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Study of solid waste in world famous Dal Lake

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Abstract

Solid waste management is a worldwide phenomenon. It is a big challenge all over the world for human beings. Dal lake of Srinagar is the "Jewel in the crown of Kashmir" or "Srinagar's Jewel". Dal Lake is unique in having hundreds of house boats which afford an opportunity to tourists to reside on the lake in an atmosphere of peace and tranquility. The research was an attempt to assess the composition, characteristics, generation and separation of solid waste in Dal Lake. The research analysis of data revealed that the average net weight kg/day of constituents of solid waste was observed maximum in summer for the food wastes followed by polythene, cloth rags and card board and minimum by the wooden chips, glass and metals. This may be attributed to the heavy flux of local as well as national and foreign tourists residing in the houseboats and Shikaras within the Dal Lake. The average net solid waste generation was observed minimum in the month of November; the reason may be the low flux of tourists as compared to other months. Seasonal tourist inflow adds significantly to the demands on resource waste and contributes considerably to the amount of solid wastes generated.The solid waste generated in human settlements within the lake and on the periphery of the lake is one of the contributory factors for the deterioration of the lake environment. Comparing the physical composition of houseboat and household solid waste, the amount of readily biodegradable food wastes was found predominant.

Key words: Dal lake, solid waste, biodegradable.

INTRODUCTION

Solid waste generation is a continually growing problem at global, regional and locallevels. Solid wastes are those organic and inorganic waste materials produced by variousactivities of the society, which have lost their value to the first user. Improper disposalof solid wastes pollutes all the vital components of the living environment (i.e., air, landand water) at local and global levels. Urban society rejects and generates solid materialregularly due to rapid increase in production and consumption. The problem is more acute in developing nations than in developed nations, as their economic growth as wellas urbanization is more rapid. One of the major problems being faced by cities and towns relate to management of municipal solid waste (MSW). Waste quantities are increasing and municipal authorities are not able to upgrade or scale up the facilities required for proper management of such wastes. In many cities and towns, garbage is littered on roads and foot-paths. Citizens are also not accustomed to use the available storage facilities (dust bins) set up by the authorities. At large, lack of organized system of house-to-house collection of waste has created the littering habits. By and large, hardly we can see any city/town complying with the Municipal Solid Wastes (Management and Handling) Rules, 2000 in 'totality".

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MATERIAL AND METHODS

STUDYAREA

Dal Lake lies between 34° 5′ - 34° 6′North latitude and 74°8′ - 74° 9′ East longitude at an average altitude of 1583 mt in the Srinagar city of Jammu and Kashmir.Nearly 38000 people reside within the lake and with a capacity of nearly 10,000 persons in the houseboats, the population within the lake contributing to the solid waste could go to about 48000, especially during the tourist season. Apart from this, about 2, 20,000 people live on the periphery of the lake, who also, directly/indirectly contributes to the pollution of the lake through indiscriminate disposal of solid waste into the lake water. Dal Lake is unique in the sense that a large number of people live in hamlets inside the lake. The Authority on a daily basis collects about 02 truck/loads of solid waste from the lake body which includes 58 hamlets, 1000 house boats and Shikaras and open water surface area. A token user charge of Rs.50/month from each house boat is charged on a routine basis.

