MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM AND ENVIRONMENTAL IMPACTS IN IRAQ: A REVIEW PAPER

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ABSTRACT

According to country's war conditions, lack of efficient infrastructure and modern waste management system, municipal solid wastes became one of the significant sources of pollution and environmental issues in Iraq. That is estimated to produce 31,000 tons of solid waste every day in Iraq, that huge number will lead to cause public health problem and damage natural resources. Proper method management system should apply to reduce municipal solid waste production and get benefit through organized plan for reuse of material that can be recycled to other services to creating a sustainable and developed country. For achieving such goal proper municipal waste management strategy from collection, transporting, reusing, reduction, disposal and life cycle assessment are required. The study represents a brief history about waste management issues, that are facing us due to the rapid increasing amount of municipal solid wastes. Therefore, the study recommends to use methods of waste treatment such composting, recycling in order to reduce the amount of waste that are taken to the landfills. Also improve more environmental awareness by government, public and individuals by regular environmental train program and reduce land usage.

Highlights

Proper waste management strategy, Direct impact of war on environment, Non-hazardous waste

Keywords: Solid waste management, Municipal solid waste MSW, Recyclable materials, Environmental issues, Landfills

Cite this Article: Huseyin Gokcekus, Dr. Youssef Kassem, Saya Abdullah Saber and Ahmed Mohammed Ahmed, Municipal Solid Waste Management System and Environmental Impacts in Iraq: A Review Paper, *International Journal of Civil Engineering and Technology*, 11(7), 2020, pp. 106-113.

<https://iaeme.com/Home/issue/IJCIET?Volume=11&Issue=7>

1. INTRODUCTION

Due to population rise it is expected that there would also be a large growth in size of urban centers and individuals [1]. Solid waste has a significant part for different types of system in residential land usage [2]. When the waste is usable, it will become a by-product of a related consumer value [3]. Significant amount of solid waste is forming daily because of human activities (industrial, commercial, agricultural, fossil fuel, urban solid wastes, domestic, construction) and animals. Production of significant volume of solid waste in cities which is caused by improper landfill management it adversely affects the human health and environment. The most common municipal solid waste disposal system (MSW) is landfills. Understanding the form of waste is the first step in management and processing of disposal waste, it impacts treatment methods, waste density and recycling [4]. In war beside human losses it often has an significant negative impacts on the natural environment of a country [5]. At the beginning of the 19th century due to country's war conditions and lack of efficient modern waste management disposal infrastructure, solid waste became the main source of pollution and environmental issues [6]. Due to population development and economic growth, huge quantities of waste were produced after 2003 in Iraq [4]. it is estimated to produce 31,000 tons of solid waste daily in Iraq [7] . Around 10 pounds of hazardous waste per soldier were produced daily by the U.S military activities in Iraq. CENCTOM estimated around 22 burning pits were in Iraq. Environmental issues have been always a part of human conflict. The environmental program of United Nations has stated' 'armed conflict causes significant harm to the environment and to natural resources. People's health, livelihoods and security could be threaten by environmental collapse directly or indirectly get damaged' [8]. Level of pollution of the environment is rising more and more, due to the absence of different garbage collection and improper disposal of waste which contains toxic substances [9, 10, 11]. Municipal solid waste (MSW) is the most varied way it consist nearly all products used by human, recycling is a recovery of useful materials such as: metals, demolition material, plastic, paper, glass, fabric, leather and construction materials. (MSW) has four main methods of disposal: first materials recovery like plastic, paper and glass. Second energy recovery through the process of burning of organic materials; third is bioconversion which is under specific condition natural component of (MSW) may be aerobically oxidized: forth is unrecoverable content of landfills .the effect of recycling system depends on the active involvement of public separation of recyclable materials [12]. recycling has an important role to decrease volume of waste from landfill to reuse waste materials again, it is necessary to remove the waste since a successful separation of them in the beginning of the process allows encourage to the next step management, it requires various sorting and separating methods, some of them should be compacted to reduce the size, some can be treated and recyclable than some others that cannot be used ,separate metals, different forms of materials and light fragments. Aim of local waste management system organization that comes under an

authority of municipalities, is to introduce the most efficient program where some facilities would treat waste from such a wide region effectively. In Iraq regional waste management schemes have been poorly studied so far comparing to developed countries. Most researchers have focused on technical, theoretical issues such as the methods of waste disposal other than social and environmental impacts. All the aspects have great importance for protecting natural areas [13]. In this paper we are going to discuss all the main effects and programs that can be used for Iraqi regions in order to achieve a wider view of the management system and environmental issues that until now a day our population facing. The average national population growth that comes in the rate of 3.03% in Iraq [14]. that management system helps to reduce the waste volume ,besides the fact that waste storage landfill cover a wide area they can also contribute to the negative affects on the environment, climate, air and deteriorate quality of life of individuals and even affect animals and plant system [9]. Another issue we face is heavy metal contamination that is linked to human activities; it cannot be neglected because it can reach dangerous amounts for animals and plant, those metals such as chemicals, fertilizers, fossil fuel combustion and untreated waste [5].

