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Fix Desalination System Technology as Development of Creative and Innovative Capabilities of Youth Community

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Abstract Community service activity is conducted in the region of KKN-PPM Universitas Maritim Raja Ali Haji (UMRAH) in the Malang Rapat Village, Bintan Regency. Malang Rapat Village was chosen because of the location on the coastal area and have a concern about the management of hydrology, clean water resources and the management of limited water resources. The lack of information and transfer of knowledge to the community in the coastal areas will produce some difficulties to solve the problems, especially in solving the problems regarding the adequacy and need for clean water. Then the general condition of the youth village in the coastal areas is not goal oriented. Based on those exercising their Community Services activities are carried out using the learning development by including the principle of 4C (Creative, Collaborative, Communicative and Competitive). It is expected that with the development of scientific principles that incorporate the principle of the transfer of the value of creativity, collaborative, communicative and competitive will give a very good impact to the target object for the long term. In this case, appropriate technology was designed for a public event in the Region KKN-PPM Malang Rapat Village in helping to resolve the problem of clean water needs for consumption is making Fix Desalination System. Fix Desalination System designed structure mica glass/acrylic which has a volume of 1 m3 to produce 15.95 ml distilled fresh water in the tank within 6 hours.

1. INTRODUCTION

Community service activity is done in the area of real work lecture-learning for community empowerment Universitas Maritim Raja Ali Haji (UMRAH) in the Malang Rapat Village Bintan Regency, due to the socio-economic conditions of society mostly

is fishermen with low economy and the lack of resources that can be used directly to the lives of the people, one of which is the adequacy and need for clean water for consumption. Groundwater or wells this coastal area, it still feels brackish for consumption and flow of the regional water company is not available, and even if there is heavy for people to pay each month.

Water is one vital necessity and a basic element for life on earth. More than 70 percent of the components of living things is water (Hidayat Rizaldi, R. 2011; Ismarti, 2013; Tanusekar & Sutanhaji, 2014). Without water, the processes of life cannot take place properly. Humans are basically living on the water planet because 70 percent of the earth's surface is surrounded by water. Human life requires about 16 thousand gallons of water. To meet the basic needs of the average human being requires 2 liters or about 8-10 glasses of water per day (Ismarti, 2013). Consumption of fresh water on the people has been increased with the development of culture and technology.

One way to provide sufficient water resources is going to make use of seawater. The sea water can be harnessed into clean water with the help of some of the technology that's been developed, one of them is the Fix Desalination System Method. Fix Desalination System technology is the technology of water purification of seawater created by utilizing solar energy as a means to create heat (Shatat & Riffat, 2012; Alkaisi *et al.*, 2017). The heat energy is delivered to the sea with the help of the method the greenhouse effect, or can also use acrylic as instead of ordinary glass. Furthermore, the temperature of the sea water will be transformation or rise which leads to evaporation or condensation, steam will rise to the glass ceiling, glass made with an inclination of 45^{o} so water vapor bias down to the pipe to deliver water to the shelter provided. The water produced by the process has become fresh water and ready to be

used to meet the needs of coastal communities, but the volume of water is depending on the amount of water vapor resulting from the evaporation process. In theory, the process of desalination by utilizing solar energy directly using the glass material can produce 3-4 liters/day of fresh water with each area the appliance 1 m^2 (Shatat & Riffat, 2012).

Fix Desalination System development, is based on research conducted previously (Mitra *et al.*, 2104; Compain, 2012; Elmenshawy *et al.*, 2015; Han, 2015). The selection of Fix Desalination System because desalination is the easiest and traditional process to produce drinking water or clean water in an area that has a very abundant geographical condition of seawater (Mitra *et al.*, 2014). A very traditional process and can be used very precisely and easy is to use using evaporative application methods of sunlight energy (Mitra *et al.*, 2014).

2. PROBLEMS

The coastal area has a problem concerning water resources, management of hydrology and water resources management is very limited (Ramjeawon, 2007). This problem causes a shortage of water supply used by the community for daily activities. Even some areas of in the Malang Rapat Village Bintan Regency sometimes people must find springs that are quite far away from the residential area in which they live. On the other hand, the number of community residents in coastal areas always increased, both globally and locally (Merkens *et al.*, 2017).

