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COMMUNICATION IV

Analysis of Floating Refuse along the Gombak River

ABSTRAK

Data jenis-jenis dan berat sampah terapung di Sungai Gombak, dekat Jalan Sentul di Kuala Lumpur pada suatu jangka masa 6 bulan telah dikumpulkan. Berdasarkan sampel-sampel yang telah diambil, sampah dibahagikan kepada kategori-kategori yang berlainan, dan kadar berat serta ketumpatan purata pukalnya telah didapati. Kadaran terbesar berat (42%) sampah itu terdiri daripada tin-tin, kontena-kontena dan benda-benda lain-lain yang perbuat daripada logam. Ketumpatan purata pukal bagi sampah basah adalah lebih kurang 100 kg/m^3. Cadangan-cadangan juga diutarakan berkenaan dengan kaedah-kaedah yang sesuai, untuk mengumpul sampah terapung, dan membersihkan sungai-sungai di sekitar Bandaraya Kuala Lumpur, berdasarkan kepada ciri-ciri sampah dan penilaian dibuat terhadap kaedah-kaedah yang sedang diuji pada masa kini.

ABSTRACT

Data were collected on the types and weights of floating refuse along the Gombak River off Jalan Sentul in Kuala Lumpur over a period of 6 months. Based on the samples taken, the refuse was divided into different categories and their proportions by weight and average bulk density were estimated. It was found that the largest component by weight (42%) of the refuse consisted of cans, containers and other products made from metal. The average bulk density of the wet refuse was about 100 kg/m^3. Suggestions are also made with regards to the best methods to collect the floating refuse and to clean up the rivers in the Kuala Lumpur City area based on the characteristics of the waste and an assessment of the various methods being currently tested.

INTRODUCTION

The problem of river pollution and efforts to clean up have recently been given a lot of attention. One of the major causes of river pollution is the refuse thrown into the rivers by people and industries. According to a newspaper report (Malay Mail, 1986), as much as 55 m^3 of rubbish was collected in the Klang river daily by a newly installed mechanical "witch". More than $25 million (New Straits Time, 1985) was reported to have been allocated by the Federal and Selangor Governments between 1980 and 1983 to dredge riverbeds and clean rivers in this country.

As a first step towards solving the problem, a study was conducted on the Gombak river in Kuala Lumpur. The objectives of this study were to determine the characteristics and bulk density of floating refuse and to propose a solution for collection and disposal of the refuse. The study was done at the site where an experimental floating lock boom was installed by *Jabatan Parit dan Taliair* as part of the cleansing efforts on rivers flowing into the city. The floating lock boom was made from empty drums strung together across the river and anchored to both banks. The boom floats with the rise and fall of the water level *[Plate 1]*.

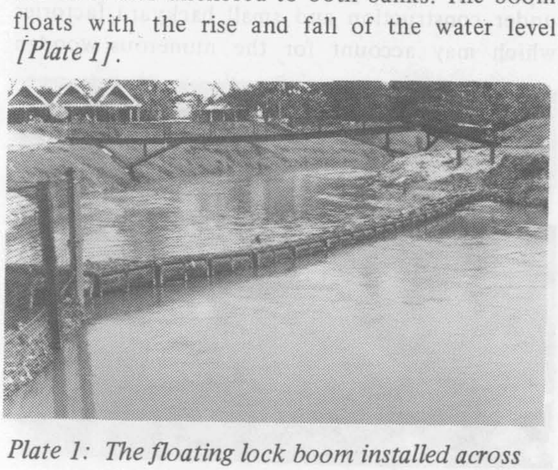

Plate 1: The floating lock boom installed across the Gombak River to trap floating garbage.

In addition to being an aesthetic problem the floating refuse also poses a potential health hazard especially to communities downstream which depend on the river for their daily chores. It may also contribute to floods due to the impediment of flow along the river course. This study looks at the types and characteristics of floating refuse that was trapped at the floating boom installed at the Gombak river. An assessment is also made to examine various methods currently employed to clean up rivers in the City areas.

MATERIALS AND METHODS

Data were collected over a period of 6 months from August 1986 to January 1987 at the site of the Gombak River off Jalan Sentul in Kuala Lumpur. The catchment area is about 122 km^2 with the maximum length of catchment at 23km and the maximum breadth being 8km. The source of the Gombak River is Gunung Bunga Buah in the Genting Highlands area. The topography consists of steep mountainous country rising to heights of 1220 m for about 60% of the catchment and the remainder is hilly undulating land.

Most of the mountainous areas are under virgin jungle while the hilly areas are mostly under rubber cultivation. The small low-lying areas are under padi cultivation and tin mining. All along the Gombak River upstream of the study site, there are numerous villages, squatter settlements, housing estates, high rise flats and some factories. A hike taken along the river bank revealed much rubbish along the river banks thrown from houses *[Plate 2]*. There were also some wooden houses under construction and small backyard factories which may account for the numerous wooden planks intercepted at the boom. At a few places, sewage from buildings and factories was discharged directly into the Gombak River.

Plate 2: Rubbish along the Gombak River Banks.

Floating refuse was trapped by a floating boom tied across the width of the river, which was built by *Jabatan Parit dan Taliair* Selangor on an experimental basis. The refuse was retrieved and collected by a team of workers from city Hall on a daily basis *[Plate 3]*. The refuse collected was then hauled away by a truck to a disposal site *[Plate 4]*. The capacity of the truck was about 10.8 m^3.

Plate 3: City hall workers collecting garbage trapped by the floating boom.

Plate 4: Garbage being loaded into trucks for disposal after sorting out the bottles, plastic, tins etc.

