



Achieving Sustainable Development Goals by Wastewater Management: Review

Qahtan Adnan Ali ¹,

¹Department of Environment and Pollution Technologies Engineering, Kirkuk Technical College Engineering, Northern Technical University, Iraq

Ozdan Akram Ghareeb ^{2*}

²Department of Community Health Techniques, Kirkuk Technical Institute, Northern Technical University, Iraq
Email: ozdanakram@ntu.edu.iq

ABSTRACT

Today, the world aspires to reach sustainable development goals (SDGs) endorsed by the United Nations, and assessing the fundamental interest of modernistic technology in achieving the SDGs is very important for planners as well as stakeholders, which will permit them to defeat many of the problems and challenges we encounter in our world. In this study, the role of water sector management represented by wastewater in achieving the goals of sustainable development was clarified. An in-depth analysis of the goals and their interactions with each other reveals that wastewater treating can participate in implementing eleven of the seventeen sustainable development goals due to its capability to raise the amount of water available. We mention some examples of these goals: eradicating poverty and famine, clean water, promoting health, economic growth, waste recycling, clean energy, reducing the environmental impact of water sanitation and climate change, and others. We discussed the difficulties associated with implementing these goals, by proposing a series of indicators to evolve importance of wastewater treatment plants in SDGs. The current review article confirmed the considerable impact of wastewater treatment on achieving the internationally approved SDGs.

Keywords:

Wastewater, sustainable development, environmental impact

1. Introduction

Wastewater resulting mainly from the water of the liquefaction network supplied to residential areas after it has been used in many fields, whether municipal, agricultural or industrial, which contains contaminated components that make it unsuitable for most uses without treatment. When untreated sewage accumulates in septic tanks, the organic materials it contains decompose into undesirable products, including the production of harmful gases [1,2]. In general, untreated wastewater harbors many pathogenic microorganisms. In addition to the presence of some nutrients that can induce aquatic plants

growing, and sometimes contains toxic compounds that cause diseases, some of which may be carcinogenic [3,4]. Most estimates indicate that (80-90%) of wastewater in in third world countries is discharged directly without any treatment into rivers, lakes and seas, which cause many serious challenges for those countries, which impede their economic development and cause damage to the environment. For these reasons, the prompt and proper removal of wastewater from the sources in which it is formed, through treatment, reuse or safe final disposal in the environment, is essential to protect environmental health [5-7]. Wastewater

management to prevent the problems resulting from it requires adopting cost-effective and applicable methods in line with the goals of sustainable development. The uncontrolled and ill-conceived management of untreated sewage into natural water sources is correlated with serious impacts on humans and the environment. Perhaps the most important reason for the need for highly methodical technologies to stand up the required standards for water quality and management is the complexity and heterogeneity of the components of this polluted water [8,9]. It is worth noting that the United Nations International Organization has called for universal access to safe drinking water by 2030, through the declared global sustainable development goals (SDGs). However, efforts to achieve these goals are still slow in most countries [10].

It is known that the environment is constantly evolving and changing over the years as a result of the development carried out by humans, as urbanization and industrialization have contributed greatly to the negative impact on the environment. As a result, many issues and challenges have been raised, the management of which requires broad engagement. Due to the growing variety of collisions in contemporaneous environment, the trend towards sustainable development has become vital and indispensable [11]. It has become an important priority for countries to focus heavily on sustainable development, in addition to knowing and correcting any action or behavior that contribute badly to the environment. Many segments of society had an active participation in wastewater management issues, in line with the scarcity of resources [12].

It should be noted the effective role of waste treatment facilities resulting from the wastewater process in the circular economy and their ability to reuse water and recover energy through the economic supply chain [13]. Most of the studies interested on the effective role of wastewater treatment plants in achieving one of the goals of sustainable development, which is the sixth goal of clean water and sanitation, as well as on the

procedures applied to take the appropriate method for treating wastewater that can increase the contribution to achieving the sixth goal [14,15]. On the other hand, the topics of the impact of wastewater treatment plants on other sustainable development goals did not receive due attention. Scientific studies on wastewater management have many advantages, including achieving the goals of sustainable development and understanding the relationship between the various goals of sustainable development [16]. Therefore, this study presents a comprehensive evaluation of wastewater management and its role in achieving the various goals of sustainable development.

