

Application of Appropriate Technology for Clean Water

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ABSTRACT

Background. The thesis focuses on community service (PkM) conducted by the Ministry of Health Poltekkes institutionally, specifically in the village of Kota Lama II, Secanggang District, Langkat Regency. The study addresses the inadequate access to clean water and poor sanitation conditions in Mr. Mujadi's house, which is among the families included in the PKH (Program Keluarga Harapan) - a conditional cash transfer program in Indonesia.

Purpose. The purpose of this community service project is to improve the living conditions of Mr. Mujadi's household by addressing their water and sanitation issues. The project aims to apply science, technology, and art (IPTEKS) through a direct scientific approach to provide sustainable access to clean water and improve sanitation facilities.

Method. The objective of this qualitative research is to explore and understand the application of appropriate technology for clean water supply in Kota Lama II Village, Secanggang District, Langkat Regency. The study aims to gain in-depth insights into the experiences, perceptions, and challenges related to the use of appropriate technology for clean water.

Results. The results obtained at the end of community service activities in Kota Lama Village II, Secanggang District, Langkat Regency, were built 1 unit of Infiltration galleries. The implementation stages include the initial survey, making Infiltration galleries, compiling filter media, and socializing about clean water and operations and maintenance of Infiltration galleries.

Conclusion. Well, water filtered from wells using Infiltration galleries looks clearer and cleaner, odorless and tasteless. This has met the requirements for clean water physically and has met the sanitation aspect.

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INTRODUCTION

Water is an absolute necessity for the life of living things, especially for human life. Without water, no life can survive (Gabriela dkk., 2022; Kartel dkk., 2022; Qureshi dkk., 2022). In quantity, the presence of water on earth is relatively fixed, but in quality, conditions are declining even in certain areas the quality of water is poor. Indonesia's geographical condition consisting of mountainous and lowland areas has the potential for abundant water resources, often contrary to existing conditions where some areas still lack water (Dewi S dkk., 2022; Keshav dkk., 2022).



Often there are abundant water sources but in terms of quality, there is still a risk of pollution. Especially for lowland areas (alluvial) tends to have shallow groundwater levels (Amado-Alonso dkk., 2019; Rahmah dkk., 2022), so the risk of exposure to pollution is relatively higher due to infiltration that occurs in groundwater sources. This condition will be further exacerbated if user behavior does not care about sanitation aspects. Kota Lama II Village, Secanggang District, Langkat Regency, is one of the areas located in a lowland (alluvial area) that has a shallow groundwater table ± 1 meter above ground level (Anoum dkk., 2022; Demina dkk., 2022; Hikmah dkk., 2022). Based on observations in the field, it is known that:

1. There are still many people who are included in the family hope program (PKH) group, so they are still given subsidies from the government
2. The source of clean water in the community group is in the form of dug wells using lead manually.
3. The existing dug wells are mostly unringed and do not have a good lip, most do not have a good floor.
4. The distance from the source of pollution, in this case, latrines and livestock sheds is on average less than 10 meters.

This condition is very risky for health threats, especially diseases related to sanitation. The most common diseases are diseases transmitted through feces to the mouth such as diarrheal diseases, and diseases caused by vectors (disease-carrying pests) associated with garbage and water (Firman dkk., 2022; Ilham dkk., 2022; Safitri dkk., 2022). The provision of sanitary clean water in these conditions aims to reduce the transmission of fecal diseases to the mouth and reduce infection by vectors by carrying out counseling on good environmental hygiene practices, providing drinking water facilities and clean water to create a condition that allows people to live with adequate health, dignity, comfort, and security.

As an alternative to provide adequate water for regional conditions as mentioned above, a simple technology is needed that can answer these problems and is affordable (Hartini dkk., 2022; Nopiana dkk., 2022). One technology that can be applied is the gallery infiltration model in dug wells. Infiltration galleries are methods that replicate soil absorption or filtration mechanisms in everyday processes. The means of providing clean water is very practical and appropriately oriented, considering that the materials used are widely available in all regions.

Based on the problems mentioned above, as teaching staff at the Department of Environmental Health (Baig dkk., 2022; Haghghi Mood dkk., 2022), Polytechnic Health, Ministry of Health, Medan, where one of the main tasks of the Tri Darma of Higher Education that must be done is community service, we team of lecturers are called to contribute knowledge and ideas to provide clean water for the community as a form of service by building infiltration galleries together with people in Kota Lama II village (Dianovi dkk., 2022; Najeed dkk., 2022; Rohmalimna dkk., 2022), Secanggang District, Langkat Regency, especially for families who are included in PKH.

RESEARCH METHODOLOGY

Infiltration galleries are one of the sand water filter models that are often used, namely for groundwater extraction with areas adjacent to river water flow. Infiltration galleries can be applied in situations where the water-giving layer is thin, to get more water. If the water layer contains poor parameters, then infiltration galleries can produce relatively better water filter results. Based on the results of research that has been conducted by Alvaro Camacho, utilizing the gallery infiltration method can remove up to approximately 90% turbidity, suspended solids, and colors. Infiltration

galleries can provide drinking water in almost stable quality and quantity throughout the year with very minimal environmental effects. Because this method utilizes a natural filtration process so that it can reduce expenses for operational and maintenance processes. The next advantage is that its location on the surface makes it easy to pick up and process. The processing technique is relatively simple so it does not require too much processing plant costs.

