

ENVIRONMENTAL IMPACT ASSESSMENT: A STUDY ON LIQUID WASTE MANAGEMENT IN ADDIS ABABA, ETHIOPIA

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ABSTRACT

With a rapidly expanding human population and a growing trend of industrial development, problems related to the management of liquid waste have become of considerable magnitude in Ethiopia. The problem is more severe in the capital city, Addis Ababa, where most of the urban population growth and industrial establishments of the country have been taking place. The process of urban growth in Ethiopia has come to be associated with tremendous socio-economic problems. Liquid waste problem is among the main areas of concern. This study was conducted so as to investigate this serious problem and find out the possible solutions. The required data were gathered through inspection of published and unpublished documents. The collected data were served to assess liquid waste management in Addis Ababa, and are used to illustrate key issues and concerns regarding problems under the study. The results of the study showed that the degree of liquid waste problem in the study area is so serious that it necessitates immediate measure to tackle the prevailing problems.

Keywords: Ethiopia, Urbanization, Population Growth, Liquid Waste

INTRODUCTION

The rapid increase in population has led to the establishment and expansion of urban centers. These will in turn accelerate pressure on the environment from time to time. Growth in population, industrialization and urbanization are the three main causes for environmental problems due to the introduction of undesirable materials into soils, water and air. Such changes in the characteristics of soil, water and air, may have a direct effects on the health of people or other living things. This condition of being impure or unclean is termed as polluted state and the process of producing this state known as pollution. The presence of these pollutants in water bodies, soil, and atmosphere will make the existence of life very difficult. Now days, Ethiopia is facing environmental crisis and it is becoming the most serious challenges of socio-economic development of the study area.

OBJECTIVES OF THE STUDY

In light of the above mentioned problems, the primary objective of the study is to assess the status of liquid waste in Addis Ababa. Its specific objectives are to:

- Analyze volume of wastewater discharged from different industries in Addis Ababa
- Assess temporal variations in liquid waste characteristics

RESEARCH QUESTIONS

1. To what extent do liquid wastes from industries in the study area result in water pollution?
2. How does liquid waste management trend look like?

REVIEW OF THE RELATED LITERATURE

Many studies show that urban areas of the third world predominantly lack basic municipal services such as water, sanitation, waste collection facilities, and storm drainage. More than one million people live in illegally or informally developed settlements, with little or no piped water, sanitation or other services (World Bank 2001; Potter and Lloyd-Evans 1998; WFP 2006).

Africa's urban revolution was different from that of the West, where urbanization is much older and occurred in a very specific context of both increased agricultural production and industrialization, in other words, parallel to economic development (Catherine 2005).

Although urban demographic growth is generally considered a positive force for economic development, very rapid urbanization can pose great challenges for urban economies, particularly with regard to environment and services (UN-HABITAT 2010). Rapid urbanization in developing countries poses great urban social, economic and environmental problems. Urban problems such as liquid waste management dominate the international development agenda of the 21st century. Up to the 1980s socio-economic problems was largely associated with the rural areas in developing countries; but the situation has changed with the dramatic increase in the number and proportion of the population living in urban areas. Irregular settlements also have become so pervasive that they seem to outnumber legally planned development, and their social legitimacy appears to be no longer in question. Unfortunately, the appalling urban environmental and social conditions associated with informal settlements constitute a major threat to the health and well-being of urban life (Nwaka 2005; Potsiou 2010).

These conditions are very severe in regions of sub-Saharan Africa where rapid urbanization is occurring within the context of economic stagnation or low economic growth, poor housing conditions, financially weak municipalities incapable of providing basic services, poor transportation system and the like. In addition to this, authorities are inefficient in meeting the service demands of urban residents particularly the urban poor (UN-Habitat 2010; CSA 2001; Harsch 2002).

Like other developing countries, many social, economic and environmental problems have accompanied urbanization in Ethiopia and have been ignored for too long. Urban areas are faced with problems of environmental quality problems (Girma 2004; Tegegne 2002).

DATA BASE AND METHODOLOGY**Location**

Addis Ababa is situated in the high plateaus of central Ethiopia in the North-South oriented mountain systems neighboring the Great Rift-Valley. It is located at latitude $09^{\circ} 02'$ and longitude $38^{\circ} 44'$. The stations in the relatively low altitude parts of the city, around Bole International airport is 2408 meters, while the elevation in Enxoxo Mountain, north of the city is more than 2444 meters. The city is overlooked by mount Yarer to the east having approximately the same height as mount Enxoxo and mount Woceca to the west, which is approximately 3361 ft above sea level. Not far from Addis Ababa there are a number of small crater lakes distributed in the east west direction, many of them around in Bushoftu about 40 Kilometers east of the city.

