13**

Table 3.1. Shows that 65% or 13 of the respondents strongly agrees that Solar Stream Puritech is functioning properly. 25% or 5 of the respondents agree and 10% or 2 of the respondents are neural.

Table 3.2

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
2. Solar Stream Puritech materials can be replaced easily.	**0**	**0**	**0**	**8**	**12**

Table 3.2. Shows that 60% or 12 of the respondents strongly agrees that Solar Stream Puritech materials can be replace easily. 40% or 8 of the respondents agree. None of the respondents are neutral, disagree or strongly disagrees.

Table 3.3

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
3. Total cost of Solar Stream Puritech is reasonable.	**0**	**2**	**5**	**7**	**6**

Table 3.3. Shows that 35% or 7 of the respondents agrees that the total cost of Solar Stream Puritech is reasonable. 30% or 6 of the respondents strongly agrees. 25% or 5 of the respondents are neutral while 10% or 2 of the respondents disagrees.

Table 3.4

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
4. Solar Stream Puritech can improve productivity.	**0**	**0**	**1**	**6**	**13**

Table 3.4. Shows that 65% or 13 of the respondents strongly agrees that Solar Stream Puritech can improve productivity. 30% or 6 of the respondents agrees. 5% or 1 of the respondents are neutral while none of the respondents disagrees or strongly disagree.

Table 3.5

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
5. Solar Stream Puritech can be easily operated.	**0**	**0**	**0**	**5**	**15**

Table 3.5. Shows that 75% or 15of the respondents strongly agrees that Solar Stream Puritech can be easily operated. 25% or 5 of the respondents agrees. and none of the respondents answers neutral, disagrees or strongly disagree.

Table 4

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1. Total cost of Solar Stream Puritech is reasonable.	**0**	**2**	**5**	**7**	**6**
2. Solar Stream Puritech materials can be replaced easily.	**0**	**0**	**0**	**8**	**12**
3. Total cost of Solar Stream	**0**	**2**	**5**	**7**	**6**

Puritech is reasonable.					
4. Solar Stream Puritech can improve productivity.	**0**	**0**	**1**	**6**	**13**
5.Solar Stream Puritech can be easily operated.	**0**	**0**	**0**	**5**	**15**
Total	**0**	**4**	**11**	**33**	**52**

Table 4. Shows that 52% of the respondents strongly agrees that Solar Stream Puritech is feasible to use in their community. 33% of the respondents agrees. 11% are neutral and only 4% disagrees.

VI. CONCLUSION

Based on the survey data, the majority of respondents have a positive perception of the Solar Stream Puritech system. Specifically: 52% strongly agree and 33% agree with the feasibility and benefits of the system, indicating strong overall support. Respondents particularly appreciate the ease of material replacement and ease of operation, with both items receiving unanimous agreement or strong agreement. Only 4% of respondents disagreed, and none strongly disagreed, suggesting minimal opposition or concern. The neutral responses (11%) indicate that a small segment may need more information or experience with the system to form an opinion. Overall, the data strongly supports the feasibility and acceptance of Solar Stream Puritech in the community.

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