2. LITERATURE REVIEW

2.1. Municipal Solid Waste Management

2.1.1. Genral History Approach

Technological approach about solid waste management during the later part of 19th century started to develop. Technology development continued such as garbage grinders, hydraulic collection system and compacting truck since the early of the 20th century. Later on by midcentury of 20th sanitary landfills were provided to eliminate the tradition of open disposal method. It becomes clear that inappropriate methods like open dumping were creating the negative affects and issues for public safety. Municipal solid waste has exceeded more than population growth now a day, due to lifestyles changing and development. Approximately 48 million tons of solid wastes in urban areas are getting produce daily [2] .Over the past 40-50 years, the mindset toward production and consumption in developed countries has taken place to get material resources and recycled energy from environmental pollutants [9]. Instruments have been created for the issue of solid waste, to reduce the impact on community and environment. The main goal of prevention is insuring better life for the product, demanding a reconsider of disposal practices linked to issues of environmental policy, growing population [9, 15].

2.1.2. Municipal Solid Waste Management in Iraq

Over the world, waste has been categorized into two different groups, hazardous and nonhazardous wastes. Municipal solid Waste (MSW) is a solid waste that include nonhazardous waste from population that needs treatment and transportation to disposal or landfill site, it also saw to contain waste from restaurants, workspace, universities and public facilities. Residential and industrial form of solid waste is plastic, paper, textiles, bottles and food wastes. Waste management varies widely for urban and rural areas, developed and developing countries. Garbage's waste is mostly containing decomposable dry material, while trash contains heavy objects that need to be properly stored and transported [16]. Iraq country has the population of more than 32 million. Waste management crisis has been worsened due to rapid population increase, economic development that is putting a large stress on Iraq's waste management infrastructure which already has been severely damaged, and safety concerns. First type of efficient waste management system in Iraq is sanitary landfill, with a volume of 1,000 tons of waste per day. For e.g., there is a sanitary landfill in village of Zindana, 18 km away from Kirkuk city in north Iraq. It started operation in 2008 and expected

to have to lifespan of 10 years based on the amount of waste produce per person per day, accept waste of markets origin and domestics [17]. another landfill site named Erbil Landfill site (ELS) , located on left side of Erbil-Mosul main road, it started to work in 2001, the site receives more than 2,000 tons of municipal solid waste every day [12].

2.1.3. Municipal Solid Waste Management Operations Strategy

The efficient solid waste management system shall include processed from at least four fractions related to generation, storage, collecting, transporting, processing and finally disposal of it, but in Iraq, unfortunately the process mostly reduced to just three steps from collection, transport and disposal, due to various reasons from lack of service, machinery and infrastructure[9,2]. Waste management strategies should contain the following processes:

1. Waste generation: contain all activities to identify a material that is no longer usable. There is no organized and efficiently planned segregation of solid waste management either by community level or household level.
2. Waste collection: involve activities of collection of wastes bins from house, public streets in the country to move them to communal bins, usually made of concrete. Industrial and commercial units can allow municipal authorities to move their waste to disposal site by charging certain amount.
3. Waste transportation: operation includes movements of waste in local sites to public waste disposal site by using large-scale transport vehicles such as trucks, hand rickshaw, trailers and dumpers.
4. Waste recycles/reuse: include practices for storage of goods that could be recycled and used again for new items.
5. Waste disposal: it is the last stem of the management process. It contains practice of organized removal of hazardous products from local sites such as landfills to energy and other facilities [18,19].

Components of (MSW) from the physical and chemical are important for proper handling, store and disposal treatment. If they contain high inorganic material it can be indicated to be recyclable solid waste, while if they contain high organic matter content it can demonstrates the ability to develop organic fertilizers [20]. It is hard to discover a waste management system to use for all types of waste generates in households. There are some different types of method, for e.g., biological methods that use living organism to treat organic waste. And there is physicochemical method of waste management system, focused on physical parameters such as strain, temperature in atmosphere without usage of living organism[21]. Gravity separation method it uses different in specific gravity various different minerals in wet process to achieve separation. It could work better due to different specific gravity of materials. Decision maker can review about Iraq's region to manage the situation of region in manner to prepare land usages in productive target, design an effective waste program model to capture the actual scenario of solid generation system [2].

