International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 4 ǁ 2022 ǁ PP. 71-73

A Review Paper on Carbon Footprint Analysis for Water and Wastewater Treatment

Ayushi Desai[1], DR. Reshma Patel[2]
[1]*M.Tech, Environmental engineering, Birla Vishwakarma Mahavidyalaya, 388120, Vallabh Vidyanagar, Gujarat, India*
[2]*Associate Professor, Civil Engineering DepartmentBirla Vishwakarma Mahavidyalaya, 388120, Vallabh Vidyanagar, Gujarat, India*

Abstract*—Wastewater Treatment Plants for preventing the natural water bodies and living spices including Humans health from negative impression by pursuit of human being play a major role in current urban water cycle of urbanization of world. However, there is a negative effect from wastewater treatment plant CETP, ETP, STP as the discharge of effluent and indirect and direct emissions resulting from energy generation or chemical production. Carbon Footprints have been used as a key or one of the major way to track human impact on the environment and environment bodies and other species than human through different areas for evaluating the sustainability of WWTPs from the Wastewater treatment operations, the greenhouse gas emissions contributions are significant at 30 – 35%. The main greenhouse gases emission from CETP/ETP/STP that contribute Carbon Footprint are Carbon Dioxide, Nitrous Oxide, and Methane. As a result of awareness and technology to understand greenhouse gas emissions from various source and specific to the various CETP Plants for Decades; there has been a strong interest in mitigating greenhouse gas emissions from CETP, STP, & ETP Plants.*

Keywords: *Greenhouse Gas, Wastewater treatment plants, CETP, STP, ETP, Carbon Dioxide, Nitrous Oxide, Methane, Carbon footprint, Emissions, Life Cycle Assessment.*

Date of Submission: 10-04-2022 Date of acceptance: 26-04-2022

I. INTRODUCTION

Due to the increasing quantity of industrial and domestic wastewater, many of these pollutants have been released into the environment. However, since treatment plants are designed to remove these harmful substances, they are also responsible for various environmental issues. Water resource recovery facilities commonly release greenhouse gases which has adverse effect to environment. Some of these include CH_4, CO_2, and N2O. The International bodies and countries on climate change has established emission factors to provide quantification guidelines for estimated Greenhouse gases emissions in Wastewater treatment plants.

Over the years, several approaches have been described to understand Greenhouse gas production processes quantify and measure emissions and predict and control their production. Direct emissions from various treatment plants are primarily related to conventional processes, and indirect emissions are correlate with electricity consumption of their treatment plants based on their capacity. The reduction of carbon footprint is worldwide concern for global warming mitigation strategies. Common Effluent Treatment plants is a heart of various industry and community/governing people to ensure and maintain the habitation of aquatic bodies and aquatic life. Greenhouse gas emissions become the key factor when evaluating performance of various treatment plants.

II. LITERAURE REVIEW

The implication of sustainability and human well-being has been investigated from different perspectives of carbon footprints. As in the wastewater treatment field, researches mainly focus on the evaluating and categorization based on impact of the wastewater treatment plants environmental impacts. In this section, the definition and development of the Carbon footprint are elaborated upon investigating previous studies about footprint assessments for wastewater treatment plants.

2.1 Carbon Footprint:

2.1.1 The Definition of Carbon Footprint:

The Carbon Footprint was initially proposed by the goal of quantifying CO_2 emissions, and has received much attention, as it is easy to explain public. Most literature tends to use CO_2 equivalent as the Carbon Footprint, which is defined as Direct and Indirect Greenhouse gas Emissions caused by Human

Activities. The total amount of Direct and Indirect Greenhouse gas emissions released by products/services at defined time prospect was derived by converting various Greenhouse gases into CO2 equivalence. It is worthless to assess life cycle with the implementation of the life cycle assessment method, the Carbon Footprint can help stakeholders understand the extent of global warming potential and improve techniques by detecting emissions hotpots.

2.1.2 The Application of the Carbon Footprint in Wastewater Treatment Plant:

Carbon Footprint has been undertake for assessing greenhouse gas emissions of various processes in wastewater treatment. The Properly designed and optimized operation could reduce Carbon Footprint in Wastewater Treatment plants. Emission factors are strongly influenced CO_2-eq balance in keeping with the benchmark study in one of the European Country Named Austria. Broaden the system boundary which analyzed centralized and decentralized wastewater treatment plants with transmission systems. The results give a perspective that the sewerage networks of community contributed more greenhouse gas emissions other than the open Drains/Nallah/Canal, and biogas (Methane Gas Majorly) recovery process considerably reduced footprints. The Decentralized wastewater treatment have high effluent standards hence they have large quantitative footprints toward environment.

Carbon Footprint assessment could be a systematic tool to evaluate exact process in Wastewater treatment plants to optimize the resource management and GHG emissions. The Carbon Footprints of various conventional and modern treatment systems (Anaerobic, Anoxic- Oxic, SBR, UASB and Oxygen Ditch/Ponds) were examined, and also the results show that direct emissions of CO_2 and N_2O, and indirect emissions from electricity consumption take up the majority of the entire Carbon Footprint. More CO_2 and N_2O emissions from aerobic process compared to the anaerobic process larger that's why anaerobic treatment should be more recommended. The results established that the majority of power consumption and GHG emissions of sludge treatment system was from the operation of digesters, the separation of sludge and water, and sludge drying in drum dryers.

