Scholar Publishing Group
Academic Journal of Environmental Biology
https://doi.org/10.38007/AJEB.2020.010405
ISSN 2789-8407 Vol. 1, Issue 4: 40-48

Environmental Biotechnology in Urban Landfills Based on Big Data of the Internet of Things

Bhimani Janki*

Autonomous Univ Morelos State UAEM, Cuernavaca 62209, Morelos, Mexico

**corresponding author*

Keywords: IoT Big Data, Environmental Biotechnology, Municipal Waste, Refuse Landfill

Abstract: The wide application of environmental biotechnology in various fields has created huge benefits for human beings. However, since the related environmental biotechnology has not kept up with the rapid improvement of biotechnology, how to improve the application of environmental biotechnology in urban landfills and realize the coordination of technological and technological improvement are the key issues to ensure the healthy improvement of biotechnology. The research purpose of this paper is the application of environmental biotechnology in urban landfills based on the Internet of Things big data background. In the experiment, a mathematical simulation in the form of horizontal pipe network recharge was adopted, taking the municipal solid waste in M City as the research object, sampling and analyzing the experimental garbage before the experimental landfill operation to obtain the component data of the experimental garbage sample. Mathematical simulation in the form of horizontal pipe network recharge. Investigate and analyze domestic waste treatment technology and bioreactor landfill technology.

1. Introduction

With the advent of the era of big data, community governance is facing unprecedented opportunities and challenges, which put forward higher requirements for the governing concepts and administrative methods of the grassroots party and government [1]. Community, as the "cell" of society, directly reflects the improvement of society. How to explore innovations in community governance and serve the "last mile" of the masses has become an unavoidable issue. Big data is an unprecedented tool and way of thinking. Big data can not only improve community governance and community service systems such as community government affairs, medical care, public security, and community public services, but also improve the efficiency of community governance and the quality of community services. Governance decisions are more intelligent, governance is more accurate, and community services are more refined, so as to continuously solve the diverse and

personalized needs of community residents. The use of big data technology to promote community governance is an era requirement for the country to keep pace with the times. Therefore, we need to respond to the call of the times and explore innovative paths and countermeasures for community governance based on big data to meet the needs of technological innovation and social improvement.

With the growth of urban population and the improvement of industrialization, municipal solid waste continues to increase.The aim of the Kulikowska D study was to determine how temperature conditions during wastewater treatment affect the distribution of organic heavy metals in humus. For this reason, copper, nickel, zinc, and iron were measured in the first two humic fractions, the humic acid and fulvic acid fractions. In the starting material, the fulvic acid groups are primarily responsible for binding all metals except nickel. The contents of Cu and Ni in the two compost series humic acids increased significantly under high temperature conditions. In the third series, however, this increase did not occur. In the first two series, the Zn content in HA almost doubled, but Zn was present in the humus. The content of Cu, Ni, and Zn in the stable humic material increased in all three chains, but the increase in two chains increased with increasing temperature. You want a distribution that is not affected by fertilization. These results may suggest that high temperature conditions during wastewater treatment should be beneficial to reduce the risk of heavy metal contamination [2]. Adelopo AO studied various types of composted waste from landfills to assess how to initiate a carbon production program. Use a one-step chemical activation procedure including microwave power saturation and KOH impregnation. For all sampling depths, the average activated carbon production from activated landfills was higher than that of closed landfills. Increasing the impregnation rate and electrical power reduces the average performance of each floor finish. The optimum pH value of methylene blue adsorption was 6-7, and the adsorption capacity increased with the increase of temperature. Carbonyl and hydroxyl groups are the main functional groups on the surface of activated carbon. The properties of activated carbon allow for excellent removal of pigments and cationic impurities. The current cycle produced by composting can be compared to cycles produced by other biomasses controlled by current power generation options. This is the first report showing the reuse of soil aggregates to produce activated carbon [3].Therefore, the application of environmental biotechnology in urban landfills needs to be studied.