The rise in the population will have a significant impact on demand, clean water that serves as drinking water as well as those used for household activities such as washing and bathing so that the demand on the water needs are very large (Steyl & Dennis, 2010; McDonald *et al.*, 2012; Walraevens *et al.*, 2015). The importance of

clean water needs is a very urgent and important thing in the management of village empowerment, specifically is in the coastal area and small islands.

Lack of information and transfer of knowledge by the people in the coastal area's community causes limitations in addressing the condition of the issues involved, specifically in solving the problems regarding the adequacy and the need for clean water. In coastal areas can provide potential supply water needs are enormous. Technological developments can help in providing water demand in coastal areas which is a border area between the ocean and the land. Conventional desalination system with the help of simple technology can be used to harness solar energy be used as alternatives in providing sufficient clean water. This simple technology can be utilized by all people residing and living in coastal areas and made it easily, especially if in coastal areas the number of productive young people is quite a lot and can be to work on a positive activity as a contribution to the development of the village.

Generally, the condition of village youth in coastal areas is not goal oriented and most of the village youth are still moving around with spending a lot of time just to sit alongside fellow that cannot be of great benefit to the development of the self and making a positive impact to the community. The village youth in the coastal areas can be empowered to literacy technology and instrumental part in the development of the village, one of which is to teach young people to be able to use the material/simple material to create a Fix Desalination System as a solution to the needs of clean water for consumption in the village are on average 2 liters /day/people. In the future, the empowerment of Coastal communities is expected to be able to produce, process and develop technology to improve the complete Fix Desalination System that is used

throughout the Village, so that the Village can provide water reserves that are suitable for consumption.

3. METHODS

Community service activity can do it on its partnership with partners is SMK N I Gunung Kijang and the Malang Rapat Village Bintan Regency. Implementation of community services activities is carried out using the development of learning by incorporating the principles of 4C (Creative, Collaborative, Communicative and Competitive). It is expected that with the development of scientific principles that incorporate the principle of the transfer of the value of creativity, collaborative, communicative and competitive, will provide excellent impact to the target object for the long term so that the values of these principles can be achieved.

Some steps are carried out in the implementation of community service activity. Dividing the understanding and knowledge about principle knowledge about a given technology is in service activities are the technology of desalination system using the method and approach to problem-solving and provides examples of problems that often occur in the community. This method is excellent in triggering capability target objects for critical thinking and increase the sense of concern for the surrounding conditions, so independently target objects can play a positive role with competence in have to provide benefits to the environment - (Creative and Communicative).

Next step is the transfer of knowledge by visual learning and provide mild case studies to be solved by some groups during the workshop. This method is very good at which time the workshop activities do play an active role as a target object with each group contributing to creating and delivering appropriate solutions to the problems that

are in the neighborhood - (Collaborative and Competitive). Then, practice or direct introduction of the given technology. This method to trigger the target object in problem-solving ability and improve the ability of science and basic knowledge of a given technology - (Creative). The last step is evaluation and questionnaire. This method works everywhere as an evaluation and consideration of the extent of scientific developments and the ability of the village through the youth vocational students and students of SMK the related technology as well as development Renewable Energy.

Implementation Community service activity with some phases of activity in the period April-September 2018 (Tabel 1). From activities will be planned, expectations will be achieved for the youth of the village at the site of Real Work Lecture-Learning for Community Empowerment such as: (1) increased sensitivity of the village youth, especially youth of the village of fundamental problems in the village which is shown by the Youth know what condition problems that often occur in the village; (2) the village youth can be creative thinking and innovative which is indicated by the emergence of initiatives in contributing to the Village; (3) youth Villages has the ability to use simple materials that can be recycled into an appropriate component indicated by the presence or the creation of a masterpiece or a component of appropriate instrumentation that can be used continuously and sustainably in the village; (4) the increasing role of youth to the development of the village which is indicated by attended Youth Village on the activities for community service activities implemented; and (5) youth can create instrumentation Fix Desalination System and can apply that system in the village.

