

**IMPLEMENTASI PENDIDIKAN LINGKUNGAN HIDUP BAGI MASYARAKAT DALAM  
MENGOLAH LIMBAH PLASTIK MENJADI  
“BBM LITIK”**

**IMPLEMENTATION OF ENVIRONMENTAL EDUCATION FOR SOCIETY IN PROCESSING  
PLASTIC WASTE INTO "BBM LITIK"**

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**Abstract:** Plastic waste is one of the synthetic waste that not easily be decomposition. Plastic waste requires special processing so as not to pollute the environment. Plastic waste processing is done to reduce the number and produce products that are beneficial to society. Environmental education need to be implemented not only in schools but also in the society. "BBM Litik" (Bahan Bakar Minyak Limbah Plastik) is one effort in processing plastic waste. This program is implemented in Pelem village, Magetan from April until June 2016. The method used is the design tools, test tools, socialization, training, practice, mentoring, and evaluation. The results of this activity are: 1) processing equipment "BBM Litik", 2) product of "BBM Litik" 3) Improvement of society knowledge in the processing of plastic waste and 4) Reduction of plastic waste. The society was very enthusiastic in training. Society has the knowledge and ability to process plastic waste into "BBM Litik". The amount of plastic waste in Pelem village, Magetan reduced by 50%. This shows that the "BBM Litik" can be used as an alternative treatment of plastic waste for the benefit of society.

**Key words:** BBM Litik, Environmental Education, plastic

## **1. INTRODUCTION**

The use of plastics in our daily lives more and more popular because it has many advantages. But the plastic waste cannot be decomposed easily by the soil, resulting in pollution. Pelem is one of the villages that produce a lot of plastic waste. Mostly people are less concerned about the environment, it can be seen from their habit of throwing or burning plastic waste without considering the environmental health. They have not known yet about the importance of environmental education and how to process plastic waste.

Plastic is a macromolecule formed by the polymerization process. Plastics can be classified into 2 kinds, those are: thermoplastic and thermosetting. Thermoplastic is plastic that when it is heated to high temperatures will melt and could be reshaped into a desired shape. While thermosetting plastic cannot be melted again by heating (Surono, 2013). In general plastic waste has composition of 46% Polyethylene (HDPE and LDPE), 16% Polypropylene (PP), 16% Polystyrene (PS), 7% Polivinilclorida (PVC), 5% Polyethylene terephthalate (PET), 5% Akronitil-butadien- styrene (ABS) and 5% other polymers (Prasetyo *et.al*, 2011; Nugraha *et.al*, 2013, Surono, 2013).

Recently, plastic waste has been just dumped and burned, causing side effects such as pollutants, carcinogens and other pollutant particles (Ermawati 2011; Ramadan and Ali, 2011). The handling of plastic waste is now known as the 3R (reuse, reduce and recycle). One application of plastic waste that is currently developed is pyrolysis, hydro-cracking, and hidroisomerasi. Pyrolysis is a burning technique of plastic waste without O<sub>2</sub> and is done at high temperature around 230°C - 1000°C (Mustafa and Zainuri, 2014; Ermawati 2011; Nugraha *et.al*, 2013; Surono, 2013). This technique produces environmentally friendly gas that is non-toxic and produces liquid hydrocarbons. Factors that affect the process of pyrolysis are temperature, time, particle size and weight of the particles. (Ramadan and Ali, 2011). Pyrolysis process can also be modified by using reforming system of a catalyst (Nugraha *et.al*, 2013).



Figure 1. Plastic waste in Pelem Village

Environmental education for the community is one effort to take care for the environment and natural surroundings. Environmental education is not only to be done in schools, but also in the community. The successful management of the environment is affected by the level of public awareness to run environmental education. The scope of environmental education includes several things: institutional, human resources, facilities and infrastructure, funding, communications, information, community role and methods of achieving the target (Dewi, 2013). The general objective of environmental education for the community is to gain awareness, knowledge, attitudes, skills, participation and evaluation. The effort to invite the community for caring the environment and managing plastic waste are done by persuasive methods and approach.