2. Wastewater treatment

It is well known that the application of an appropriate wastewater treatment method is necessary for water reuse as well as environmental recuperation. Especially since the abundant wastewater production is a source of environmental fear [17]. Initial procedure in wastewater handling is the removal of massive particles by pretreatment, and removal of large granules is usually an operant treatment step. The sifting process removes suspended contaminants such as leaves and plastics [18]. Wastewater primary treatment includes a sedimentation procedure that removes large unsettled matter. These particles are deposited in large tanks where they remain for several hours, allowing them to settle, and then removed from the sludge formed at the bottom. By employing microorganisms developing from the oxidation of organic pollutants, the process of removing organic matter from wastewater is carried out [19]. As a result of the nitrification and absorption procedures, secondary processing removes nutrients such as N_2 . The last, third stage involves the removal of remaining organic and inorganic materials, and then the treated wastewater is sterilized with chemical substances such as Cl or $NaClO$, or irradiation such as UV light before being released into the ecosystem [20, 21]. Recently, nanomaterial has been applied for wastewater treatment for its unique properties in terms of high surface area,

effective chemical performance, along with low energy consumption [22]. The low-efficiency adsorbents are coated with nanomaterial and the size and porosity are controlled, in order to maximize their efficiency in removing various contaminants [23].

3. Comparison of wastewater treatment methods

There are several different environmental, social, economic, and technical factors that are taken into consideration when applying the optimal wastewater management procedure. However, majority of the previous studies investigating wastewater treatment methods focused only on environmental aspects [24]. Therefore, choosing one of the methods suitable for a particular environmental area may not be appropriate for another. Sometimes, precision of comparing the results of different wastewater treatment methods may be limited to the available environmental data only without taking into consideration the economic and social factors. Still, deciding to implement the optimal wastewater treatment process based on the correct criteria is not easy. This may be due to the presence of diverse advantages correlating with the same wastewater treatment plants. Incorrect decisions lead to higher costs, lower processing efficiencies and potential environmental deterioration [25,26]. A multi-criteria decision-making method is proposed, which is based on comparing different alternatives to choose the most appropriate wastewater treatment approach. It is very important that the optimal selection method be verified based on the applicable sustainability indicators, which are on different categories such as water quality [27,28].

4. Sustainable development goals (SDGs)

Many challenges related to sustainable development require significant attention from

governments and relevant organizations. There is no doubt that the growing industrialization and urbanization that the world is witnessing has made focusing on sustainable development extremely necessary [29]. Sustainable development has the characteristic of being devoid of negative impact on society and the environment, so its goals can be defined as a road map to achieve more sustainability and a better future for all individuals in this world. In order to be competent to optimally apply SDGs, a deep and specialized investigation of the environment and society concerned must be conducted [30,31]. In general, each region is exposed to a special set of issues and challenges that differ from others, and therefore the approach taken to achieve the goals of sustainable development may differ in each case. It can be said that the sustainable development goals are the goals set at the global level for sustainable and equitable development at all levels. The broader goal of sustainable development is to save and protect the planet, both now and in the future. Sustainable development approaches influence individuals to establish healthy behavior for the benefit of societies as a whole [32]. Accordingly, if the governments of the countries take the right approach to sustainable development, all individuals may get the benefit and thus the society in all its segments can be protected. To be able to implement sustainable development, we must be committed to social progress while caring for economic growth and environmental balance at the same time [33]. Achieving the goals of sustainable development requires educating the community, promoting voluntary work, and empowering change makers. It is worth noting that in 2015 the United Nations General Assembly established SDGs, a set of 17 interrelated goals (Figure 1) designed as a proposal for a better future for all [34].



Figure 1: Sustainable Development Goals [35].

It is expected that all of these specific targets will be completed by 2030 through an assessment of the validity of the results and associated extracts. The decision focuses on specific objectives, and each objective has indicators that are applied to estimate progress. Although most of these goals are set to be achieved with 2030, some of goals are not subject to a deadline. Therefore, to ensure monitoring, several equipment and techniques have been introduced to aid and supports tracking of proceed toward goals [36].

5. Wastewater and SDGs achieving

Natural water resources can be considered the most important resource for development activities in general. However, urbanization, industrialization, and overpopulation have led to overuse of water resources, which has made the resource more scarce and polluted [37]. On the other hand, anthropogenic climate changes such as precipitation patterns an additional threat [38]. Recycled wastewater is utilized for many aims and has the possibility to provide countless avails to communities in diverse ways. Wastewater is used for other non-potable uses such as industry and irrigation, after treatment. In terms of sustainable development, wastewater can be used in several ways such as making it safe for human consumption and improving wastewater treatment plants to support the SDGs. It is necessary to make progress in wastewater management to improve associated outcomes [39]. Sixth goal of SDGs is directly related to the provision of clean water and the treatment of wastewater in a manner that ensures that it is managed sustainably, leading to a significant

benefit at the global level l, especially in improving the quality of life and social and economic development. From the above, it can be said that trying to make optimal use of wastewater can be considered as very important. By reducing the amount of untreated wastewater while promoting its safe reuse and recycling, improved water quality is achieved [40,41]. Otherwise, clean water will not be sufficiently available in the long run if wastewater is not gathered, processed, reused and disposed appropriately. Today every country needs to recycle wastewater and use it in the best way prospective via every mean, as wastewater management affects the other sixteen sustainable development goals. The main role of wastewater sector management comes from its ability to provide clean water for various uses [42].

