Possibilities of Renewable Energy Technologies to Address the Pollution Hazard Due to Backwater Tourism in Kuttanad Area of Kerala, India

A. Afsal*[1], J. Haritha[1] and P. Shaji James[2]

[1] Post graduate scholars, Academy of Climate Change Education and Research, Kerala Agricultural University, Thrissur, India, 680656

[2]Professor, Kelappaji College of Agricultural Engineering and Technology, Kerala Agricultural University, Tavanur, India, 679573

Corresponding Author*: afsalayoob95@gmail.com

Abstract

Kuttanad is one of the major wetland systems in India, which is included in the Ramsar sites and comprise of a unique ecology located below 2.2m from mean sea level. The present study was focused on the major ecological threats due to backwater tourism. The methodology included field surveys for data collection and analysis of secondary data. It was observed that the major problems were pollution from untreated sewage waste, seepage of oil from engine driven boats, discharge of non-biodegradable waste as well as wastage of energy. On assessment of available renewable energy technologies, it was evident that solar photovoltaics along with anaerobic digestion of organic wastes to treat the wastes from house boats with simultaneous biogas production as well as energy conversion of aquatic biomass the probable option.

Keywords: Backwater tourism, Energy, Environmental pollution, Renewable energy

INTRODUCTION

Climate change has emerged as the major threat to the environment ever experienced (IPCC, 2013).Accelerated rate of greenhouse gas emission has been abruptly increasing and it is the major the root cause for climate change. Through its growing potency to threaten ecological balance of the earth as well as the natural water bodies mainly related to the tourism industry in

worldwide. Moreover considering the negative consequences associated with tourism field, it is a real challenge for the industry to optimize these effects in a multidimensional manner. Population explosion is another global event intensifying the adversities of climate change since the human driven contribution to climate change is very crucial (FAO, 2013). Global earth surface temperature is rising at an uncontrolled level. Projection is that surface temperature will rise between 2.6 to 4.8ºC and sea level is expected to raise 0.45 to 0.82mby the end of 2100 which has harmful effects on both environment and water resources (IPCC, 2007). The probability of occurrence of extreme events like heat waves, droughts, floods, cyclones, and various natural disaster occur is more in the changing climate (IPCC, 2007). By 2025, it is estimated that, most of the countries will experience water stress (R K mall et al., 2006).

The study location Kerala state comprises of a unique geographical features that have made it one of the most exclusive tourist destinations in Asia. Even though there is positive impact on the economy, however environmental pollution is the major problem associated with this industry. It is mainly located in Kuttanad region. Kuttanad wetland system is a deltaic formation of five river systems viz. Meenachil, Pampa, Manimala, Muvattupuzha and Achencovil, located in the fertile low-lying areas of Vembanad Lake. Traditional boats which were used as goods carriages (Kettuvallams) in olden days have been converted to house boats and at present they are widely depicted as the icon of back water tourism of Kerala. As the populations of house boats have increased significantly in the recent past, there is a serious concern over their impact on the wet land ecosystem (Narayanan and Karlaganis, 2014). Also Even though there are legal restrictions and rules imposed by the government to mitigate the environmental impacts of backwater tourism, there are many instances of negligence on the part of the corporate industry. Hence this study was aimed at understanding the major pollution problems associated with backwater tourism in Kerala and to propose suitable renewable energy techniques for reducing pollution hazard in a cost effective manner. Concerted efforts are needed for developing proper adaptation, mitigation and modeling strategies have to implement for conserving our natural resources.

Materials and Methods

Details of the Location

The district has a tropical humid climate with an unfair summers and plentiful seasonal rainfall. The period from March to the end of May is the hot season. This is followed by the southwest monsoon season, which continues till the end of September. During October and major part of November southwest monsoon retreats giving place to the northeast monsoon, and the rainfall up to December is associated with northeast monsoon season (*source: Central Ground water board*)

The methodology adopted for the present study was a mix of primary data collection through surveys as well as analysis of secondary data collected from various stakeholders. The survey was conducted during the months of February to April 2016. The pollution hazard in the area becomes severe in this period of the year due to the closing of *Thaneermukkam* bund resulting in the stagnation of wastes in the backwaters. In order to collect information, interviews with key stakeholders, focus group discussions and interactions with a number of selected informants were done. The office bearers of All Kerala House Boat Owners Association (AKHBOA) were also interviewed. Data from the Kerala State Pollution Control Board and documents from the Department of Port, Government of Kerala were reviewed. The analysis was based on the surveys at two sites viz. Alappuzha (Alleppy) and Kainakari.