Socialization and training are done to urge people directly to practice in real condition. It would require creative and applicable efforts to process plastic waste. One of the efforts is through training, outreach and mentoring program "BBM Litik" (Fuel Plastic Waste).

The purposes of this study are 1) To make a tool which is able to proceed plastic waste into BBM Litik. 2) To produce pyrolysis of plastic waste into BBM Litik. 3) To increase public knowledge about the environment education and the process of plastic waste into BBM Litik. 4) To reduce plastic waste in the village Pelem, Magetan.

## **2. RESEARCH METHODOLOGY**

This research is a qualitative descriptive study and conducted for 3 months from April to June 2016. The target of this study is 20 persons from Pelem Magetan. The methodology in this study are:

### **a. The design of the tool**

The tools used to make "BBM Litik" made of a simple apparatus that LPG cylinders, dim half-sized iron pipes, iron pipes, condensers, large hose, a small hose and connecting hose.

The work steps to make the tool are: 1) LPG is modified to provide channels to put the plastic waste on the side and at the top, connect it with an L-shaped metal pipe as high as 30 cm. 2) The small pipe is connected to a hose. Then, connect the large hose to the smaller hose. 3) Connect the hose to the condenser for discharging oil.

### **b. Socialization and training**

Socialization and training are given to emphasize the importance of environmental education for the community. Besides that, training and socialization are given so that people are able to process plastic waste into "BBM Litik".

### c. The knowledge of society

The increasing knowledge of the society is scored by giving tests related to description of the material. Society is considered as having enough knowledge about "BBM Litik" when the obtained score is more than 65. In addition, community's skill is also evaluated through observation sheet. The indicators of society's skill success is seen from the percentage of achievement more than 70%.

### d. Plastic waste in the community.

Methods to determine the reduction of plastic waste is by observing directly the plastic disposal in each houses.

## 3. FINDING AND DISCUSSION

The results of this study covers several aspects, those are: design tools, socialization and training, achievement of the society's knowledge, and the amount of plastic waste on post-study.

### a. The design of the tool

The tool that is used for processing plastic waste is fairly simple to take items that exist in the surrounding. The tool uses the principle of pyrolysis and fractional distillation. Plastics will be heated in a reactor with a high temperature above the melting point, there will be a polymer vapor that passes through the cooling pipe then is condensed to produce alternative fuels from plastic waste. Prasetyo *et.al* (2011) said that plastic waste processing machines are very applicable and can overcome the problem of environmental pollution due to plastic waste which is difficult to decompose.



Figure 2. The tool of BBM Litik

This tool can be used on a small scale to reduce household plastic waste. The tool is also designed with the principle of recycle, using unused goods. The use of tools from the recycle is one of the implementation of environmental education for the community.

### b. Products of "BBM Litik"

"BBM Litik" is the result of the pyrolysis process and fractional distillation of plastic waste. It can be used as an alternative fuel in a variety of sustainable research. In general, the pyrolysis process 1 kg of plastic will produce approximately 900 ml "BBM Litik". Plastics that used are polyethylene and polypropylene. The factors that affect the pyrolysis process are time, particle's temperature and weight (Ramadhan and Ali *et.al*, 2011).



Figure 3. BBM Litik

The research of Nugraha *et.al* (2013) showed that the type of polyethylene plastic can be processed into liquid fuels by pyrolysis method. Activated carbon is an efficient catalyst for this type of degradation and can produce higher amounts than aromatic compounds. Activated carbon is chosen for its heat resistant, inexpensive and a good catalyst for the degradation of polyethylene waste. Pyrolysis of plastics with high temperature will produce CO<sub>2</sub> and H<sub>2</sub>O that are environmentally friendly (Ermawati, 2011). When Polyethylene is heated, it also will form a liquid hydrocarbon compounds and other compounds such as wax paraffin and olefin. Polypropylene plastic can be converted into fuel through a pyrolysis process and be continued by the process of catalytic reforming (Nugraha *et.al*, 2013). In addition for using simple pyrolysis, a catalyst that can be used is a zeolite X which can accelerate the reaction (Wahyudi *et.al*, 2015).