2.2. Environmental Impacts Due to Wars and Municipal Solid Wastes

Iraq has high air pollution, due to amount of particulate matter which contain various components like dust, acid, organic chemicals as defined by Environmental Protection Agency (EPA) might cause health issues [8]. The 2003 military operations in Iraq had a direct environmental impact also long term effect on human health and community. Continuous intensive battle and trucks moving across roads put a massive stress on soil and collapsed it's internal frameworks. 92% of Iraq's land has faced danger of desertification. Oil Change International (OCI) estimates in 2008 that 141 million tons of carbon dioxide produced in the result of 2003's war. Climate has been exposed to a range of factors that still needs more study

and data [22, 23,24,25]. multicriteria analysis is widely used for case researches including optimal strategy for assessing environmental approaches to quantify energy used and waste produced to environment. Life cycle evaluation (LCA) to assess environmental improvement it contain four stages, first, identifying the target, second, energy and source inventory required for all phases of life of the product. Third, estimate actual and potential impact with use of resources and release to environment. Forth assess of change required to improve the environment [26, 27,28,29] .When wastes are transported to disposal or recycle or site, it can be seen air pollution occur around the place[30].

3. RESULT AND DISCUSSION

Municipal solid waste is a recognized as environmental and safety problem but it is also an economic opportunity for thousands of people who collect, reuse and recycle .the expected performance index for waste management has tremendous potential to recognize the need for on-site waste management systems and projects as expected Iraq faces severe environmental problems where the intended instability created by the occupation forces has led to the breakdown of all Iraqi state institutions, rendering them high environmental risks that continue to threaten the health, livelihoods and protection of the people [4,31] .Out of all human activities (fossil-fuel combustion, municipal solid waste, and forestry, industrial and commercial activities) large amounts of solid waste are generated daily [32]. People get to give more attention to the health of the environment 21st century [33]. Inefficiency manages generated lead disposal metal waste amounts in towns and functions as a pollutant as it affects the environment negatively and human welfare composition and amount of household waste has been calculated to vary from place to place [17] .The discrepancies are due to the disparity in consumer style, individual waste production, population density, and socioeconomic and cultural status while developed countries continue to expand economically, so doe's urbanization and the solid waste management problem [2]. Also, inefficiencies in environmental protection performance produced employees of the organization, corruption, lack of accountability and all other related barriers that prevented any successful steps taken to address the big environmental issues facing Iraq in the last two decades [12]. Today the citizens of Iraq and their society face a challenging situation, problems that require equity and an urgent solution some of those include: drinking water scarcity, deforestation, desertification and land degradation Air pollution harmful to safety like outbreaks of toxic particles [34]. The standard of evidence related to environmental risks in Iraq differs, as there is a lack of credible knowledge and some regions have been studied rather than others [22]. Iraq cities solid waste primarily includes what solid waste offers in homes, restaurants, stores, factories, and farms. And the accumulation of these wastes created a strong environmental issue that seemed to affect the streets and highways, as it distorted the picture of the beautiful [34]. Due to population growth and economic development, the reduction and recycling of household wastes are becoming imperative Although there is widespread public support for minimizing and recycling household waste, this is not reflected in participation rates in Iraq cites [35,36]. Future analysis predicts that the area will suffer from rising temperature and heat waves, also increasing water level in the north part of it, which would impact the southern part of Iraq [20]. Here's a big problem it is the lack of a complete infrastructure which makes waste management the most complex mechanisms therein. Until now, the current system hasn't had an assurance of conscience the carriage companies' responsibilities at the correct stage [37].

4. CONCLUSION AND PERSPECTIVE

The urban environment is enveloped by the forces of life change. Iraq's people and environment today face serious environmental problems needing immediate action and

resolution. The review reveals a convergence of concerns such as rapid population development, lack of efficient municipal solid waste management and inadequate waste management. Implementation of MSW differs greatly across countries and territories. Many of the management resources are either offered by local authority agencies or by private firms in the industry. It specifically points the need forward for a comprehensive policy structure for the control of solid waste in urban areas with regard to its share of residential land usage as a regional objective. Decrease in the effect of landfill tax on the overall expense of waste management services. The program shall be highly productive and successful in enforcing the required regulations and laws to facilitate the treatment of hazardous waste in compliance with international standards.

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