



TYPES OF WASTE AND DISPOSAL METHODS: A STUDY BASED ON INDUSTRIES IN GAMPAHA DISTRICT

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ABSTRACT

The bulk of the industrial and service industry is concentrated in the Western Province of Sri Lanka. Moving toward a sustainable industrial activity requires an effective waste management that is applicable and efficient for all different types of industrial wastes. It is vital to study the different types of waste generated by industries, their method of disposal and treatment methods followed by industries in Gampaha District. Twenty industries were taken for the study. Primary data were taken from personal interviews with industries using a questionnaire. Results revealed that majority of the industries were producing textile (25%). 85% of industries produced solid waste followed by 50% produced chemical wastes. 65% of the industries dumped their waste into the village side. Very few (5%) industries disposed their waste in to the compost bin. Only 25% of industries followed regulations related to environment in a proper way. 50% of industries used chemical precipitation and landfill as treatment methods. And 20% of industries used composting. Chi square results revealed that a high significant association observed between the type of industry and liquid wastes produced by industry ($X^2=7.013$, $p < 0.01$). And a high significant association observed between the type of industry and dumping of waste in to the village side by industry ($X^2=15.918$, $p < 0.01$). It is highly recommended that the Local authority must instruct industries to make compost and biogas using their solid waste which is one of the major sources of water pollution in the study area

Key words: Industrial waste, treatment methods

INTRODUCTION

Industrialization plays a vital role in the development of any country and sometimes considered as the backbone of economic development. Industrial activities produce the products that are fundamental for human's survival. Moving to a greater emphasize suggests that industrial activities improve the human's lifestyle from rural to urbanization. However the deterioration of environment and natural resources are the consequences of many industrial activities (Gandhi *et al.*, 2006).

Industrial wastes include solid waste, semi solid waste, liquid waste and gaseous wastes in vessels that were not permitted to discharge into environment or could be classified as organic wastes and inorganic wastes. Managing waste can be challenging for industrial sectors as they are the major sources of pollutants in all environments and various levels of the pollutants are discharged into the environment either directly or indirectly (Glyn and Gary, 1996). For example, discharged effluents from industries have been found to be carcinogenic (Tamburline *et al.*, 2002) while other chemicals present are poisonous to humans and toxic to aquatic life (WHO,

2002). And wastes may contain bacteria or viruses harmful to human health. At the opposite extreme, chemical nutrients stimulate the growth of nuisance aquatic vegetation, and hasten the natural aging processes of lakes. Dissolved and suspended inert solids affect the turbidity of water and may congest the watercourse as they precipitate. Effluents from industries were found to alter the physical, chemical and biological nature of receiving water bodies (Kanu *et al.*, 2006)

The bulk of the industrial and service industry is concentrated in the Western Province of Sri Lanka. Gampaha district is in Western province and is one of the most populated districts in the country (Census and Statistics Department of Sri Lanka, 2015). In Gampaha District there are industries which cause water pollution directly and indirectly; Pugoda textile industries, McCallum beverage factory and other beverage factories, rubber latex factories, milk food industries, steel manufacturing factories, plywood factories, fertilizer manufacturing factories, petroleum refinery-Sapugaskandha, chemical industries (soap, detergents, and pharmaceuticals) and industries within the Biyagama Export Promotion Zone (Illeperuma, 2000). Industries (such as alkaline battery manufacturing and metal finishing, bleaching and dying, etc.) in Ekala, Ja elä area have been dumping their hazardous waste in marshy land causing severe environmental degradation of land and water (Hearath and Randeni, 2003).

The response by the government of Sri Lanka concerning the unsafe water and related health problem needs to be urgent and comprehensive. It needs to immediately address the problem at its source by effectively regulating, monitoring and reducing the use of toxic chemicals that enter the water system, rapid urbanization, industrial activities and intensive agricultural practices (Hettige *et al.*, 2014). Moving toward a sustainable industrial activity requires an effective waste management that is applicable and efficient for all different types of industrial wastes. It is vital to study the different types of waste generated by industries, their method of disposal and treatment methods followed by industries in the District.

METHODOLOGY

Gampaha District is located in the west of Sri Lanka. There were 6,417 industries registered under Central Environmental Authority under two different categories such as category A and Category B. This study was conducted in five Divisional Secretariat Divisions in Gampaha District which were Gampaha, Kelaniya, Biyagama, Negambo and Ja Ela. From this twenty industries were taken for the study. Primary data were taken from personal interviews with industries using a questionnaire. The collected data was analysed using the SPSS. Descriptive statistics, frequency distribution and chi square analysis were done.

RESULTS AND DISCUSSION

Information on industry

Among the respondents, majority of them were laborers (61.9%) and few of them were supervisors, technicians, owner, manager and other worker in the industry among 20 selected industries. According to the data analysis most of the industries were started in between 1990 - 2000 and from the 20 industries 14 were small scale industries and the 6 were large scale industries.

Table 1. Respondent role in the industry

Respondent	Percentage
Owner	4.8
Manager	4.8
Supervisor	9.5
Technician	9.5
Labourer	61.9
Other	4.8
(Multiple Response)	

Products and raw materials of Industries in Gampaha district**Table 2: Information about products and the raw materials used by the industries**

Product types	Percentage
Textiles	25
Beverage	5
Food	20
Leather	5
Steel manufacturing	0
Chemical products	15
Other	50
Source of Raw material	
From another industry	85
From village	30
Import	35
Other	5
(Multiple Response)	

The study results showed that majority of the industries were producing textile (25%) while 50% of the industries produce other types of products such as papers, books, cushion making, etc. in Gampaha District. About 85% of industries were getting raw material from another industry.