Through the research background and significance, this paper expounds the related concepts and characteristics of big data, an overview of the Internet of Things, the concept of landfills, and the site characteristics of landfills. In the experiment, using the basic principle of bioreactor landfill technology, taking M City's municipal solid waste as the research object, sampling and analyzing the experimental garbage before the experimental landfill operation to obtain the component data of the experimental garbage sample. Mathematical simulation in the form of horizontal pipe network recharge. Investigate and analyze domestic waste treatment technology and bioreactor landfill technology.

2. Research on Environmental Biotechnology in Urban Landfills Based on Big Data of the Internet of Things

2.1. Research Background and Significance

On top of the great national rejuvenation that China's economic construction is vigorously advancing, the improvement of national infrastructure has effectively promoted urbanization [4]. In the process of improvement, urban diseases caused by the expansion of urban scale have begun to appear in many regions and provinces. One of the prominent symptoms is the problem of massive

garbage disposal. Although it is common to dispose of waste by means of landfills, the reconstruction and utilization of waste landfills is imminent under the background of economic construction and improvement in which the scale of cities continues to expand [5].

At present, the landfill treatment method in most cities in my country is still in its infancy, and the proportion of landfill that has truly achieved the goal of harmless treatment is relatively low in the annual output. In addition, some urban waste sanitary landfills invested and constructed in the early stage of some cities have gradually exposed some problems that need to be solved after the official operation. The existing garbage disposal level is low, and the phenomenon of "garbage siege" has long been not only a harsh reality that many cities need to face, but also a major practical problem that needs to be solved in time. The vision of realizing sustainable improvement in most cities in China is facing such a major realistic challenge. The related research on urban waste landfills not only has academic research significance in environmental geotechnical engineering, but also has practical significance in solving urban improvement problems [6].

2.2. Related Concepts and Characteristics of Big Data

Big data has brought a significant impact on all aspects of people's lives. Big data has continuously improved people's work efficiency, and at the same time, big data has changed the way we think about problems [7]. "Big data" is a product of the times and a new technological tool. Many scholars have explored and explained the connotation of big data, but have not come up with a unified definition [8].

Big data refers to datasets that are large in scale, rich in content, and rich in depth. Big data has three meanings, namely data itself, processing technology, and applied thinking. By observing the definition of big data by scholars from all walks of life, it is not difficult to find that the "big" of big data is generally accepted. The "bigness" of big data is not only reflected in the huge amount and variety of data, but more importantly, the big data brings a new world view. Different from traditional data, the core of big data is prediction, and the analysis of data in the era of big data is more about correlation than causality. Big data has the following four characteristics, namely Volume, Variety, Velocity, and Value [9].

2.3. Overview of IoT

The Internet of Things is also known as a network of connected things, which is a network composed of identified virtual subjects or objects. In the network, the identified information is filled in the functional space, and people communicate and communicate through smart ports [10]. The Internet of Things is now used worldwide and is given a standardized technology, so that any object has its own special code that makes it identifiable. Smart supervision can be achieved through all kinds of cutting-edge information technology data, thereby connecting all items with an invisible web. The Internet of Things technology is synchronous, intelligent, and information-based, and is a product of the era of rapid improvement of information technology [11].

2.4. The Concept of Landfill

Garbage is the solid waste produced by human beings in the process of survival and improvement [12]. Garbage in a general sense refers to discarded and useless solid materials, which are polluting to a certain extent, and some of which can be recycled and require harmless, reduction and resource treatment. Garbage can be regarded as a misplaced resource, and reasonable disposal

methods can make it play a social role again and reduce the pressure on the ecological environment. At present, the common waste disposal methods include simple landfill, harmless landfill, high-temperature composting and incineration, but no matter which treatment method, it will have adverse effects on the ecological environment and social environment to varying degrees. An important component of domestic waste is the waste produced by human beings in the process of survival and improvement [13]. Due to the fluidity and extensiveness of human social activities, the composition of domestic waste is complicated, including mixed components such as waste paper, fiber, ash, kitchen waste, and scrap metal. With the improvement of cities, the composition ratio of domestic waste will also change accordingly. At this stage, the improvement of FMCG-related industries has greatly increased the proportion of plastic and glass [14].