Results and Discussion

1. General perception of respondents

The profile of the informants selected for the study is given below:

Table 1. Profile of informants

Sl. No.	Category of informants	Total number	%of informants
1	Local inhabitants	50	38
2	House boat workers	35	27
3	Tourists	45	35
	Total	130	100

The respondents were asked to record their opinion on the environmental hazard as 'very much', 'slightly' and 'not significant'. The perspectives of the different classes of respondents were as shown below:

Category	Number of respondents	Response of informants					
		Very much		Slightly		Not significant	
		Nos.	% of total	Nos.	% of total	Nos.	% of total
Local people	50	33	66	5	10	2	24
House Boat Workers	35	7	20	10	28.57	18	51.42
Tourists	45	23	51.11	10	22.22	12	26.66

Table 2. Perception of respondents on the impact of backwater tourism

Out of the 130 people surveyed local inhabitants were the maximum and 66 of them were sceptical about the house boat tourism (Table 2). More than half of the tourists were also concerned about the environmental problems caused by house boats. Only 10 per cent of the house boat workers felt that there is any serious problem and more than half of them considered that the problems if any are not at all significant.

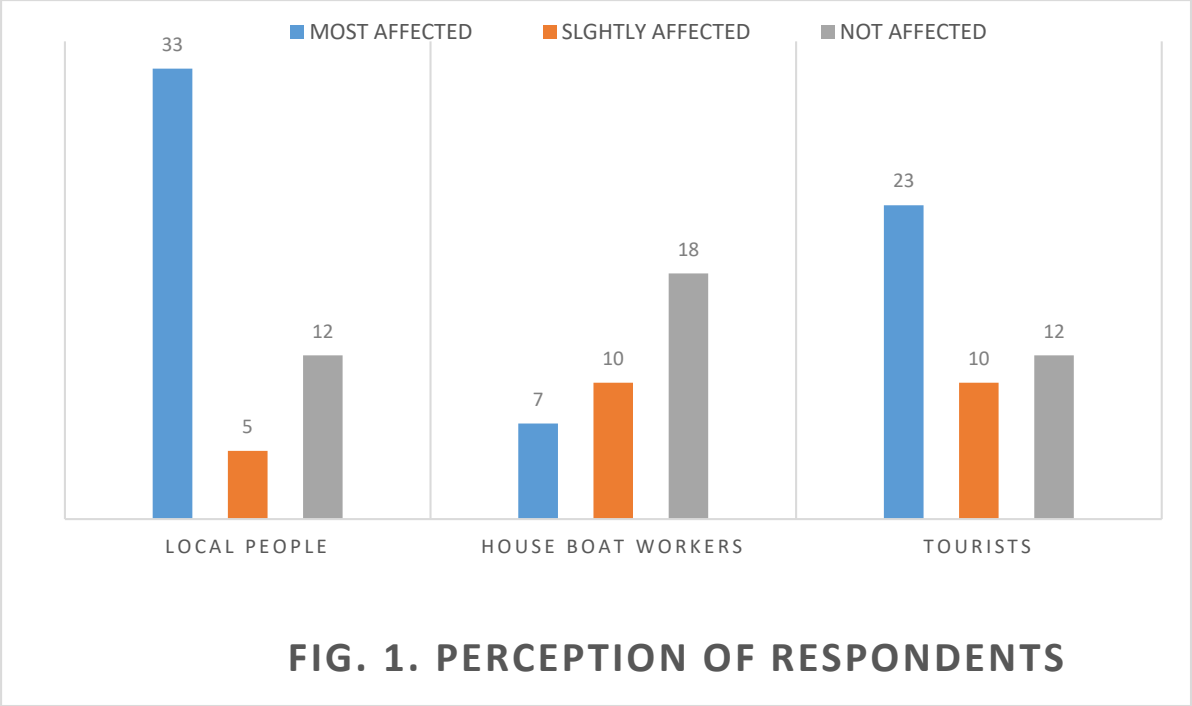


FIG. 1. PERCEPTION OF RESPONDENTS

From the Fig. 1 it is clear that local inhabitants as well as tourists are at present worried about the environmental problems even though the house boat workers generally seem to neglect them. The personal biases of the informants are evident from this.