Level of Analysis

The administrative structure of Addis Ababa has three levels. These are the central city administration, sub-cities and Kebele. The city is divided into ten sub-cities and about 99 kebeles (lowest administrative unit in Ethiopia).

For the purpose of this study, the study area is classified in to two more or less distinctive morphological, demographic and functional zones, namely central and peripheral.

1. Central Addis Ababa incorporates Addis Ketema, Arada, Qirkos and Lideta sub cities
2. Peripheral Addis Ababa incorporates Akaki, Bole, Gullele, Kolfe Nefas Silk Lafto and Yeka.

Table 1. Sub Cities of Addis Ababa According to Population Size, Area and Density

Sub City		Population size	Area in km	Density
Central	Addis Ketema	271644	898	302
	Arada	225999	1156	196
	Lideta	214796	1240	173
	Qirkos	235441	1626	145
	Total	947880	4920	193
Peripheral	Kolfe Keraniyo	456219	6510	70
	Gullele	284865	3273	87
	Yeka	368418	8230	45
	Bole	328900	12093	27
	Akaki Qaliti	195273	12613	15
	Nefas Silk Lafto	335740	6510	52
	Total	1969415	49229	40

Source: Addis Ababa City Government, 2010

Data Source and Methods of Data Analysis

Data for this study was obtained from secondary sources. It relied on various published and unpublished sources which reveal the most current liquid waste management information for Addis Ababa. Addis Ababa City Municipality and Central Statistical Authority of Ethiopia (CSA) provided crucial information (mainly tabulated data) for this study. Secondary data for this study was also obtained from several published and unpublished literatures. The available data covered type of liquid wastes and disposal systems. Tables and percentages mutually with qualitative descriptions served as the main techniques of analyzing and presenting the collected data.

Population Growth of the Study Area

During the past century, the population of Addis Ababa increased significantly. The population of the city during 1935 was estimated to about 100,000. Within the span of less than a century the population of the city increased dramatically. According to the 2007 national population and housing census carried out by the Central Statistical Authority of Ethiopia, the size of the city's population was 2738248. Compared to the 1994 census, the 2007 population size has shown a 3.95% increase. This change had occurred due to not only natural increase and migration but also reclassification of area. It must be notified that the built up area size of Addis Ababa had increased from 13763 hectares in 1994 to 33,900 hectares in 2010(Addis Ababa City Government 2010).

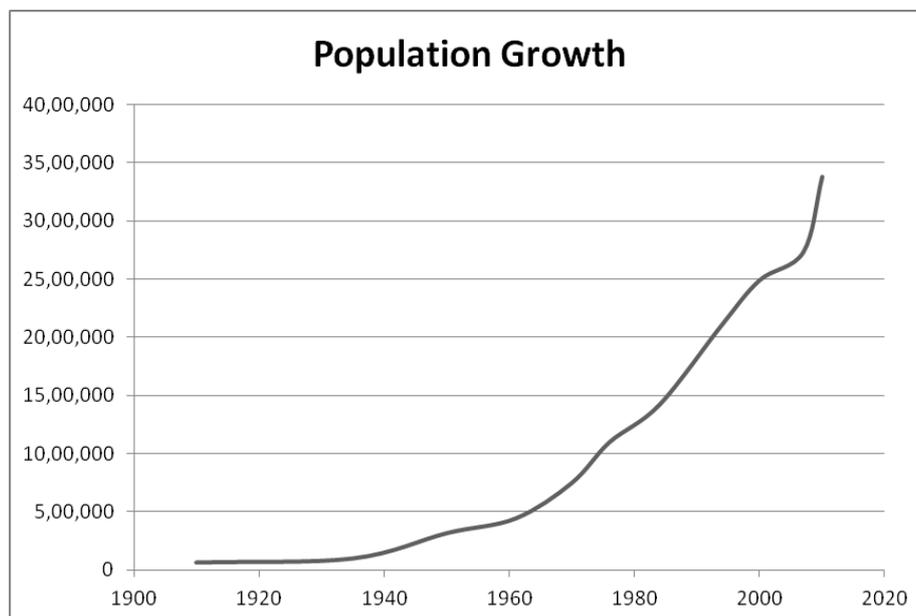


Figure 2. Population Growth of the Study Area (Source: Central Statistical Authority of Ethiopia, 2010)

