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Removal of NITROGEN from Industrial Effluent: A Review

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Abstract: Nitrates pollution of waters is a worldwide problem and its remediation is a big challenge from the technical and the scientific point of view. One of the most used and promising cleaning techniques is the biological treatment of wastewaters operated by bacteria. A freshwater microalgae Chlorella sp. was investigated for its ability to remove both nitrogen and phosphorus from influent. Amount of waste water containing nitrogen is increasing in the environment due to industrialization. It is necessary to remove nitrogen from waste as it causes eutrophication. The study was carried out to increase characteristics, efficiency and economy of waste water by low cost microorganism.

Keywords: Micro-organisms, Industrial Effluent, Biological Nitrogen Removal.

I.INTRODUCTION

Nitrogen is the chemical compound with the symbol **N**. Its atomic number is 7. Nitrogen was first discovered and isolated by Scottish physician DANIEL RUTHERFORD in 1772. The nitrogen was suggested by JEAN- ANTOINECLAUDE CHAPTAL in 1790. It was found that nitrogen was present in the nitric acid and nitrate form the name of some nitrogen compounds are such as Hydrazine, Azides, and other azo compounds. Nitrogen is the colourless compound in the solid, liquid and gaseous form. It is present in the p-block of the periodic table. Nitrogen is the diatomic nonmetal.

The water quality degradation is quickly joining water scarcity as a major issue in the region. The biological denitrification process requires a long detention time, pH control, and carbon substrate as a chemical reduction of nitrates. Activated sludge treatment is most commonly used the process for the removal of nitrogen from waste water. There are two biological steps for the removal of nitrogen. They are Nitrification and Denitrification. In this process, nitrifies, including ammonia oxidizing bacteria (AOB) and nitrite oxidizing bacteria (NOB), convert total ammonia to nitrate.

The denitrification process takes place in an anoxic environment in which denitrifies reduce nitrate and nitrite to nitrogen gas. It takes 4.57 grams of O_2 to oxidize per gram of total ammonia to nitrate. The use of high quality effluent is important for the treatment of waste water.

For the removal nitrogen from the waste water, it is necessary to identify the different process taking place in wastewater. Excessive concentration of Nitrate is a potential public health hazard in water consumed by infants. In the human body, nitrate is converted to nitrite which can convert hemoglobin to methemoglobin by the contaminants of bacteria or the presence of bacteria in the digestive system. Methmoglobin binds oxygen less effectively than normal hemoglobin.

The decrease in the level of oxygen in the young children can cause methemoglobinaemia which can cause vomiting, diarrhea and in the extreme case, it may cause death.

Many processes has been explained for the removal of nitrogen from waste water. The four methods found to be appropriate for the removal of nitrogen are biological nitrification, Air stripping of ammonia at high pH, Removal of nitrate, Ammonia by ion Exchange.

II. METHODS FOR COD REMOVAL

Guibing Zhu, Yongzhen Peng, Baikun Li, Jianhua Guo, Qing Yang, and Shuying Wang has aimed to study the Biological Removal of Nitrogen from Wastewater, this study confirmed that Eutrophication in natural water environments. Nitrogen compounds in wastewater can only be effectively removed by biological approaches[1].Many biological technologies and processes have been developed and implemented for nitrogen removal from wastewater, such as predenitrifi cation (Anoxic/Oxic), modifi ed Bardenpho, Bio-denitro, sequencing batch reactor (SBR), oxidation ditch (OD)[2]. Takahiro Yamashita and Ryoko Yamamoto-Ikemoto have studied that Nitrogen and Phosphorus Removal from Wastewater Treatment Plant Effluent via Bacterial Sulfate Reduction in an Anoxic Bioreactor Packed with Wood and Iron [3].