Table 1. Process Implementation and Assistance Community service activity

Implementation phase	Activity	Achievement Indicators
Phase I (April 2018)	Pre-Workshop "Youth Character Building Innovative and Creative Village" and Decision Data on Youth Village on the ability of critical thinking, innovative and creative using questionnaires measured and systematic	Initial preliminary survey and the percentage rate Innovation and Creative Ability Youth Villages Villages using Statistically analysis
Phase II (April 2018)	Designing instrumentation Fix Desalination System	Draft Technology of Fix Desalination System
Phase III (May 2018)	Workshop "Fix Desalination System as a solution to water supply alternatives in coastal areas"	The village youth to know and be able to make simple instrumentation Fix Desalination System
Phase IV (June-July 2018)	Manufacture of instrumentation Fix Desalination System	Made the Fix Desalination System instrumentation
Phase V (August 2018)	Monitoring and Evaluation tool manufacture instrumentation Fix Desalination System in Event Location	Evaluation, Solutions and Youth Guidance to Fix Desalination System instrumentation equipment.
Phase VI (September 2018)	Application and Evaluation tool Fix Desalination System in Event Location	The technology of Fix Desalination System can be used well, Evaluation, Solutions and Youth Guidance to Fix Desalination System instrumentation tool for improvement.

Source: *Prayetno (2018).*

4. RESULTS & DISCUSSION

4.1.Pre-Workshop, Workshop, and Designing instrumentation Fix Desalination System

The gift and selection of materials to develop youth creativity in the field of technology, especially in applying technology in desalination systems need to be done in the structure and trace, so that the achievements and objectives can be done well. In this case, the executor cooperates with SMK N I Gunung Kijang and village officials of

Malang Rapat Village Bintan Regency. Students from SMK N I Gunung Kijang be elected as the most appropriate target in carrying out community service activities that use technology applications to help communities and provide appropriate solutions to the problems in the community due to the following considerations such as; (1) students from vocational senior high school have a skill very good because the educational background of an already strong with applicative activities and technology practice will be very helpful in the process of transfer of knowledge is implemented; (2) students from vocational senior high school are young men and women who have an optimistic and spirit in creating a useful applied technology, in which a high curiosity to technological developments will be highly beneficial for the development of technological processes delivered; (3) students from vocational senior high school have a fairly good level of creativity, so the technology delivered in the future can be developed into a better, more effective and efficient; and (4) students from vocational senior high school have a strategic place in the structure of the village community, which has a significant role in creating a conducive atmosphere and creative so that positive action must always be given to the youth that is beneficial to the village.

Technology has a very important role in exploiting the potential of the sea as both a source of electrical energy or sources of clean water are still a constraint in an area remote islands and coastal areas. Seawater used as a source of clean water for the people to do the desalination process, where the process requires the design of technology that seawater has a salinity level can be filtered and converted into clean water that can be consumed. The sea water is necessary through good processing in order to be viable water used and even in consumption, because the necessary feasibility of seawater is good for health. Desalination is a process to obtain high-purity water in

which is the basic principle of desalination is a process to obtain clean water from water that has a high level and salinity as seawater. So that the desalination process is a process aimed at a separation of fresh water from salt water, with removing salt in the air consisting of cations (positive ions) and anions (negative ions).