Increasing biogas production and usage, and decreasing addition of external fossil Carbon sources for Denitrification could decrease the Carbon Footprint of a wastewater treatment plants. In large scale Wastewater Treatment Plants, Fugitive emissions share 74% of the entire Carbon Footprints, but the proportion was only 0.05% for the micro, small treatment plant. Amongst these Wastewater treatment plants, direct greenhouse gas emissions accounted for big proportion of the Carbon Footprint. Additionally, found that power consumption and direct greenhouse gas emissions were deem because the major source of the carbon footprint.

2.1.3 The Current Use of Life Cycle Assessment Applications to Wastewater Treatment Plants:

As numerous Life Cycle Assessment Studies Investigate the total environment impacts and potential outcomes from an entire wastewater treatment system cycle, a small number of examine the related environmental influences, in particularly with the reference to Greenhouse gas emissions from various treatment plants.

When consider Greenhouse gas emissions from Wastewater Treatment plants, the greater part of Life Cycle Assessment studies focus on: 1) CO_2 emissions originate from energy Consumption; and 2) CH_4 emissions originate from sludge treatment.

III. Outlook

A no. of studies has complete efforts and contributes to the use of carbon footprint to develop the design and management strategy of sewage systems, although these assessments are essentially one-perspective Life Cycle Assessment. But, in attendance some challenge in the performance of a carbon footprint assessment, in addition to the general approach is not the only appliance use for carbon footprint. In this part, Challenges of Carbon Footprints in Effluent treatment plants are planned.

3.1 Challenges in adding, other challenges are describe in this part:

3.1.1 Introduction of tools for Improvement:

Raw evaluation method based on process-based on model is simple to carry out and recognize, but these method contain high insecurity and might be incompatible with actuality. In compare, practitioners contain paid less attention to the change of Carbon Footprint assessments. The challenge here is to merge with other tools with Carbon footprint Assessments and improve the toughness and accurateness of the outcome.

3.1.2 Discover of System Variant:

The System Differences have study in various paper, and the difference direct to different outcome. But comparison of these studies is under various variables, and thus can only give qualitative outcome. For Example, Compare Carbon Footprint of seven Wastewater Treatment Plants with different influent quality, scales, techniques, supply chains and management strategy. In addition, Effluent Treatment Plants are vibrant system; the environmental impact of a single Wastewater Treatment Plants can also differ from season to

operation stage. So, more study in this way is necessary, because a sound conclusion of system difference would give to stakeholders with a new option for design and organization of Wastewater Treatment Plants.

3.1.3 Make Use of New Footprints:

There are many studies implement on footprint assessment in Wastewater Treatment plants, without the Carbon Footprint. The Carbon Footprint Evaluation tend as they are correlated to water source appropriation and climate change, correspondingly. In fact, not all footprints are appropriate to review on Wastewater Treatment Plants. However, a Footprint such as Nitrogen Footprint, Phosphorus Footprint is useful to depict the sustainability of Treatment Plants. While the Nitrogen Footprint, Phosphorus Footprint are extensively using on huge scales, one dispute is to change the assessment Framework to adjust in the Wastewater Treatment Plant Standard.

IV. Conclusion

Wastewater Treatment Plant is difficult operational process that contains transportation, treatment, and resources consumption. Bigger Wastewater Treatment Plants with anaerobic digestion and utilize heat and power generation system can generate significant amounts of electricity and reduce the greenhouse gas emissions. The Worldwide anthropogenic greenhouse gas contribution from the Waste and Wastewater category is 2.8% of the entire greenhouse gas emissions. Also, the researchers found that the Life Cycle Assessment is that the Basic framework to implement Carbon Footprint Assessment.

Additionally, the result of electricity consumption is that the major contributor within the wastewater treatment plants while N_2O serge a majority within the direct Carbon Footprint. In short, Carbon Footprint assessment study for wastewater treatment plants continues to be at the initial stage and wishes further exploration and improvement, like introduce new tools, explore system variant under a variety of scenarios, and combine other footprints.

Regarding the performance of a wastewater treatment plants, four aims must be considered and balanced strategy: (1) Mitigate the pollutants discharge including GHG; (2) Ensure quality and quantity of raw influent; (3) Channelized the Financial scope for the Lifetime of a Wastewater Treatment Plants; and (4) Minimize the Worldwide Environmental impact. Evaluating strategies could be a difficult task regarding the amount of parameters and variables which will affect the results at different levels.

REFERENCE

[1]. Ke-Hua Chen, Hong-Chengwang, 'the application of footprints for assessing the sustainability of wastewater treatment plants: A review', Journal of Cleaner Production 277 (2020).
[2]. Giorgio Mannina, George Ekama, 'Greenhouse gases from wastewater treatment – A review of modeling tools', Science of the Total Environment 551-552 (2016).
[3]. T.K.L Nguyen, H.H.NGO, 'A critical review on Life Cycle Assessment and plant-wide models towards emission control strategies for greenhouse gas from wastewater treatment plants', Journal of Environmental Management 264 (2020).
[4]. William F. Ritter, S.Rao Chitikela, 'Greenhouse Gas Emissions from Wastewater Treatment Plants and By-product Operations – A Comprehensive Review', World Environmental and Water Resources Congress (2014).
[5]. Daniel Valenzuela-Heredia, Ángeles Val del Río, 'Greenhouse Gases Emissions from Wastewater Treatment Plants: Minimization, Treatment, and Prevention', Journal of Chemistry (2016).