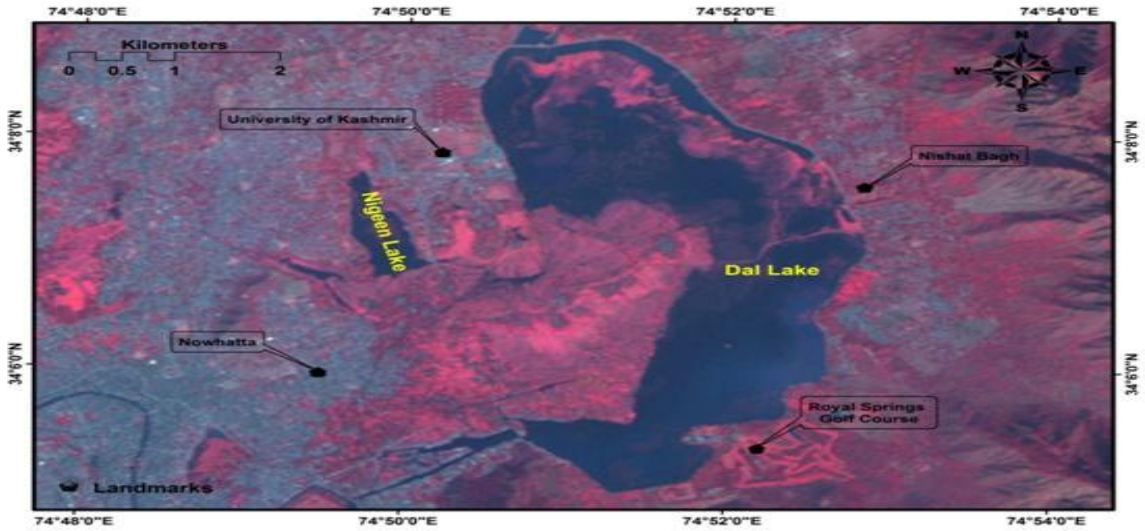

Figure 1*Satellite imagery of dal lake*

METHODOLOGY

Sampling of solid waste generated withinDal Lake was carried out on monthly basis. Direct examination of the waste stream such as characteristics, weight, composition, moisture content and existing waste management practices prevailing in Dal lake were carried out.The samples of solid wastesgenerated within Dal lake were collected near solid waste collection point located near the Dal lock gate, Boulevard Road. In every month three composite samples were collected. During each sampling wastes were collected in polythene bags of 10kg capacity weighed on spot using spring balance and were subsequently taken to the laboratory for further analysis (Gaxiola1995).Then solid wastes were segregated into different constituents and weighed separately.Net weight composition (%), Moisture content (%), Net weight (kg) or dried weight (kg) werealso determined.

RESULTS

The study was an attempt to assess the composition, characteristics, and to estimate the approximate quality and quantity of solid waste generation in Dal Lake from primary and secondary data. The characterization of solid waste showed that the solid waste stream was comprised of food wastes, polythene, cloth rags, cardboard, metals, wooden chips, glass and inert material with different proportions. The research analysis of data revealed that the average net weight kg/day of constituents of solid waste was observed maximum in summer for the compostable food wastes followed by polythene, cloth rags and card board and minimum by the wooden chips, glass and metals. This may be attributed to the heavy flux of local as well as national and foreign tourists residing in the houseboats and Shikaras within the Dal Lake. Net seasonal tourist inflow adds significantly to the demands on resource waste and contributes considerably to the amount of solid wastes generated.On comparing the net weight composition (%) of solid waste generated in different samples of various months, food wastes, polythene, cloth rags and cardboard constituted the maximum proportion to the solid waste generated within Dal lake. Moisture content was found highest in biodegradable food wastes.

