

Surface Litter Barrier: A Response to Solid Waste Management

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Abstract - The surface litter barrier technology was developed and initiated as a response to solid waste management. The purpose of the development which was being combined with fermented organic matter technology was on the idea of addressing the solid waste problems in Bikol River situated at Naga City Camarines Sur Philippines. Purposely to trap the floating solid wastes in the river for the city personnel to collect and dispose it to proper waste facilities. This is to improve the surface litter collection system aiming to lessen the solid waste volume to promote 3R's (reuse, reduce, and recycle). The study was conducted in Naga City for both onsite and off-site interviews of key respondents composed mainly of personnel from the City Environment and Natural Resources Office (ENRO). The ones directly involved in the management and interventions in the Naga River. The respondents provide ratings as to the effectiveness of the product and their level of acceptability. Respondents were personally interviewed and the rating resulted in five (5) with the verbal interpretation of Highly Acceptable (HA)). It was also mentioned by the respondents that the reasons behind the high rating on acceptability in the effectiveness of the technology were mainly the simplicity of the product, durability, ease to assemble, availability of materials used, cost-effectiveness, promotion of 3R's (reduce, reuse and recycle) and product can be replicated by other LGUs (Local Government Unit). It was then concluded that because of the quest for the proper segregation of waste plastics, the community was aware of its responsibilities. Respondents were also asked for their ideas and recommendations on how to further improve the technology. It was then recommended to apply the following: barrier should cover the entire cross-section of the river; bottles should be in an upright position to better capture the floating wastes; increase the width of the barrier instead of a single file barrier, and place a barrier in other strategic major locations along the bridges

Index Terms - Barrier, Fermented Organic Matter, Solid Waste Management, Surface Litter

INTRODUCTION

The problem of solid waste had been considered as one of the major unsolved cases in our surroundings. It is indeed a massive quest to our environment and for everyone to stop the rampant throwing, especially of plastic waste even there were already gigantic demands on proper segregation of wastes and materials.

Undeniably, this is one of the considered perennial problems in Naga City River, Camarines Sur Philippines, and the constant contest and hope of the entire Bicolanos to regenerate its unceasing aesthetic and water content as what before where it considered as non-toxic, unpolluted, free from harmful bacteria of contaminated silts whereas river is the eighth largest basin in a country and play an important part in the water cycle, acting as drainage channels (Bicol River Development Foundation).

The river in the current phase today needs in-depth care to rejuvenate its peculiar identity. Hence, several technologies and projects had been served and initiated to bring back the life of plants and other living things; however, these actions were proved to be complicated and very costly in terms of energy or power consumed every month which is too much for the city to sustain. Also, the equipment itself was very expensive thus making the project a failure. There were also some dredging operations that the city had conducted which seemingly have a significant effect on the quality of the river. However, just like the other initiatives, the limiting factor was on the budget sustainability which made these dredging operations indefensible.

On the other hand, Vice President Leni Robredo through her effort granted a revetment project on addressing the informal settlers in the riverbank where they were considered as one among factor contributors to inappropriate waste disposal.

This action was based on the recommendations in the different research findings on how to manage the sanitation of the river. And also this project was among the aesthetic issue of the river and had paved the way for other initiatives to be possible and implementable because of the recovered legal easement and relocated informal settlers encroaching the riverbanks.

However, it does not equate to resolve the entire problem. This is not to talk about its physical or infrastructure issues but more about biological the concern. According to the report of the Environmental Management Bureau (EMB) Regional Office, the Naga River falls into a Class C water classification which means it is not suitable for activities with skin contact. Some of the parameters failed to meet the quality standards including Total Coliform, Fecal Coliform, Dissolve Oxygen, Biochemical Oxygen Demand (BOD), and other parameters (Naga City -WQMA 2016).

This concern is sentient and awakens researchers' affection for the river by way of giving ideas and share new technology to renew the Bikol River. Guided with the principles learned through experienced and education, the researchers grasp the ideas on reaching out support to the quest of the Naga City to restore the beauty of the Naga City River that:

"The most effective solutions are usually the simplest ones".

It is with the innovative minds that the researchers made a better-quality Surface Litter Collection System and combine it with the Fermented Organic Matter (bokashi ball) technology.

The combine technology of surface litter as a barrier with fermented organic matter gives initial contributions to response the call of LGU (Local Government Unit) -Naga to participate in the long pursuit to revitalize the river.