2.5. Site Characteristics of Landfills

Landfills are a special site type with unique site characteristics, mainly manifested in environmental characteristics. Landfills are often accompanied by damaged ecosystems [15]. The garbage heaps in the site are continuously fermented and degraded, and a large amount of leachate and landfill gas will be produced during the stabilization process of the heaps, which will cause pollution to the atmospheric environment, water environment, and soil environment. Among them, the problem of groundwater pollution is the most difficult to deal with., The main environmental characteristics of the domestic waste landfill after the closure are as follows:

First, the surface environment is uneven [16]. Under the influence of its own weight and internal and external force conduction, the internal landfill voids are further compressed, and the fine particles are pressed into the larger voids to play a filling role. In addition, during the stabilization process of the heap, the waste components will be fermented and degraded, which will also affect the volume of the heap [17]. Because the slope stability is greatly affected by the uneven settlement during the stabilization of the heap, the site safety is low. Second, a large amount of landfill gas is generated during the degradation of the garbage dump. Thirdly, leachate with complex composition will be produced when the garbage is degraded. Leachate is mainly high-concentration organic sewage produced by the fermentation reaction of garbage, rainwater washing, groundwater immersion, etc. during the stabilization process of the garbage heap or during the landfill operation. There are toxic and harmful substances with complex components in the landfill leachate. If not effectively controlled, it will overflow with rainwater and pollute the surface, groundwater, interior of the site and the surrounding soil environment. It is necessary to establish anti-seepage measures in the site to collect and process the leachate [18].

3. Investigation and Research of Environmental Biotechnology in Urban Landfills Based on Big Data of the Internet of Things

3.1. Basic Principles of Bioreactor Landfill Technology

Stabilization of waste in landfills is a complex and long process involving physical, chemical and biological reactions at the same time. It usually lasts for decades or even hundreds of years. During this period, due to the complexity of the composition and structure of the landfill waste, after the pollutants enter the landfill, a series of physical and chemical processes will occur in the waste-microbe-leachate-landfill gas micro-ecosystem. and biological reactions, such as adsorption, precipitation, complexation, biodegradation and other processes, to degrade and purify pollutants.

3.2. Subjects of Test Plan

The main collection sites for municipal solid waste in M City come from vegetable markets and living areas. Before the test landfill operation, the test garbage was sampled and analyzed, and the component data of the test garbage sample were obtained as shown in Table 1:

Table 1. Composition analysis table of test waste samples in Science City

Sample Ingredient	Textile	Plastics	Metal	Brick glass	Muck	Kitchen waste	Peel	Paper products
Scale	78.18	8.21	1.65	2.61	4.61	0.06	4.02	0.66

The composition of the domestic waste in the Science City used in this experiment is close to the domestic waste in the relatively improved large and medium-sized cities in my country. Therefore, it is reasonable and representative to choose the domestic waste in M city as the test object of the anaerobic bioreactor landfill technology.

3.3. Mathematical Simulation of the Movement of Recharge Leachate in the Landfill

This paper adopts the mathematical simulation in the form of horizontal pipe network recharge. In the formula, E is the horizontal pipe trench spacing m; h percolation hydraulic head m. Based on the perforation rate of the perforated pipe, the hydraulic pressure head and the hydraulic conductivity of the garbage, the specific formula is as follows:

$$E = 2h \tag{1}$$

Assuming that the properties of the landfill waste around the recharge pipeline are isotropic, in the formula, Y_{max} is the maximum infiltration height above the horizontal pipeline, X_{well} is the leachate reinjection rate, K is the average waste hydraulic conductivity The horizontal distance X_{max} is the maximum horizontal penetration distance of the recharge pipeline, and aa is the penetration distance on the plane where the recharge pipeline is located. The mathematical model of the leachate recharge pipeline is:

$$Y_{max} = \frac{q}{2_{\pi k}} \tag{2}$$

$$\frac{x}{y} = tan\left(\frac{2_{\pi k}}{q}\right) \tag{3}$$

$$X_{max} = \frac{q}{2k} \tag{4}$$

$$X_{well} = \frac{q}{4k} \tag{5}$$

4. Application and Analysis of Environmental Biotechnology in Urban Waste Landfill

4.1. Domestic Waste Treatment Technology

Modern sanitary landfills are fundamentally different from traditional landfills and fully comply

with current environmental protection requirements. Because of its safety and reliability, less investment, and low processing costs, it has been adopted by many countries in the world. The comparison of municipal solid waste treatment technologies in major industrialized countries It can be seen that the position of sanitary landfill in terms of waste treatment technologies in various countries is shown in Table 2 and Figure 1:

Table 2. National household waste treatment data sheet

Country	Dumping	Compost	Burn
A	96	0	11
B	85	10	50
C	74	5	43
D	63	11	31

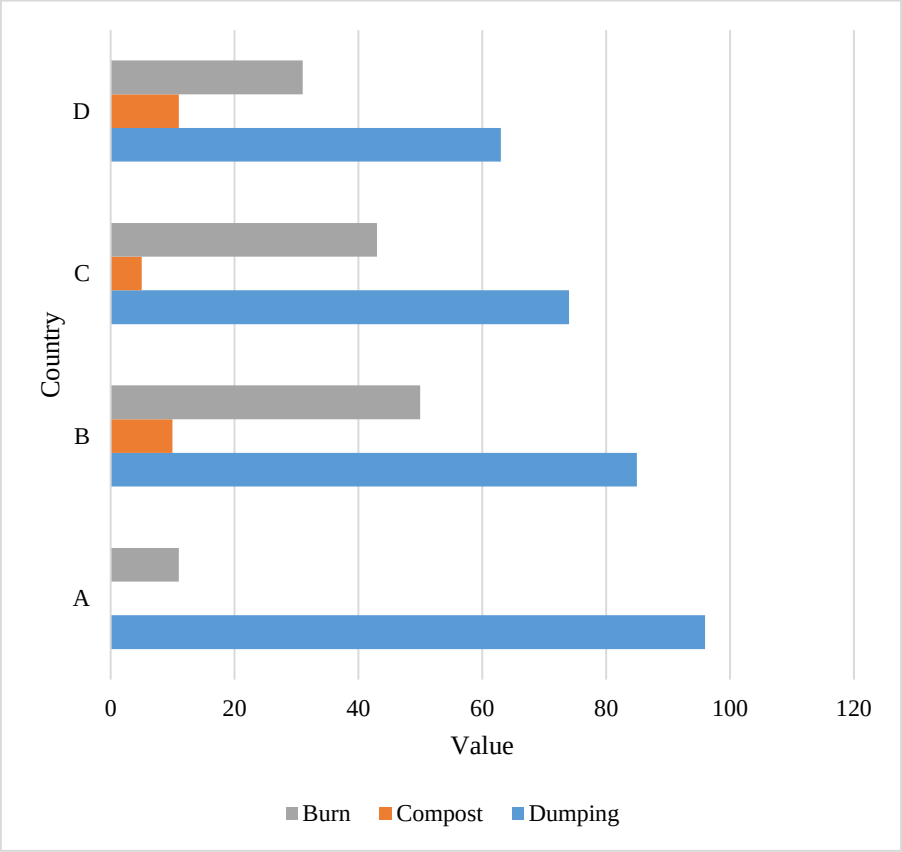

Figure 1. Improved countries of municipal solid waste treatment technology comparison of countries

4.2. Bioreactor Landfill Technology

In this paper, the anaerobic biological landfill technology for municipal solid waste is selected to explore the bioreactor landfill technology suitable for the treatment of domestic solid waste in large and medium cities in my country. Anaerobic bioreactor landfill technology has a high degree of

harmless treatment of garbage. The purification efficiency of some pollutants in the anaerobic bioreactor leachate is shown in Table 3 and Figure 2:

Table 3. The pollutant purification data table

Pollutant name	COD	BOD	Cu	Ni
Maximum concentration during the test (mg / 1)	156514.5	45411.6	132.5	95.6
Concentration at test end (mg / 1)	54118.6	18514.5	13.51	10.5
Purification efficiency (%)	66.5	14.6	13.5	5.4