RESULTS OF PRIMARY DATA

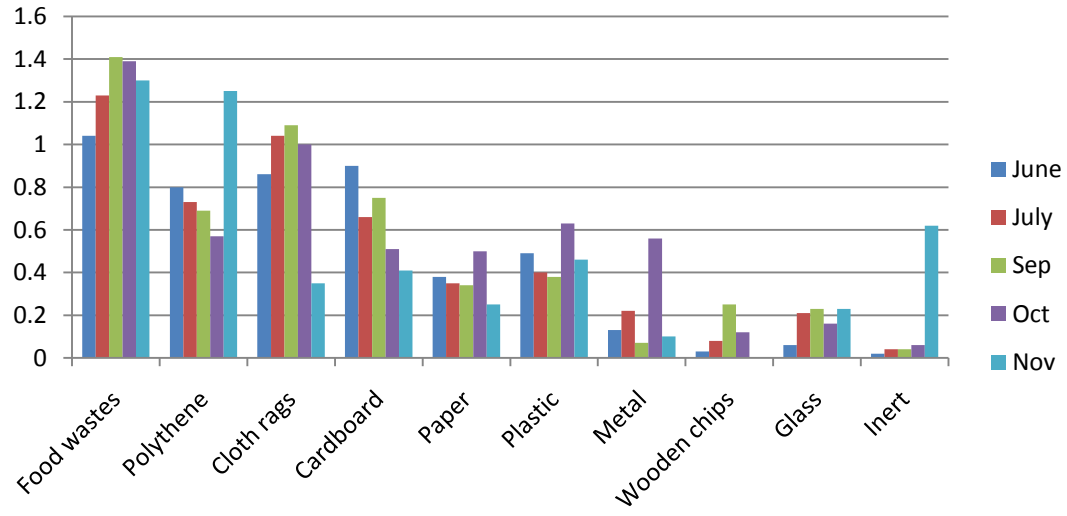

Figure 2 *Composition of Solid Waste(kg) during study period (June-November 2013)*

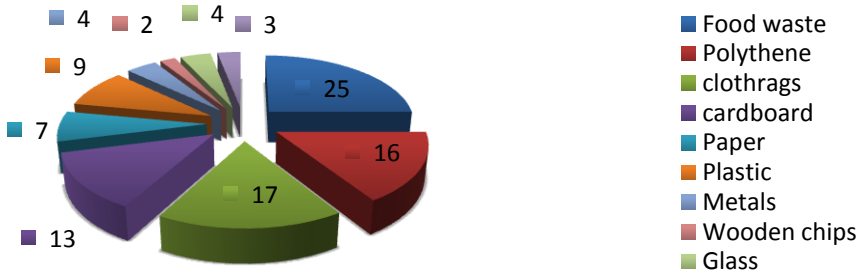

Figure 3*Average net weight composition(%)of solid waste samples generated during the study period.*

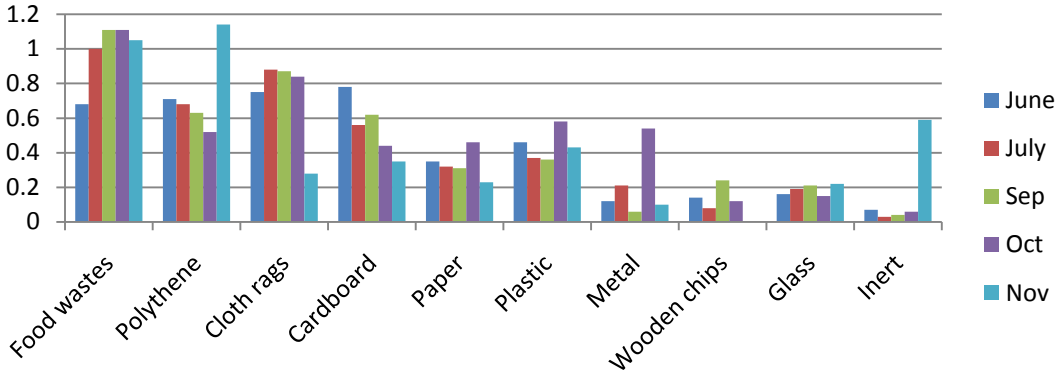

Figure 4 *Net weight composition of solid waste (kg)*

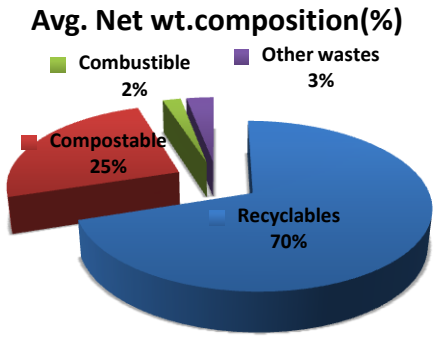

Figure 5 *Categorization of solid waste stream*

Results of Secondary data

Table 1.Monthly solid waste generation (net weight; kg/person /day) within Dal Lake by Houseboats, July 2012-June 2013

Month	Net Wt (kg/person/day)
July	1.40
August	0.90
September	0.70
October	0.56
November	0.37
December	0.45
January	0.48
February	0.41
March	0.45
April	0.90
May	1.20
June	1.30
Mean	**0.76**