The practice and the existing system that the city is currently using in addressing the floating wastes in the Naga river is a makeshift barrier made of bamboo that is placed horizontally across the river. The main purpose is to trap the floating solid wastes making it easy for the city personnel to collect and dispose it properly. However, it was inconvenient for the city personnel to use because from time to time they need to replace the bamboo barrier; since it was not durable and soaked in the water for a long period of time. Fortunately, because of the collection of plastic waste out of soda litters, the so-called life span of holding the fermented organic matter (bokashi balls) was sustained plus the demands the solid waste problem were addressed.

The researchers believed that proper dissemination on the importance of plastic litters on the project to the community enlightens them to impart contributions on proper segregation. Thus, constitute solid waste management.

OBJECTIVES OF THE STUDY

The researchers technology dealt mainly with enhancing the existing surface litter collection method by developing an innovative yet inexpensive water- barrier system; and the initial bio- remediation technique that aims to improve the quality of water at the microorganism level. However, the researchers did not yet give much attention to the Naga River water purification because the intent concern was on the response to solid waste management. The study was the preliminary phase of identifying how acceptable the technology in terms of contribution to revitalize the river.

Meanwhile, researchers establish the main objectives of this project to determine the acceptability of the Surface Litter as Barrier with Fermented Organic Matter Technology in terms of resiliency, efficiency, and durability; and how it addressed solid waste problems in the community.

The researchers were guided with the following specific objectives such as: identify the design and the materials used in developing the Surface Litter Barrier; determine the steps in making the Surface Litter Barrier; and describe the procedure of assembling it in the river.

MATERIALS AND METHODS

The researchers made use of applied experimental research and development methods in developing the project. The Research and Development (R & D) obviously employed to achieve the objectives of the study with the aim of realizing and implementing the usefulness of this new technology to collect solid waste in the Bikol River as a response to the solid waste management system. The study also includes identification, procurement and preparation of the materials and equipment needed for the study. Also, the timeframe for each activity was properly outlined.

In this study, the researchers used cluster sampling because personnel from the Naga City Environment and Natural Office (ENRO) served as the respondents of the study. This is the office that manages and directly involves in the supervision and interventions in the Naga River. The study comprises ten (10) respondents which include the head of the department. The researchers collectively gathered responses from those employees who have hands-on contact with the river. Using the researchers-made and interview survey questionnaire the researchers conducted in both onsite and off-site of these key respondents. They provide their ratings as to the acceptability of the technology.

RESULTS AND DISCUSSION

Following the Research and Development (R&D) method, the researchers develop the technology and administer the procedures of assembling and placing it in the river. Likewise, govern the face-to-face conduct of data to determine the acceptability of the technology as effective technology.

I. Design of the Surface Litter Barrier with Fermented Organic Mater

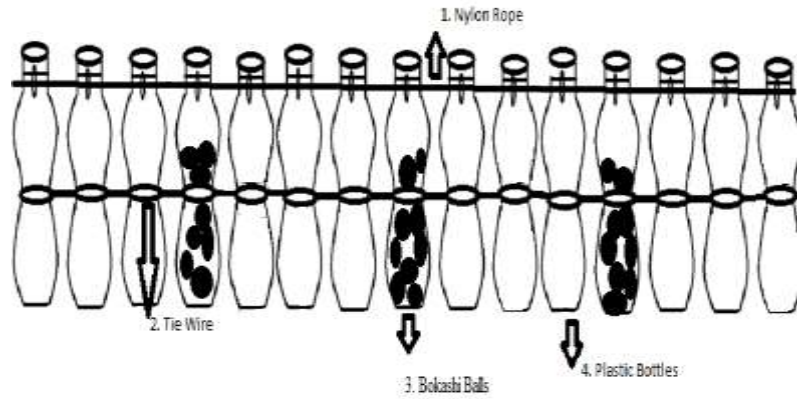


FIGURE1 : DESIGN OF THE SURFACE LITTER BARRIER



FIGURE 2 : ACTUAL SURFACE LITTER BARRIER WITH FERMENTED ORGANIC MATTER

Figure 1 and 2 shows the design of the Surface Litter Barrier.

II. *Developing the Technology*

The technology being developed followed the technical aspects of research and development (R & D). The technology was divided into (2) two parts: a. Formulation of the Fermented Organic Matter and b. Development of Surface Litter Barrier.

a. *Formulation of Fermented Organic Matter*

Combining all the steps such as (a)Effective Microorganism (EM) preparation because accordingly Effective Microorganisms (EM) is a culture of coexisting beneficial microorganism predominantly consisting of lactic acid bacteria, photosynthetic bacteria, yeast, fermenting fungi, and actinomycetes that are claimed to enhance microbial turnover in soil and thus known increase soil macronutrients and increases plant growth and yield(Crawford 2002). This play a significant role in the study since researchers initially study the potential of this formula to regenerate the water level of the Bikol River; (b) EMAS (Effective Microorganism Active Solution preparation; (c) Preparation of Fermented Bokashi Mixture; and (d) Fermented Organic Matter (Bokashi Balls) Making. Through its formulation, researchers initiated to combine this fermented organic matter in order to describe the use of surface litter as a barrier. Hence, the problem on the rampant litter plastic connotes huge participation as the main material in the study.