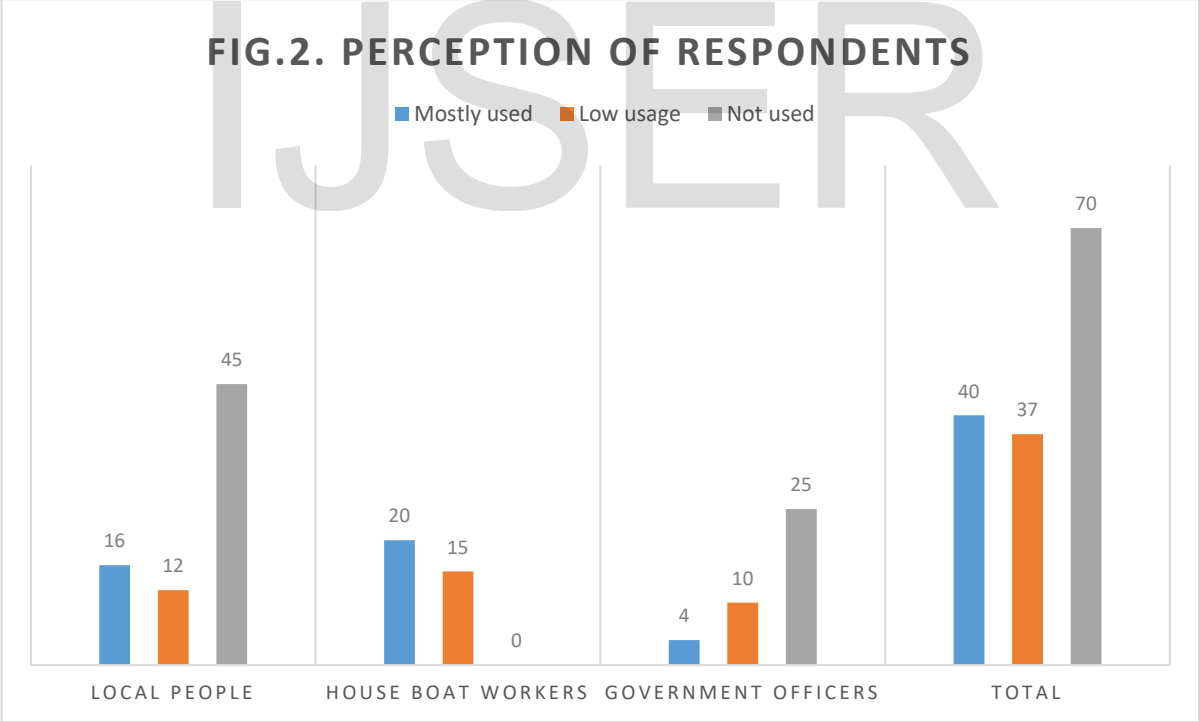
2. Sewage Treatment Plant at H Block

The sewage treatment plant installed by the District TPC in collaboration with AKHBOA with a capacity of 180000 litres per day was intended to prevent the discharge of sewage from house boats to the lakes.

The process involves collection of raw sewage from house boats in an equalization tank. Natural aeration by recirculation by the feed pump ensures homogeneity of effluent from the equalization tank and it is fed to a reactor. The reactor runs on electricity on the principle of electrocoagulation. The treated sewage coming out from the reactor is passed through the clarifier tank. The solids settle down and the clarified water is collected in the filter feed tank. From the filter feed tank, the water is fed to the pressure sand filter and activated carbon filter. The outflow of the carbon filter is passed through electro chemical oxidation unit for microbiological disinfection and the treated water is finally discharged to the soak pit.