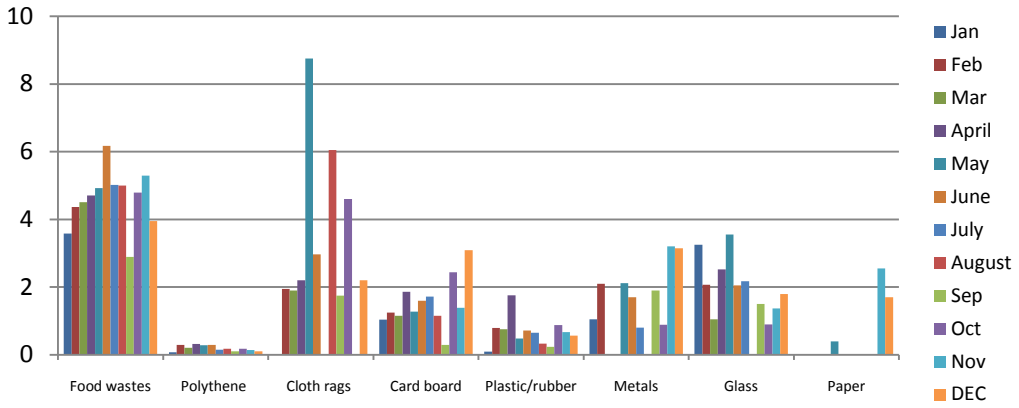

Figure 6 Average variation in the net wt (kg/day) of constituents of solid waste generated in various months (year) by houseboats

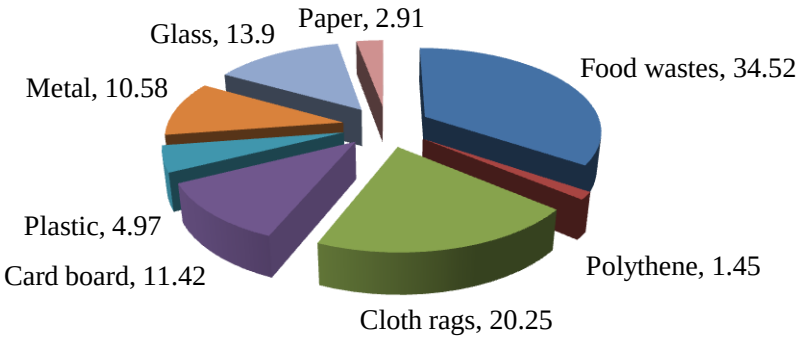

Figure 7*Average net weight composition of solid waste generated in various months by houseboats*

Table 2: Monthly solid waste generation (net weight; kg/person /day) within Dal Lake by Households, July 2012-June 2013

Month	Net Wt (kg/person/day)
July	0.84
August	0.64
September	0.38
October	0.36
November	0.31
December	0.28
January	0.33
February	0.36
March	0.39
April	0.37
May	0.44
June	0.61
Mean	0.44