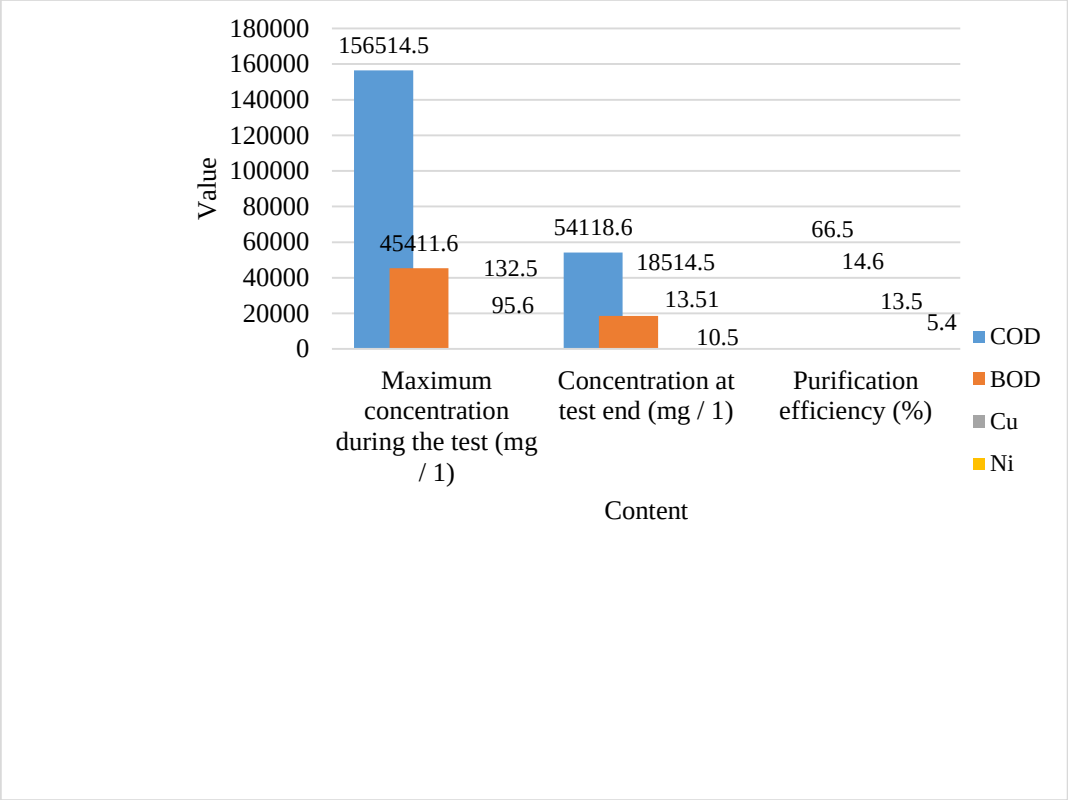

Figure 2. Purification efficiency of leachate recharge pollutants

The data show that the anaerobic bioreactor adopting the leachate horizontal recharge method has the same removal rate of organic matter and heavy metals in the leachate within the weekly reaction time. At the same time, the traditional anaerobic landfill technology does not reduce leachate pollutants. This proves that the MSW anaerobic bioreactor landfill can accelerate the biodegradation of organic waste inside the landfill. Concentration in effluent leachate.

5. Conclusion

The arrival of the era of big data has brought earth-shaking changes to the social life of the people. The popularization and application of big data theory and technology has promoted earth-shaking improvement and progress of social operation mode and industrial operation form. In the process of building an automated and intelligent "smart city", we should not only pay attention to the modernization of the social public service infrastructure system, but also innovatively

conduct feasibility studies on the application of advanced technologies in the new era to accelerate their transformation into real improvement. Both the research of environmental biotechnology and the types of organisms have improved rapidly, and environmental biotechnology has created huge economic benefits. In order to realize the effective value of environmental biotechnology and ensure the coordinated improvement of science and technology and the environment, we must strengthen the application of environmental biotechnology to urban landfills.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Mittal R D, George G P, Mishra J, et al. Role of Functional Polymorphisms of P53 and P73 Genes with the Risk of Prostate Cancer in a Case-Control Study from Northern India. Asian Journal of Microbiology, Biotechnology and Environmental Sciences, 2018, 20(4):1189-1194.