Orlando, A. U. Nishijima said that the removal of nitrogen and phosphate from the effluent of a sewage treatment plant over a long-term operation in bioreactors packed with different combinations of wood and iron, with a trickling filter packed with foam ceramics for nitrification. The average nitrification rate in the trickling filter was 0.17 kg N/m3·day and remained at 0.11 kg N/m3·day even when the water temperature was below 15 °C[4]. Simona Matrella, Antonio Proto, and Giovanni Vigliotta have aimed that Nitrate Removal from Wastewater through Biological Denitrification with OGA 24 in a Batch Reactor, this said that Nitrates pollution of waters is a worldwide problem and its remediation is a big challenge from the technical and the scientific point of view[5]. Changfu Wang, Xiaoqing Yu, Hong Lv and Jun Yang has studied that Nitrogen and phosphorus removal from municipal wastewater by the green alga Chlorella sp, this said that The potential of microalgae as a source of renewable energy based on wastewater has received increasing interest worldwide in recent decades. A freshwater microalgae Chlorella sp. was investigated for its ability to remove both nitrogen and phosphorus from influent and effluent. Chlorella sp. grew fastest under 50% influent and effluent wastewaters culture conditions. High removal efficiency for total nitrogen (17.04-58.85%) and total phosphorus (62.4397.08%) was achieved [6].

Javid Ghorashian V. Dean Adams Dennis B. George has aimed that Removal of Nitrogen from Secondary Wastewater Effluent through No 3-N Reduction Using Sulfur Dioxide (SO_2), this confirmed that the overall purpose of this study was to evaluate the ability of sulfur dioxide ($S0_2$) to remove nitrate-nitrogen (i.e. reduction to a gaseous form) from the secondary wastewater effluent. To accomplish the above task a jar test procedure was established and the concentration of $N0_3$-N along with the concentration of NH_3-N present in the secondary wastewater treated with $S0_2$ and iron was used as the catalyst [7]. Federico Rossi, Oriana Motta, Simona Matrella, Antonio Proto and Giovanni Vigliotta has aimed that Nitrate Removal from Wastewater through Biological Denitrification with OGA 24 in a Batch Reactor, this said that Nitrates pollution of waters is a worldwide problem and its remediation is a big challenge from the technical and the scientific point of view. One of the most used and promising cleaning techniques is the biological treatment of wastewaters operated by denitrifying bacteria. It is a study of denitrifying performances of the bacterium Azospira sp. OGA 24[8]. Mara Hauck, Francisca A. Maalcke-Luesken, Mike S.M. Jetten, Mark A.J. Huijbregts has studied Removing nitrogen from wastewater with side stream anammox: What are the trade-offs between environmental impacts? It is compacted Anaerobic ammonium oxidation (anammox) is a novel way to reduce nitrogen in ammonium rich wastewater. Although aquatic eutrophication will certainly be reduced, it is unknown how other environmental impacts may change by including anammox in the treatment of wastewater. Here, life cycle assessment (LCA) was used to assess the environmental profile of a full scale wastewater treatment plant over its complete life cycle [9].

Mahatheva Kalaruban a, Paripurnanda Loganathan a, W.G. Shima,b, Jaya Kandasamya, H.H. Ngo a, Saravanamuthu Vigneswaran has studied that Enhanced removal of nitrate from water using amine-grafted agricultural wastes, this said about Adsorption usin glow-cost adsorbents is a favorable water treatment method for the removal of water contaminants. In this study, the enhanced removal of nitrate, a contaminant at elevated concentration affecting human health and causing Eutrophication of water, was tested using chemically modified agricultural wastes as adsorbents. Batch and fixed-bed adsorption studies were performed on corn cob and coconut copra that was surface modified by amine-grafting to increase the surface positive charges [10].

III CONCUSION

Many methods such as chemical, physical and biological have been tried by different researchers for removal of nitrogen from waste water. Removal with micro-organism is found to be the best method for removal of nitrogen by low cost media. There is still scope for research in order to reduce nitrogen economically by using low cost methods.

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