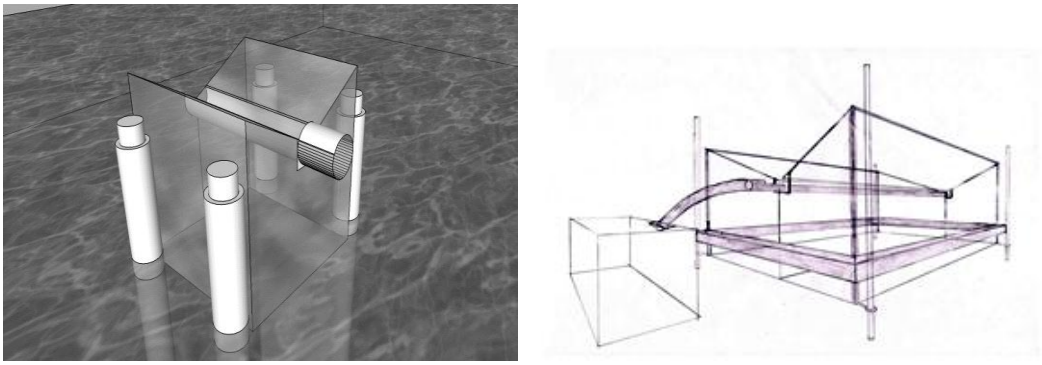
Technology and methods that are simple and appropriate to apply the process of seawater desalination in coastal areas and small islands is to utilize precipitation and evaporation process by filtering using the membrane reserve osmosis. The desalination process using solar energy as the main source energy that will provide increased temperature on the inside of the appliance indoor acrylic glass. The temperature in the appliance hotter than the outside causing the evaporation process and the formation of salt crystals becomes faster. The vapor formed is then condensed on the glass because the glass temperature is cooler than the temperature inside the appliance. Hot steam that exposed to the cold will become water granules. The water granules are fresh water that can be used as clean water that can be used.

Simple technology desalination process comes directly from the source seawater. Installation of desalination technology that uses the evaporation process is applied directly on the sea so that the structural design of the desalination system, must be floating. The design process of desalination system must consider the resilience and structural dynamics that will be installed in the sea in a floating state so that the bottom of the desalination apparatus is not using coated glass material. To make the tool floating very well, use buoys in pairs on each side of the tool. Stanchion serves to restrain movement of the waves so that the tool does not sweep away and damaged. The designed buoys are functioning to determine the occurrence of tides, if the seawater is high, the buoys and glass will rise upwards, and when the sea water recedes, the buoys

and glass will drop because this section has been glued with a ring on a support pole, so that it is more flexible to the tidal conditions that occur.

4.2. Manufacture of instrumentation Fix Desalination System

The first process of making desalination system using the floating structure is designing Fix Desalination System with the help of software Google SketchUp (Figure 1a & 1b).



(a) (b)

Source: *Prayetno (2018).*

Figure 1. Design of Fix Desalination System

After designing the model, the manufacturing process is to design and create the initial framework desalination apparatus and give prisoners the device structure, so that when applied at sea has very good durability. Making the initial frame using an aluminium plate that is designed in such a way and the walls of the desalination apparatus such as mica glass with a thickness of 3 mm that has been cut into sections to resemble with a roof house upside, with glued together with silicone glue glass to stand. Then, the aluminium plate that was cut into 24 pieces with a length of 1 meter each. Four trunks united and aligned by using hooks, hammers and pliers, and on one side in mild steel scissors with scissors. Furthermore, one piece of glass mica in pieces with grindstone into two parts with a size of 50 cm x 50 cm for roof, where one piece as a backup in case of damage to the appliance and one again for shape of the upper part within the

form of a little hollow functioning as pipe placing and a cantilever roof. The aluminium plate in addition to functioning as a framework and structure of barrier, this plate also serves as a liaison each glass mica in pairs.

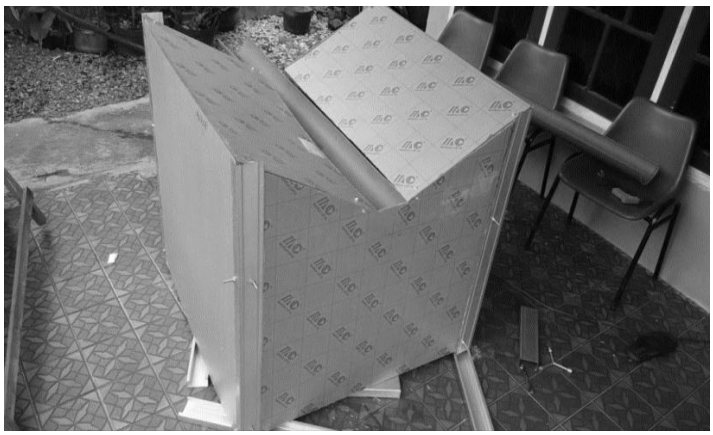
At the bottom of the mica glass at the shape and made four (4) pieces small pillar made of iron pipe with aluminium as a connector with mica glass. Each connector gave fox glue and silicone glue, so making them a more resistant connection. After a well-formed structure desalination System, then assembled using a lightweight steel frame. Mild steel which has been cut about 1m x 1m and measured and marked make a square created by connected by bolts. This step, made 2-fold, namely to the bottom and the middle order mica glass is not easy to shake or slightly convex. Then on each side of mild steel that will be connected straightened around approximately 5 cm to more easily when drilled. Once finished, connect with 4 light steel rods that have been straightened before and do the drilling to connect, do the same on each side (Figure 2).