[2] Kulikowska D, Gusiatin Z M. Effect Of Temperature Conditions On Cu, Ni, Zn And Fe Complexation By Humic Substances During Sewage Sludge Composting. Environmental Engineering & Management Journal, 2019, 18(1):213-223. https://doi.org/10.30638/eemj.2019.021

[3] Adelopo A O, Haris P I, Alo B, et al. Conversion of landfill composite to activated carbon to improve landfill sustainability. Waste management & research, 2018, 36(8):708-718.

[4] Yamamoto K, Toya S, Sabidi S, et al. Diluted Luria-Bertani medium vs. sewage sludge as growth media: comparison of community structure and diversity in the culturable bacteria. Applied Microbiology and Biotechnology, 2020, 2020(1):1-12.

[5] Mnif I, Ellouz-Chaabouni S, Ghribi D. Glycolipid Biosurfactants, Main Classes, Functional Properties and Related Potential Applications in Environmental Biotechnology. Journal of Polymers and the Environment, 2018, 26(5):2192-2206.

[6] Michalak I. The application of seaweeds in environmental biotechnology. Advances in Botanical Research, 2020, 95(1):85-111. https://doi.org/10.1016/bs.abr.2019.11.006

[7] Tanveer T, Shaheen K, Parveen S, et al. Omics-Based Bioengineering in Environmental Biotechnology - ScienceDirect. Omics Technologies and Bio-Engineering, 2018(1):353-364.

[8] Speight J G, El-Gendy N S. Biotransformation in the Environment - ScienceDirect. Introduction to Petroleum Biotechnology, 2018(1):259-286.

[9] Silva A B, Costa M F, Duarte A C. Biotechnology advances for dealing with environmental pollution by micro(nano)plastics: Lessons on theory and practices. Current Opinion in Environmental Science & Health, 2018, 1(1):30-35. https://doi.org/10.1016/j.coesh.2017.10.005

[10] Dunn J B. Biofuel and bioproduct environmental sustainability analysis. Current Opinion in

Biotechnology, 2019, 57(1):88-93. https://doi.org/10.1016/j.copbio.2019.02.008

[11] Eskandari F, Shahnavaz B, Mashreghi M. Optimization of complete RB-5 azo dye decolorization using novel cold-adapted and mesophilic bacterial consortia. Journal of Environmental Management, 2019, 241(7):91-98.

[12] Sharma J, Shamim K, Dubey S K. Phosphatase mediated bioprecipitation of lead as pyromorphite by Achromobacter xylosoxidans. Journal of Environmental Management, 2018, 217(1):754-761.

[13] Guest J, Novak P, Wang A. Anaerobic technology. Environmental Science: Water Research & Technology, 2018, 4(11):1720-1720. https://doi.org/10.1039/C8EW90040J

[14] Tuomela M, Hatakka A. Oxidative Fungal Enzymes for Bioremediation ☆. Comprehensive Biotechnology (Third Edition), 2019, 6(1):224-239.

[15] Fulcher J. Great minds share insights into water research. World water & environmental engineering, 2018, 41(6):24-24.

[16] Pandiyan, Rajesh, Ayyaru, et al. Non-toxic properties of TiO2 and STiO2 nanocomposite PES ultrafiltration membranes for application in membrane-based environmental biotechnology. Ecotoxicology and Environmental Safety, 2018, 158(8):248-255.

[17] Vasenko L, Bonnemain-Fernandes A, Malwade C, et al. Phosphorus recovery from municipal wastewater via a two-step process of ozonation and crystallization: process development, optimization and upscaling. Environmental Science: Water Research & Technology, 2020, 6(3):817-828. https://doi.org/10.1039/C9EW00994A

[18] Akhtar N, Gupta K, Goyal D, et al. Lignocellulosic Biomass Characteristics For Bioenergy Application: An Overview. Environmental engineering and management journal, 2019, 18(2):367-383. https://doi.org/10.30638/eemj.2019.035