### c. Socialization and training

Socialization and training are done three times to the people Desa Pelem, Magetan, with the materials of environmental education for the society, processing plastic waste into "BBM litik" and the practice of making "BBM litik". Socialization went smoothly and conducive. The society is very enthusiastic and the discussion goes interactively during the event because the society thinks that they are able to apply all theories and utilize plastic waste in their everyday life.



Figure 4. Socialization and training

Socialization and training are aimed to educate the public about the importance of environmental education. All stakeholders are expected to take care of institution, Human Resources (HR), facilities and infrastructure, funding, materials, communications, information, community role and methods to achieve them. This training is expected to have public awareness and the ability to keep the environment as clean and healthy. Processing of plastic waste using recycle and reduce principle is a step to preserve the environment and produce alternative fuels that are environmentally friendly.

### d. The knowledge of society

After socialization and training have been done, there is an evaluation of cognitive knowledge and skills of society. The instrument that used for identifying the cognitive aspects of society in the making "BBM Litik" based on environmental education is a test contains 20 questions. Based on the score analysis, it is obtained data as Table 1 and Figure 5.

Table 1. Results of material achievement

Achievement	Amount	Percentage
Achieved	16	80%
Not achieved	4	20%
Total	20	100%



Figure 5. Result of material achievement

According to the table and diagram above, the data show that there are 16 persons who achieve scores more than 65 with a percentage of 80%. This is because at the time of delivery of material, the speaker uses clear and simple language, and people pay attention to it enthusiastically. Good delivery will bring good, effective, and efficient attainment. People who have not achieved cognitive ability and knowledge of environmental education and how to make the BBM fuel is as much as 4 people with a percentage of 20%. This inaccessibility is due to several factors including the age of the participant, cognitive ability, and enthusiasm of participants. Those 4 people are classified as non-productive age thus less enthusiastic about the activities of a theoretical nature. Based on the results of these achievements, it can generally be said that this training can improve public knowledge about environmental education and manufacturing BBM fuel from plastic waste. People who have not reached cognitively will be given additional information to strengthen cognitive skills.

In addition to cognitive aspects, the subjects are also scored by their skill in making tools and producing BBM Litik. The data from the observation sheet show that 80% of people are able to make a simple plastic processing tool for producing BBM Litik. This ability indicates that materials can be applied by the society; therefore, it can be said that people are able to apply environmental education in the changing process of garbage into useful products. How to deliver the material is also one important factor to support the skill and knowledge escalation of society in making "BBM Litik". The application model of environmental education in the community uses a participatory approach that leads to awareness and skills (Dewi, 2013)

#### e. The amount of plastic waste

Because of this program, the amount of plastic waste in Pelem-Magetan is reduced by approximately 50%. It can be seen from the plastic waste capacity in each family. Plastic waste before the program is only abandoned and burnt to pollute the environment. But now, after this program, the plastic waste is separated from other waste then processed collectively in each quarter to produce "BBM Litik". However, the drawback of this activity is the absence of laboratory analyzes related to the content and level of fuel from plastic. So the further studies need to develop this fuel into alternative energy.

## 4. CONCLUSION

The conclusion of this study are 1) The presence of tools to proceed plastic waste into "BBM Litik". 2) The presence of pyrolysis product of plastic waste into "BBM Litik". 3) The presence of public awareness for the environmental education and the processing of plastic waste into BBM Litik increases 80%. 4) Plastic waste in Desa Pelem is reduced by 50%. The suggestions for further research is the need for laboratory study of "BBM Litik" and innovative methods and the addition of a catalyst.

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