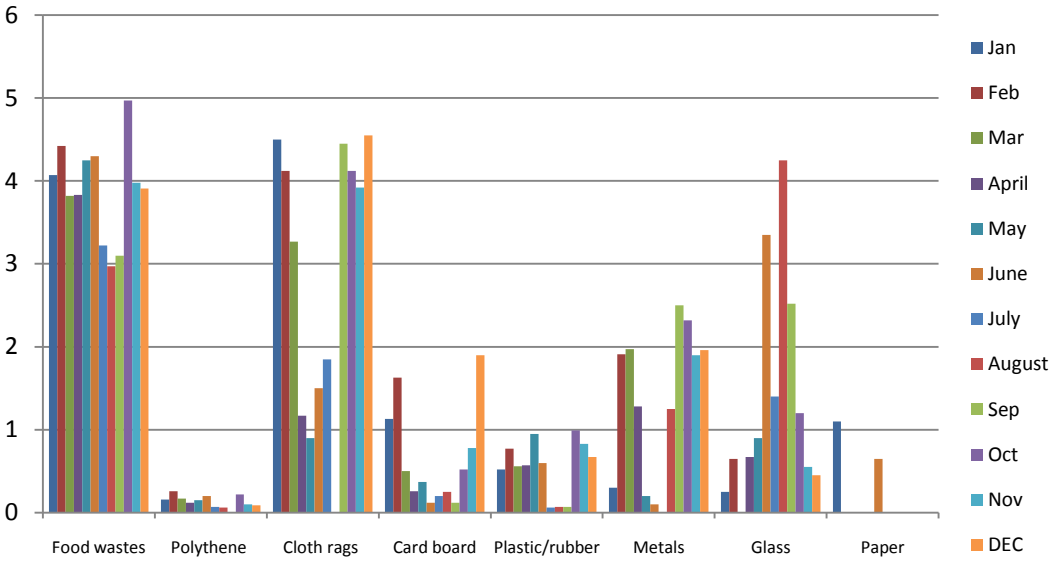

Figure 8 Average *variation in the net wt (kg/day) of constituents of solid waste generated in various months by households*

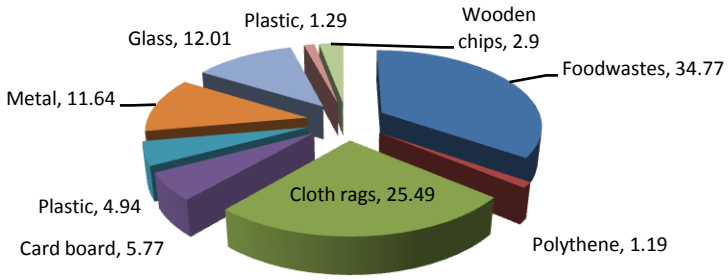

Figure 9 Average *net weight composition of solid waste generated in various months by households*

DISCUSSION

The quality and quantity of solid wastes in the area varies from summer to winter, this is because the tourist flow (both local as well as foreigner) flow decreases in the winter. The solid waste generated in human settlements within the lake and on the periphery of the lake is one of the contributory factors for the deterioration of the lake environment. Comparing the physical composition of 'Houseboat' and 'Household' solid waste, the amount of readily biodegradable food wastes was found predominant in both houseboat and household generated solid waste. The rest of the biodegradable and non biodegradable waste was significantly low showing almost same trend for both houseboats and households.This may be attributed to the people and tourists living in the houseboats and also to the preferences of the people to carry cooked rice, vegetable, fruits and also non vegetable items. These activities have been reported to contribute significantly to biodegradable wastes (Patil et al.,1985).

CONCLUSION

The present study revealed that MSW generated in Dal lake contains 70 % of recyclable waste, 25 % of compostable waste, very less amount (2%) of combustible waste, and 3% of other wastes. The main sources of solid wastes generation in Dal lake are, commercial and tourism. Tourism related activities contributes the most to solid wastes generation about 70%, and followed by commercial by about 30%. Based on analysis of secondary data collected from LAWDA office Srinagar, the average per capita solid waste generation within Dal lake was found to be 0.76 kg/person/day contributed by houseboats whereas households contributed about 0.44 kg/person/day. The average net weight generation (kg/person/day) was found maximum in the months of April to August by houseboats and May to August by households and minimum in the months of October to February by both. Secondary data analysis also revealed that food wastes were dominant constituting 34.5% (by houseboats) and 34.8% (by households) followed by cloth rags (20% by households and 25.5% by households).

RECOMMENDATIONS

Dal lake, a natural beautiful tourist resort is a natural home of an ample of living creatures, but increased population and tourist inflow could change whole scenario very soon. Because increasing population and growing tourist inflow could lead to generate more and more solid waste, as this place is not facilitated with modern gadgets to collect, transport, storage, treat and dispose solid wastes. In order to conserve and protect this treasure for future, the hands of Lake and Water Development Authority (LAWDA), SMC and civilized citizens, following suggestions should be taken into consideration:

- ✓ As the wastes generated within Dal lake were comprised mostly of recyclables and compostable items, therefore priority should be given to recycling and composting so that only a small portion of solid waste should reach to disposal facility.
- ✓ Separate waste bins should be provided for on spot segregation into compostable, combustible and recyclable wastes generated in Dal Lake area.
- ✓ Number of tourists visiting the lake should be restricted because more the number of tourists more wastes will be generated.
- ✓ LAWDA and SMC should maintain the temporary storage facilities in such a manner so that these places do not create unhygienic and unsanitary conditions in and around Dal lake. It is strongly advised to the Health Department officials to keenly look into this matter.

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