According to Asmadi (2010). Filtration in a water treatment system is the process of removing fine particles/floc that escape from the sedimentation unit, where the particles will be retained in the filter media as long as the water passes through the media. Filtration is needed to improve the reduction of contaminant levels such as bacteria, color, taste, and iron odor (Fe) so that clean water that meets the permissible standards is obtained. The method of implementing the application of processing technology using infiltration galleries in Kota Lama II Village, Secanggang District, Langkat Regency uses the socialization method through discussion and demonstration of sieve unit assembly, with the following stages

1. Determination of galleries infiltration technology to be applied to the condition of clean water sources at the specified PKM location
2. Conduct initial preparation of technical and non-technical field problems, including
 - a. Consultation with relevant agencies, conducting meetings with village officials to convey the aims and objectives of activities, managing permits, and administration and organizing activities.
 - b. Socialization and initial observation of the field to the community on the implementation plan, determination of the house of one of the PKH group residents who will be applied infiltration galleries.
3. The implementation of field construction includes:
 - a. Assembly of infiltration galleries, including drum preparation, and drum mounting frame
 - b. Disseminate and deliver information on concepts about the environment, clean water, clean water treatment, and sanitation. Convey information about infiltration unit galleries (operational and maintenance)
 - c. The assembly of gallery infiltration units and the preparation of filter layers by the community is supervised by the service team.
 - d. Trial implementation of the use of water filters for the gallery infiltration method and the handover of the gallery infiltration unit to residents
 - e. Implementation of monitoring and evaluation of activities. This process is also carried out by the service team and also involves residents. the implementation of service activities describes the steps and stages of implementation of previously planned solutions.

RESULT AND DISCUSSION

The result obtained at the end of community service activities in Kota Lama II Village, Secanggang District, Langkat Regency, is that 1 unit of Infiltration galleries has been built in one of the residential areas (Kumar dkk., 2020; Zhu & Jassby, 2019). The implementation of community service is located in one of the houses of residents of Mr. Mujadi's family hope program group (PKH), farming work and house conditions are quite poor (Bridge & Bridge, 2019; Fdez-Sanromán dkk., 2020; Papaioannou dkk., 2022). The condition of clean water sources is in the form of dug wells with shallow water surface layers, adjacent to dirty water discharge, and does not have a permanent bathroom or septic tank outside the house building.

a. Preliminary Preparation

The coordination with agencies and the community was carried out on July 10, 2021, and determined that one of the residents' houses would be paired with 1 Galeries Infiltration unit. Includes identifying needs, identifying existing potentials and weaknesses, conducting meetings with village officials conveying the purpose of activities, obtaining permits and administration, and organizing activities. Furthermore, initial field observations were carried out to see the condition of the house and clean water sources at the location.

Figure 1. Existing Conditions of Clean Water Sources in Kota Lama II Village, Secanggang District, Langkat Regency



b. Making Water Filter Infiltration Galleries

1. Preparation of Tools and Materials

Here are the tools and materials for the manufacture of 1 infiltration gallery unit

a. Tools

b. Iron drum holder

a. Ingredients

c. Fine sand 1 m³

d. Blue drum UK. 200 Liters

e. Zeolite 25 kg

f. Active Kabon 25 kg

g. Foam Filter

2. Procedure for making Infiltration Galleries

a. Making iron drum stands so that drums can inundate the water table in dug wells is adjusted to the conditions of dug wells owned by residents.

b. Creation of infiltration galleries

1) The bottom of the drum is given a hole as an inlet in the infiltration galleries with a distance between the holes of 20 cm

2) The contents of the drum that has been hollowed out with the lowest layer is fine sand 1 m³,

3) Fill the drum with zeolite sand on top of fine sand of as much as 25 kg

4) Fill the drum with activated charcoal stone on top of zeolite sand as much as 25 kg

- c. After the filling is filled, it is put into a dug well owned by the community, and adjusted to the drum holder, so that the position of the drum is in the water, and an up flow system filtration process occurs.
- d. The part of the water that pools at the top of the drum is clear filtered water.