The refuse was weighed in a bamboo basket of 110,880 cm^3 capacity on a weighing balance with an accuracy up to 25 gm. The bulk density of the wet refuse was obtained from the weight and volume readings. All readings were taken on a wet weight basis. The refuse collected was divided into different types and their characteristics and proportions by weight were evaluated. A total of 12 sample readings were abstracted from the data for further analysis.

RESULTS AND DISCUSSION

In an attempt to characterize and classify the refuse. the following major categories were identified:

(i) Metal — tin cans, containers and other metallic products.

(ii) Glass — bottles etc.

(iii) Plastic — bottles and containers.

(iv) Household Refuse — household waste tied in plastic bags.

(v) Rubber — products made of rubber e.g. slippers, shoes etc.

(vi) Paper — cardboard boxes and containers.

(vii) Miscellaneous — includes polystyrene, rattan, cloth, tree branches and other materials not classified above.

The average bulk density of the refuse was found to be about 100 kg/m^3 with a standard deviation of 30. About 42% of the refuse was found to be from the metal category which formed the largest proportion by weight of constituents. Next came household refuse (18.6%) followed by plastic products (18.4%). The remainder consisted of glass (10.3%), miscellaneous items (4.3%), paper (4.0%) and rubber (2.5%) in decreasing order as shown in Table 1.

In addition to the above types of floating refuse, a large proportion of the material trapped by the floating boom consisted of pieces of wood, logs and tree branches of various sizes. During periods of heavy rain, large pieces of timber and

TABLE 1
Composition of floating refuse taken from Sungai Gombak, Kuala Lumpur.

CONSTITUENTS	% By Weight		
Constituents	Gombak River	Kuala Lumpur [1]	Petaling Jaya [2]
Metal	41.8	5	5.9
Household garbage	18.6	51 **	48.3
Plastic	18.4	8	9.4
Glass	10.3	3	4.0
Paper	4.0	28	23.6
Rubber	2.5	–	–
Miscellaneous	4.3	5 ***	8.8
Bulk Density (kg/m^3)	100 *	286	172

Notes: [1] Department of Environment's Survey, 1978
[2] Petaling Jaya Solid Waste Management Study Report 1985.
* Total of 12 samples analyzed and results based on wet weight basis
** Food waste (garbage)
*** Wood and Textiles

logs floated down the river. On average, a normal day's composition did not contain a significant amount of logs and owing to the difficulty in quantifying them, these were not included in the above categories of refuse.

It was observed that the weight of refuse that floated down the river and got trapped in the boom showed a positive correlation with velocity and discharge of the river. This is to be expected as heavy rain and the subsequent swift flowing waters would dislodge a log of the refuse that got trapped along the bottom and river banks. The amount of refuse including logs and tree branches that were collected daily varied from less than 1 truck load to a maximum of 3 truck-loads per day. This means that during rainy days, as much as 30 m^3 of refuse gets trapped in the boom daily.

It was found that the floating boom shown in *Plate 1* was not effective in trapping refuse during extremely low and high flows. Under these conditions a lot of refuse either got sucked under or flowed over the top of the boom. The floating boom also overturned and failed at one point during the investigation due to exceptionally heavy rain and the swollen state of the river. One of the reasons for its failure was inadequate slack provided at both ends of the boom resulting in it not being able to rise and fall with the water level.

In Malaysia, it has been estimated that the per capita waste generation rate is in the region of 0.5 kg/person/day (Pillay & Tan Hoo, 1985). Surveys were carried out by the Department of Environment (DOE) in major towns in Malaysia and some basic information on the quality and the characteristics of solid waste generated from domestic and commercial areas of urban centres are shown in Table 1. Comparing the characteristics of the samples of floating refuse collected and the results of the DOE survey, it is seen that the greatest difference was found in the categories of metal and paper. The greater percentage of paper collected from the DOE survey is probably attributable to the fact that the solid wastes were collected from commercial and industrial sources in addition to residential areas whereas the floating refuse was mainly from domestic sources. The large percentage of metal items collected (42%) from the Sungai Gombak compared with the solid wastes collected from Kuala Lumpur (5%) could simply be due to the fact that the people living along the Sungai Gombak are using the river as a convenient dumping ground for used tin cans, metal containers and other household junk. In addition the bulk density of the wet floating refuse was found to be much less than that of the municipal solid wastes taken from the DOE survey. It is expected because only the less dense materials would be carried down by the river while the heavier ones would sink to the bottom and remain there.

CONCLUSION

1. The present methods employed to clean up the rivers in the Kuala Lumpur city area includes floating booms, nets, a mechanical floating "witch" and thrash screens made of concrete and iron grilles to trap the refuse. All the above methods require the stationing of 1 to 4 persons to dispose the refuse that is collected. If appears that a fully mechanized and efficient collection system would be too uneconomical and difficult to implement and not likely to be able to handle the occasional huge logs and branches that float down the river. Any successful system would probably have to be a combination of human manpower, nets, booms and mechanical rakers in series in order to handle all the different types of refuse found.

2. On the whole, most of the floating refuse were from domestic wastes and a minimal amount of industrial/trade wastes were found. This suggests that efforts to clean up rivers would be futile without comprehensive public education campaigns and most importantly, the provision of adequate disposal and collection facilities for the solid wastes generated by squatters and those living along the river banks.

3. A comprehensive strategy and plan of action need to be formulated to clean up the rivers in the City area and to restore them to a reasonably clean condition so that they are environmentally and aesthetically pleasant enough to be used for recreation purposes by the public. If this is not done, it will not only result in an increased burden to the nation in the future but also in increased invisible costs

related to disease and other environmental problems.

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