The rapid growth of the urban population has accelerated the process of slum formation in Addis Ababa. The formation of slums in developing countries in general is largely influenced by the rate of city ward migration as well as by the rate of absorption and assimilation of migration that hold to their traditional attitudes and values. The city ward

migrations have given rise to the worst slum conditions in Addis Ababa. The congested areas of high gross residential density have very often more than 5071 persons per km² with attached houses built in an extremely haphazard manner without regard to lack of adequate liquid waste disposal facilities, sanitary toilets, inadequate surface drainage and open drains; this result in environmental degradation.

RESULTS AND DISCUSSIONS

As it can be observed from Table 2, the great proportion (40.9%) of the annual waste water was discharged from textile industries, followed by food and beverage industries constituting about 36.8 %. The proportion of waste water discharged from Leather and footwear industry forms about 11.2 %.

Table 2. Volume of wastewater discharged from different industries in Addis Ababa

Type of Industry	Quantity of Waste water(m ³ /year)	Percent
Iron and Steel	146,239	3.0
Non-ferrous metals	2,217	0.0
Food and Beverages	1,795,252	36.8
Paper and Printing	45,967	0.9
Petrochemicals	11,421	0.2
Rubber	205,746	4.2
Pharmaceuticals	50,089	1.0
soap and detergents	1,089	0.0
Tobacco	31,080	0.6
Textiles	1,992,597	40.9
Leather and Footwear	547,860	11.2
Wood	47,805	1.0
Total	4,877,362	100.0

Source: CSA, 2010

Table 3. Temporal Variations in Liquid Waste Characteristics

Indicators	Annual Trend				
	2005	2006	2007	2008	2009
Daily Liquid Waste generated in M ³ /day	136,893	136,027	149,392	155,013	161,668
Daily Liquid Waste Collection Capacity M ³ /day	10,000	10,000	10,000	10,000	10,000
Daily per capita liquid waste generated in M ³	88	88	88	88	88
Daily liquid waste treated in M ³	8,530	8,592	8,760	8,024	6,728

Source: CSA, 2010

As details are presented in Table 3, there is an increasing trend in the daily liquid waste generated over years under discussion. For instance, the daily liquid waste generated in 2005 was 136,893 m³ while that of 2007 was 149,392 m³. The figure was grown to 161,668 m³. Hence, one can guess that the total liquid waste generated in 2009 exceeds that of 2005 by 24775 m³.

However, the daily liquid waste collection capacity of the city was much lower than the total generated. Throughout the period under study, the capacity of the city's liquid waste collection capacity was 10,000 m³/ day, and the actual daily liquid waste treated was much lower in volume. Particularly, the gap between the volume of liquid waste generated and treated was much higher during years 2008 and 2009.

The degradation of river water quality becomes one of the major environmental problems that we are facing today. Because of most of the industries are directly discharging their waste into the water bodies near to them without any treatments and there is no law which prohibit them not to do so (EPA 2005).

CONCLUSIONS AND RECOMMENDATIONS

Inadequate municipal and industrial liquid waste collection and disposal creates a range of environmental problems in Addis Ababa. A considerable amount of waste ends up in open dumps or drainage system threatening environmental quality, and causing over flooding which provides a breeding ground for diseases - carrying pests. The daily liquid waste collection capacity of the city is much lower than the total generated. Throughout the period under study, the capacity of the city's liquid waste collection capacity was 10,000 m³/ day, and the actual daily liquid waste treated was much lower in volume. Particularly, the gap between the volume of liquid waste generated and treated was much higher during years 2008 and 2009.

Lack of the most basic liquid waste services in crowded, low-income neighbors is a major contributor to the high morbidity and mortality among the urban poor. The adverse effect of inadequate liquid waste service on productivity and economic development of the city expected to be significant. Hence, measures for the improvement of environmental quality are given below:

1. The involvement of private and non-governmental organization in the management of liquid wastes will improve environmental quality of the study area. Hence, their participation in environmental management should be given due attention.
2. In line with the internationally recognized liquid waste management hierarchy, the first priority should be given to waste minimization (reduction at source). It should be followed by recycling, treatment and disposal in order.
3. The study identified that the current liquid waste disposal system is not environmentally friendly and socially acceptable. Hence, environmentally feasible and socially acceptable waste disposal site should be identified and implemented.

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