6. Wastewater treatment and SDG 6

Proper wastewater treatment and safe reuse are prerequisites for achieving goal 6 by 2030. Wastewater that is safely treated and reused becomes a new source of water that can be provided to a growing population. Reuse of potable water is even more important during droughts [43]. Clean water and sanitation goal has six targets revolve around human and environmental scales. These targets explicitly include drinking water, sanitation and hygiene targets, in addition to beneficent water quality by reducing pollution as well as untreated wastewater as adapted from UN & WHO (2016) . The fourth target includes significantly increasing the efficiency of water use in all sectors in order to ensure the withdrawal and

sustainable supply of fresh water. The fifth target revolves around the integrated management of water resources at all levels ,

and finally protects water-related ecosystems [39,44], as shown in Figure (2) .



Figure 2: Framework and targets of SDG 6 [45] .

7. Relationship of clean water and sanitation with other SDGs

More generally, the ways in which goal 6 addresses ecosystems, and the achievement of other SDGs, makes goal 6 of paramount importance going forward. Goal 6 was developed to ensure clean water, safe disposal of wastewater and sustainable management for all by 2030 [46]. Figure 2 shows that clean

water and sanitation is a core requisite goal for sustainable development, as SDG 6 dominates the top 10 pairings globally in terms of synergies. Besides, it is a means of developing and maintaining the natural processes of the inner circle of SDGs (2, 3, 7-9, 11-15). In contrast, for the outer circle (1, 5, 4, 10, 16, and 17) its availability represents an enabler for SD and human well-being[47].



Figure 3: Relationship of goal 6 with other SDGs [47] .

It is well known that water is a crucial component of human life, so it is important to have clean and sustainable water, and with continuous improvements in wastewater treatment and reuse, the treatment plants, in turn, employ many people to work contributing to reducing the number of unemployed [48]. Moreover, wastewater treatment plants can produce high-quality compost at low prices, especially for landowners and small farms, leading to higher incomes. Clean water is essential to eliminate hunger, being part of a healthy diet. Wastewater treatment allows for a sufficient supply of water, which can be used to satisfy hunger and other personal needs [49]. Due to advances in technology in recent times, the operation of reusing and recycling treated wastewater is becoming more effective while achieving the desirable results in a more effective manner. If wastewater is well managed and used in an optimal way through reuse and recycling, it can increase and help grow food. Once this happens, the goal of Zero Hunger can be achieved [50,51]. Undoubtedly, there are many health-related issues that caused by wastewater. Therefore, there is an urgent need to manage them in an effective way to reduce the risk of potential infectious diseases. It has been observed that rural areas are affected more than urban areas by the harmful health consequences, due to the deterioration of wastewater management and treatment in rural areas [52]. Today, sanitation systems inevitably contribute to the prevention of infection, however clean water and sanitation are an important part of water management [53]. Sludge from various wastewaters is usually treated by thermal cracking to destroy organic matter into minimal that are used to produce biogas for combustion or as fuel cells to produce electricity. It should be noted that organic fertilizers are produced from this biogas and are used for agricultural purposes. The dumping of polluting toxic waste into waterways and the creation of large quantities of highly polluted wastewater from industries along with domestic sewage contribute to a significant decrease in the availability of fresh water on the planet [54,55]. It is better to

recycle part of the waste water and treat it chemically for use in the development of cheap and environmentally friendly energy. Due to the importance of wastewater treatment, the fresh water consumption of rivers and lakes can be reduced in the development of renewable energy. Its exploitation in the renewable energy sector can significantly reduce pollution while ensuring environmental safety for humans and animals alike [56]. Recycled wastewater can make the oceans and seas lifeless. By treating wastewater, substances that are toxic to underwater life can be filtered out and rendered harmless. Finally, poor management of wastewater has reduced soil quality, affecting forest growth and vegetation. Therefore, water and land resources must be planned and managed, and polluted water discharge should be reduced [57,58].

8. Conclusions

Ongoing discussions on the collaboration of wastewater treatment to the SDGs are needed to assist decision makers and those interested in sustainable development issues, as it contributes squarely or in squarely to achieving all the goals of sustainable development. The integrated system will support and promote the achievement of Goal 6 as well as the other SDGs. Among the most relevant SDGs are: eliminating hunger by providing the patency of water that can be used for agriculture, being healthy by beneficent water quality and availability of clean water, clean energy, improving water recycling, biogas production, living underwater by reducing waste water discharge. Water scarcity must be dealt with comprehensively, all alternatives for water supply must be considered and the magnitude of this objective must be brought to the interest of relevant organizations.

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