Figure 2. Illustration of How Infiltration Works Galleries

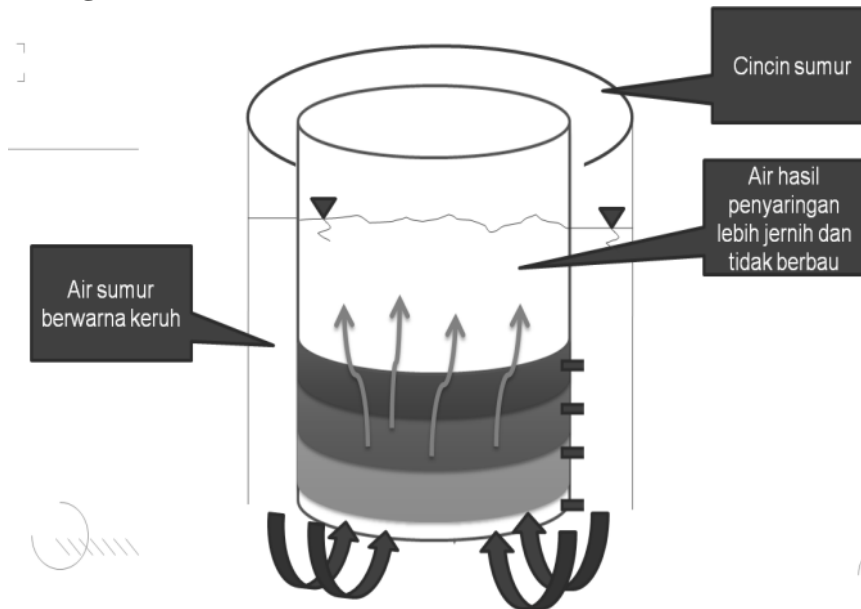


Figure 3. Infiltration Galleries



- c. Dissemination and delivery of information about Gallery Infiltration

Socialization and delivery of information about Infiltration galleries were carried out on September 25, 2021, through discussions. Residents whose homes will be applied to the Infiltration galleries unit are equipped with knowledge and information related to the manufacturing and operational methods of the construction of Infiltration galleries. The

community has also been equipped with knowledge about clean water and sanitary clean water supply. In these conditions, clean sanitary water can reduce the transmission of fecal diseases to the mouth and reduce infection by vectors. By carrying out counseling on good environmental hygiene practices, and providing drinking water and clean water facilities to create a condition that allows people to live with adequate health, dignity, comfort, and security.

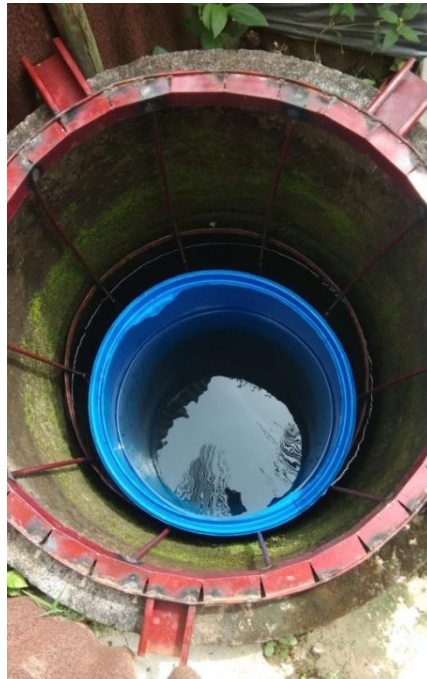
During the demonstration of the infiltration assembly of galleries, mechanical information is conveyed to the work of the unit and the processes that occur in filtering using infiltration galleries. Assembly procedures, coating problems, and how to clean the filter with the backwash method. Furthermore, a trial was carried out using a water filter for the gallery infiltration method. Filtered well water in wells that use Infiltration galleries looks clearer and cleaner, odorless and tasteless. This has fulfilled the requirements of clean water physically and has fulfilled the aspect of sanitation.

Figure 4. Dissemination and delivery of information about infiltration galleries



Figure 5. Sand Media Washing Process



Figure 6. Infiltration galleries that have been supplied to clean water sources

d. Community service success indicators

Community service activities can have been successful and on a target marked by the fulfillment of the following success indicators:

1. 1 unit of Infiltration galleries has been installed in one of the houses of PKH group residents in Kota Lama II Village, Secanggang District, Langkat Regency
2. Residents have understood and understood about the operation and maintenance of Infiltration galleries, can be known by being able to mention the tools and materials for making Infiltration galleries, being able to arrange filter layers independently, and having been able to install Infiltration galleries into dug wells.
3. Residents can practice simulating backwash/washing filter media
4. Residents can convey to residents who are not present in socialization activities about the unit and the function of Infiltration galleries.

e. Monitoring and Evaluation

PKM monitoring activities are carried out 1 week after the installation of 1 unit of Infiltration galleries. It can be seen that residents continue to use filters in Infiltration galleries in their daily lives, and the filtered water is clean and odorless.

Based on the evaluation of the implementation of activities, supporting and inhibiting factors can be identified in the implementation of this service program, including:

1. Supporting Factors

- a. The community is willing to be invited to cooperate and greatly assist in the implementation of service activities.
- b. The enthusiasm of the community in participating in the service program is carried out because the community needs clean water.

2. Inhibiting Factors

- a. Limited time for the implementation of service.
- b. The distance of the service location from the campus of the Department of Environmental Health

CONCLUSION

Community service activities have been carried out, namely the installation of 1 gallery infiltration unit in dug wells in the homes of PKH group residents. Residents are familiar with appropriate technology for providing clean water that is environmentally friendly and has been exposed to information about sanitation and clean water. Infiltration galleries can remove up to approximately 90% turbidity, suspended solids, and colors. Infiltration galleries can supply drinking water in almost stable quality and quantity throughout the year with very minimal environmental effects.

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AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing,

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

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