Source: *Prayetno (2018).*

Figure 2. Frame Structure that has been completed in Install

The next step is mica glass which has been formed, placed in a frame and aligned height with mild pole steel straightened his side, then after already fit start in the drill from the

outside, i.e. from mild steel to penetrate into the mica glass , do the same on each side, in order to not easily shake and then the given bolt. Then the holder of the rest of the mild steel pipe laid on the mica that has been holed. Then, also given the glue that can be mutually glued between the material and the pipe placed side to prevent water from results evaporation can flow into the hose and down into the container. The buoy that placed on the mica glass aimed as retaining structures in order to remain above water. It will make the building structure of the desalination equipment remains floating on the water and at the bottom of the structure is installed roller ring which has a function as a dynamic process of fluctuating structure of the device to follow the tidal pattern in seawater as well as in the iron stick structure as a buffer so that the structure stays in position when hit by waves (Figure 3).



Source: *Prayetno (2018).*

Figure 3. Glass Mica / Acrylic that has been Installed on the Desalination System.

Pipe polyvinyl chloride (PVC) in the cut one part and on the extends section horizontally, placed at the top and the middle of the glass on the buildings structure desalination apparatus. The position in the middle of the glass roof is made upside down and not in closed meetings that PVC pipes can drain the water from the condensation that has evaporated into a tub of water. The design of the pipe polyvinyl chloride (PVC)

is, should be done very carefully and put in the right position because it will affect the water flow filter process that cannot be accommodated well. Besides, if the installation mica glass is done with no carefully so that it becomes easy to crack and break anytime. The added of wave energy on the structure of the desalination system also did well. The next process is the installation of a hose in the pipe so that the water that has become fresh water can immediately flow into the reservoir that has been designed and installed properly.

Next is the reservoir in the bottom of the desalination apparatus structure into a container of clean water. The most important process in determined the selection of reservoir and refining and to get clean water that has been available on the appliance, and piped directly into storage on land. It is most important, that clean water cannot too long if placed on the structure of the tool because will be occurred evaporation process which will inhibit in the tank, so to reduce the amount of volume of clean water produced. One way to prevent too much water evaporation process is lined with aluminium foil and plastic sheeting with a thickness of 0.5 mm which serves as a heat barrier and evaporation in the tank. After the desalination unit is formed, trials are carried out at sea.

4.3.Monitoring, Application, and Evaluation tool Fix Desalination System in Event Location

Desalination technology has been applied in the field that is in the sea area the Malang Rapat Village, to look at the device floating capability, durability and the results of the desalination system process. The application process implemented in area beach with the sun's heat so that the maximum intensity of the testing time held at 09.00 am until

3.00 pm. The core purpose of the application of the desalination apparatus is knowing litres maximum volume that can be generated from simple desalination technology that's been made. The testing process is done for two (2) consecutive days (Tabel 2).

Table 2. The Results of Testing

Trial	Fresh Water Volume (ml)			
	09.00-11.00	11.00-13.00	13.00-15.00	Water Cumulative
Day-1	7.3	8.1	4.4	19.8
Day-2	4.2	5.7	2.2	12.1

Source: Prayetno (2018).

The trial results from testing conducted desalination apparatus for 6 hours (09.00 am up to 3.00 pm) within two days, resulting in a volume of freshwater that is good enough. Where on the first day of the cumulative total of the filtered fresh water in the tub as much as 19.8 ml and the second day during the 12.1 ml. So that the average cumulative filtered water at the two-day trial was as much as 15.95 ml. The result of the cumulative average of the filtered water shows that the desalination apparatus using acrylic has a very good performance although not as good as using a glass base material as the main medium.