Table 3: Perception of respondents on the working of sewage treatment plant

Category	Number of respondents	Response of informants					
		Mostly used		Low usage		Not at all used	
		Nos.	% of total	Nos.	% of total	Nos.	% of total
Local people	68	16	23.52	12	17.64	40	58.82
Houseboat Workers	35	25	71.42	15	42.85	0	0
Government officials	34	4	11.76	10	29.41	20	58.82



From the survey, we understood that the treatment plant was not effectively used by the houseboat operators. The sewage wastes from the houseboat were most often not passed to the treatment plant and it was dumped in to the backwaters. The septic tank wastes from the

households on the bank of lakes also find their way into the lakes. More than 50% of stakeholders have endorsed that the management of wastes and sewage is not at all done in a proper way (Table 4). Large percentage of the people has the opinion that water and soil characteristics have been badly also affected because of the backwater tourism. These results call for urgent measures for reducing the pollution and to protect the ecosystem of the wetland systems

Table 4. Waste generation from house boats

Sl. No.	Particulars	Particulars
1	No. of house boats in Kuttanad region	838
2	Average number of house boats in daily service	465
3	Average number of persons per boat	10
4	Total amount of sewage waste	1.1625 tonnes
5	Total amount of plastic waste	0.697 tonnes

From the survey, we understood that the treatment plant was not effectively used by the houseboat operators. The sewage wastes from the houseboats were most often not passed to the treatment plant but they were dumped in to the backwaters. More than 50% of stakeholders have endorsed that the management of wastes and sewage is not at all done in a proper way. Large percentage of the people had the opinion that water and soil characteristics have been badly also affected because of the backwater tourism. An estimate of the waste generation is given in table 4. On an average 1.2 ton of sewage wastes were dumped in to the backwater daily. From the current study we understood that majority of house boats were not obeying the rules and regulations. These results call for urgent measures for reducing the pollution and to protect the ecosystem of the wetland systems.

Possible Renewable Energy Technologies

The examination of possible options for renewable energy use revealed that solar panels cannot be installed on houseboats due to technical and aesthetic difficulties. They may damage the traditional look of the boats and wind could create problems. The suggestion is to install

small capacity decentralized solar power plantsat suitable locations in Kuttanad. Floating systems also may be thought of. The electricity demand of the house boats can be met from solar power plants to some extent. Charging points may be provided or there can be provision for hiring charged batteries. A preliminary investigation of the wind potential was not very promising for the conventional aero generators. The possibility of low speed wind turbines also need detailed investigation.

Another option is anaerobic digestion of organic wastes and aquatic weeds. Supply of bottled biogas at safe pressures can reduce the fossil fuel combustion and economic costs expended on fuel for cooking. The produced bio-slurry is a very good organic fertilizer and may reduce the use of chemical fertilizer in Kuttanad agriculture. The aquatic weeds like *salvinia* and *eichornea* are posing threat to navigation in the lakes. Proper technology is already available for converting them to bioenergy. However, no effort in this direction is seen materialized. If the harvesting and energy conversion techniques for aquatic biomass is adopted a significant amount of green energy can be made available to the system.

Conclusion

Even though the backwater tourism around Kuttanad area have a positive impact on the economy, there are negative effects due to pollution. Major problems due to the backwater tourism arise from discharge of solid and liquid wastes andseepage of oil from diesel enginesof house boats.It result in various problems associated with mainly agricultural production in Kuttanad region. Moreover, the farmers were affected by the incidences of health problems when prolonged contact with polluted water. The renewable energy technologies, especially solar and bioenergy alternatives are capable of reducing the pollution hazard. A proper monitoring from the local self-government authorities are required for conservation of *Vembanad* wetland system and to achieve the long term sustainability of eco-friendly backwater tourism.

Study Area

Figure 1

HOUSE BOAT IN VEMBANAD LAKE

Figure 2

SEEPAGE OF OIL FROM HOUSE BOAT

Figure 3

POLLUTED VEMBANAD LAKE

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