FIGURE 3 : FORMULATION OF MAKING FERMENTED ORGANIC MATTER

b. Surface Litter Barrier Preparation

From the collected soda litters out of waste, it was then clean and properly cut with a certain opening for the insertion of fermented organic matter.



FIGURE 4

SURFACE LITTER BARRIER PREPARATIONS



FIGURE 5

SURFACE LITTER BARRIER WITH FERMENTED ORGANIC MATTER TECHNOLOGY



FIGURE 6

SAMPLE RESPONDENTS WITH ACTUAL HANDS –ON AND INVOLVEMENT WITH THE TECHNOLOGY

The respondents were composed of employees from the ENRO office who possessed knowledge in the management of the Bikol River.

The technology was then placed at Magsaysay Bridge, Naga City.



FIGURE 7

SURFACE LITTER BARRIER WITH FERMENTED ORGANIC MATTER TECHNOLOGY



Figure 8

WASTE TRAPPED USING THE TECHNOLOGY

TABLE 1

SHOWS THE SUMMARY OF EVALUATION RESULT AFTER THE CONDUCT OF STUDY

Indicators	WM	Adjectival Rating
Resiliency	5.0	Highly Acceptable
Efficiency	5.0	Highly Acceptable
Durability	5.0	Highly Acceptable
GWM	5.0	Highly Acceptable

In the evaluation indicators, most of the responses established an outstanding rating result equivalent to five (5) points with an interpretation of highly acceptable (HA). Thus, this surface litter barrier is a new technology that responds to solid waste management. A very simple study yet signified overall encouragement to all on proper segregation.

There is a high level of acceptability from the personnel in charge of river garbage collection. The technology provides a significant contribution to the decreased of surface litter visible along the main river segment (from Magsaysay Bridge down to the City proper).

Regular monitoring and assessment were done after the installation of the barrier. Designated City ENRO personnel conducted regular collection of solid waste in the river. This is to measure the efficacy of the technology and to evaluate if there are adjustments or modifications needed.

On the other hand, to weigh the improvement of water quality, the researchers coordinate with the Environment and Management Bureau and request for a copy of the water quality sampling results during the conducted pilot testing of the technology. And the result shows that there were improvements in the quality of water. Thus, the researchers were eager and optimistic to continue the study on formulating fermented organic matter or bokashi balls from the preliminary actions made.

CONCLUSION AND RECOMMENDATION

There is a huge impact brought by this technology. The procedures of making this technology concede the issues and concerns of respondents about the durability of their surface bamboo barrier. The study thereby addressing both the physical and biological problems of the Naga River by introducing a plastic surface-litter barrier combined with the fermented organic matter (bokashi ball) technology.

It was then concluded that the technology was an accepted new technology to revitalize the river. Since the technology used plastic bottles, it helps to lessen the volume of waste plastic in the city or in the entire community. Aside from experiencing the decrease of plastic waste it increased the awareness of the community on proper segregation because it was then collected as main material for this technology. Hence, community able to observed the 3R's.

▪ Recommendations were also given in the improvement of this technology such as: Increase the length of the barrier in order to cover the entire cross- section of the river; Improve the design of the barrier by adding weights in order to keep the bottles in an upside down position; Improve the aesthetic feature of the technology to make it more appealing to the general public; Add more barriers to other strategic locations to better capture the surface litters in Naga River; Seek support from the City or other institutions to provide the researchers assistance in order to facilitate further study and improvement of the technology; and propose this technology to the City government to adapt and utilize this surface litter barrier with fermented organic matter technology.

REFERENCES

- [1] Bicol River Development Foundation (BRD) <http://www.bicolriver.com/about04.html>
- [2] Crawford (2002), Diver (2001), Higa (1985) https://www.researchgate.net/publication/229085089_Evaluation_of_Effective_Microorganism_M_for_treatment_of_domestic_sewage
- [3] Naga City Environment and Natural Office (ENRO) Naga City Camarines Sur Philippines, on existing Naga City Surface Litter "Bamboo Barrier".
- [4] Naga City Water Quality Management Area (WQMA, 2016), on Naga River Water Classification, Environmental Management Bureau (EMB) Regional Office Report.
- [5] Rizza Mae (2009) from <http://seed-balls.com/bokashi> <https://www.unbound.org/Stories/2009/August/Filipino-project-cleans-river-with-bokashi-balls>.