Table 3: Type of insurance schemes practiced by industries for employees (N=14)

Insurance	Percentage
Life	42.9
Accidental	35.7
Particular insurances for activities	50
Medical cover	42.9
Other	0
(Multiple Response)	

From 20 industries only 14 industries had insurance schemes for their employees. According to the results, majority of the industries have insurance schemes mainly for Life and Medical cover while 50% of them had insurance schemes for particular incidents and activities.

Types of wastes produced by the industries and the disposal methods

Table 4: Types of waste and method of disposal

Types of wastes produced by industry	Percentage
Solid wastes	85
Liquid wastes	45
Biological wastes	10
Gaseous wastes	15
Chemical wastes	50
Other	5
Methods of Disposal	
Into the village side	65
Into the compost bin	5
Into treatment process	25
Into cannels	50
Into safe place	30
Other	60

(Multiple Response)

According to survey result, 85% of industries produced solid waste followed by 50% produced chemical wastes. 65% of the industries dumped their waste into the village side. Very few (5%) industries disposed their waste in to the compost bin which is available in their industries but they also stated that they do not prefer to do composting as it takes more time.

Number of employees worked in industries

Result revealed that mean number of employees in the industries were 68 and from that 36 of them were male employees. In the large scale industries number of female employees were higher than the male employees. But in small scale industries in the study area number of male employees were higher.

Table 5: Possible causes of water pollution by industries in study area (N=18)

Disposal methods	Percentage
Dumping untreated solid waste	50
Dumping of untreated chemical waste	33.3
Open discharge of waste water	55.6
Other	11.1

(Multiple Response)

Most of them agreed that their industry might have caused water pollution and they accepted that the surrounding area of industry might also have polluted due to their wastes generation in the study area. Among them 55.6% of industries caused water pollution by open discharge of waste water which is a major source of water pollution than other factors.

Knowledge of employees on water pollution**Table 6: Negative impacts of industries to the community (N=19)**

Negative effects	Percentage
Effect on human health	79
Effect on animals	21
Effect on plants	26
Effects on environment	79
Other effects	11

Respondents agreed that due to their industrial activities there were negative impacts on human, animals, plants, environment and other components.

Method of waste treatment and precaution taken to prevent water pollution by the industries**Table7: Results on Regulations, Treatments and Prevention methods**

Constraints to follow regulations related to environment(N=15)	Percentage
No technician available	93
Lack of treatment equipment's	67
Cannot spend more money on treatment	20
Cannot spend too much time to care about environment	7
Not interests on environment	13
Other	7

Methods of waste treatment by the industry (N=10)

Aerobic treatment	0
Anaerobic treatment	0
Chemical precipitation	50
Biological treatment	0
Filtration	10
Composting	20
Incineration	30
Landfill	50
Recycling	20
Other	10

Prevention methods followed by industry

Reuse	55
Chlorination	50
Purification	45
Filtration the waste water	40
Regulations are followed to minimize	0
Other	15

(Multiple Response)

Result revealed that only 25% of industries followed regulations related to environment in a proper way and rest of them were not. Among them non availability of technician (93%) were the major constrains to follow regulations. But in Gampaha District 50% of industries used chemical precipitation and landfill as treatment methods which were popular than the other methods. The results also revealed that 20% of industries used composting which is a healthy sign of controlling pollution in better way.

But biological, aerobic and anaerobic treatments were not practiced by any industries in Gampaha District which is a common problem in most of the Asian Countries. For example None of the cities have any biological treatment process except Islamabad and Karachi, and even these cities treat only a small proportion (<8%) of their wastewater before disposal in Pakistan (Ghulam and Munir, 2012). Almost all industries followed prevention methods. Among them most of them used reuse of wastes, chlorination, purification and filtration methods as prevention methods for water pollution in the study area.

Table 8: Cost for treatments and prevention methods

Cost	Mean	Std. Deviation
Cost to treat the waste per month (Rs.)	3550	5614.596
Cost for prevention of water pollution per month (Rs.)	4150	4610.8

Industries were spending Rs. 3550.00 to treat the waste but average cost for prevention of water pollution was Rs.4150.00 per month.

Chi-square analysis

Table 9: Chi-Square analysis between type of industry and the selected variables

Variables	X^2	df	P value	Decision
Produce liquid waste	7.013	1	$P < 0.01$	Highly significant
Dump waste into the village side	15.918	1	$P < 0.01$	Highly significant

There was a high significant association observed between the type of industry and liquid wastes produced by industry ($X^2=7.013$, $p < 0.01$). And also there was high significant association observed between the type of industry and dumping of waste in to the village side by industry ($X^2=15.918$, $p < 0.01$).

CONCLUSION

A study was conducted to find out the different types of waste generated by industries, their method of disposal and treatment methods followed by industries in Gampaha District. It was found that 85% of industries produced solid waste followed by 50% produced chemical wastes. 65% of the industries dumped their waste into the village side. 50% of industries used chemical precipitation and landfill as treatment methods which were popular than the other methods. And 20% of industries used composting. But biological, aerobic and anaerobic treatments were not practiced by any industries. According to Chi-square analysis for the industries there was a high significant association observed between the type of industry and liquid wastes produced by industry. Similarly, there was also high significant association observed between the type of industry and dumping of waste openly into the study area by industry. It is highly recommended that the Local authority must instruct industries to make compost and biogas using their solid waste which is one of the major sources of water pollution in the study area.

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