(a) (b)

Source: Prayetno (2018).

Figure 4. Application of Fix Desalination System at the Sea

With the structure of the mica glass/acrylic which has a volume of 1 m^3 to produce 15.95 ml distilled fresh water in the tank. If the desalination system structure can be expanded dimensions will be able to produce the amount of volume of freshwater more. 1 m^3 can yield 15.95 ml for 6 hours of operational tools. If the designed structure of the tool into a 10 m^3 volume expected to generate as much as 159.5 ml of fresh water within 6 hours. When the desalination apparatus was applied for one month during the operating hours (12 hours), the volume of water that can be generated is of approximately 9570 ml or about 9.57 litre. If the additional system is designed with advanced technology which improves evaporation by using a 100-watt bulb and solar panels, this technology can be used as an alternative for clean water reserves for communities in coastal areas and small islands (Sucipto, *et al.*, 2013).

Constraints may be the case when applied in the long term is the influence of the ever-changing weather. At the time of activity application, on the 2nd day trial in a state of cloudy weather, a little drizzle and sea waves high enough to affect the process of evaporation that occurs in mica glass/acrylic, resulting in the volume of water being stored cannot be maximized. In term of durability at the time of the trial process, the tool has very good durability. In the event of weather conditions are unfavorable, the tool can do stability very well to follow the pattern of water up and down, because the buoy in pairs on the four sides of the structure and the pile as retaining an additional structure, so the structure has the dynamics of good also.

5. CONCLUSION

Appropriate technology that is designed for a community service activity in the area KKN PPM Malang Rapat Village Bintan regency has been successfully implemented.

Fix Desalination System that is designed with the structure of mica glass/acrylic which has a volume of 1 m^3 can produce an average of 15.95 ml distilled fresh water in the tank. If the desalination system structure can be expanded dimensions will produce a total volume of fresh water to more.

From this activity, the youth community will also become increasingly aware that technology an important role in the activities carried out. The quickly technological developments provide a change of mindset in completing daily activities. So that, the youth community should begin to realize the importance of how to make use of the surrounding environment, which can be said to be all lacking into something useful, especially in fulfill the needs of clean water and its efficient use.

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APPENDIX A

As for the structure of the material discussed on the activities of the Knowledge Transfer Principle desalination systems technology are as follows;

a. Riau Islands as having a great potential of Renewable Energy
b. Energy issues
c. The development of technology and its relation with Renewable Energy
d. Applied technology in solving environmental problems
e. Small islands are still not well developed
f. Lack of clean water sources and a source of electricity in the area of small islands
g. Alternative dispute resolution solutions and sources of clean water and electricity resources in the area of small islands
h. Basic introduction on desalination
i. The simple process of desalination systems
j. Explanation of desalination technology which simple and applicable
k. Make a simple technology of existing goods
l. The role of youth in society and the environment
m. Youth is an agent of change and the backbone of the village
n. Students of SMK ready to go down and help the community in providing alternative solutions that are effective, efficient and technologically.

APPENDIX B

The workshop process conducted by the method of manufacture detailed explanation of simple technology desalination systems. With detailed explanations, students from senior high school can understand the technology in design and usability and benefits. Learning materials carried by the structure of a continuous and complete from the design process through the process of testing the tool. Following the structure of the material described in the activities of Community Services in the process of making a simple technology desalination system is;

a. Basic principle of the circulation of rain
b. Benefits of the process of evaporation and condensation
c. Exploiting the principle of the greenhouse effect in improving the results of evaporation and condensation
d. Process of ocean physics and its changes to the intensity of sunlight
e. The basic principle of desalination
f. The benefits use desalination
g. The selection of the basic design of desalination systems
h. Design of the body structure desalination system
i. Selection of materials, tools, and materials
j. Process of making desalination system
k. The formation process of desalination system uses acrylic
l. The whole process of the formation of desalination systems
m. Process of testing and the results of the desalination system