Assessment And Reduction of Canal Water Pollution At Aquaculture Wastewater Treatment

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Abstract- *Aquaculture wastewater is a major source of pollution in canal water because it contains organic waste, nutrients, salts, and harmful microorganisms. This study looks at pollution levels and ways to lessen its impact using simple treatment methods. Water samples were collected from the aquaculture pond, nearby areas, and the canal. They were tested for pH, turbidity, salinity, and BOD.*

The results showed that the water is highly polluted and not suitable for direct irrigation. To improve water quality, we used chemical treatment with boric acid, sodium hydroxide, and sodium tetraborate, along with sand filtration as a physical treatment method.

This combined treatment effectively reduced pollution and improved water quality. This method is simple, cost-effective, and supports sustainable aquaculture and environmental protection.

Keywords: Aquaculture Wastewater, Water Pollution, Chemical Treatment.

I. INTRODUCTION

Aquaculture wastewater pollution is one of the most common types of water pollution today. Organic waste, nutrients, salt, and microorganisms are found in aquaculture wastewater, which negatively impacts canal water quality and agricultural and aquatic species. The purpose of this study is to evaluate the extent of pollution and minimize it using chemical and sand filters.

This research focuses on the study of canal water pollution by effluents from aquaculture operations. The study measures the quality of water, employs chemical purification, and filters using sand for pollutioncontrol.

II. WATER SAMPLESCOLLECTION

Three samples were taken from different sites: the aquaculture pond, near the discharge point, and the canal. The samples were collected at a depth of 15 to 30 centimetres under the water surface by means of clean containers to prevent contamination. These samples were coded to facilitate testing.

III. ANALYSIS OF WATER QUALITY PARAMETERS IN AQUACULTURE POND

The examination of water quality parameters is necessary to ascertain the extent of pollution in the aquaculture pond water. In the current research, various parameters like pH value, electrical conductivity (EC), turbidity, chlorides, bicarbonates, nitrates, biological oxygen demand (BOD), salinity, and microorganism contents have been examined.

The findings suggest that the aquaculture pond water consists of higher concentrations of salts, solids, organics, and microorganisms. This has made the water unsuitable for immediate irrigation, which might impact adversely on soil and crops growth.

Thus, the adoption of appropriate measures to minimize pollution is critical.

IV. PREPARATION OF CHEMICAL DOSAGE LEVELS FTREATMENT

An assessment of water quality parameters is necessary for the estimation of pollution levels in aqua-pond water. The parameters measured include pH, electrical conductivity (EC), turbidity, chloride, bicarbonate, nitrate, biological oxygen demand (BOD), salinity, and microorganisms.

It has been found that there is a significant presence of dissolved salts, suspended solids, organic materials, and microorganisms in aqua-pond water. Such a composition renders the water unusable for irrigation purposes and can also have negative effects on soil quality and plant life.

Thus, appropriate measures must be taken to alleviate the situation**.**

V. CHEMICAL TREATMENT PROCESS

The chemical method is a technique applied in treating aquaculture waste to reduce pollution and stabilize the water environment. In the experiment carried out, chemicals like sodium hydroxide, boric acid, and sodium tetraborate are employed in a systematic sequence.

The first step involves the addition of sodium hydroxide to raise the pH level of water. Second, boric acid is added for microbial growth inhibition and as a disinfectant. Lastly, sodium tetraborate is added to buffer the pH levels.

VI. FINAL WATER QUALITY ANALYSIS

This study's final water quality analysis was conducted after the process to measure the efficiency of the chemical treatment and sand filtration process. Results indicated that there was notable improvement in the level of the water quality in terms of parameters like pH value, EC, turbidity, chloride ions, bicarbonate, BOD, salinity, and microbiology.

In this case, we observe that pH became near the standard range values, but the turbidity was decreased by filtration processes. There was a marked reduction in the level of salinity, chloride, and EC values because there was a decrease in the total dissolved salt in the water sample. At the same time, the BOD and microbiology also came down.

VII. RESULT AND DISCUSSION

SI.No	Parameter	Before Treatment	After Treatment	Acceptable Limit (IS 11624:1986)
1	Ph	6.8	6.8	6.5 – 8.5
2	Electrical Conductivity (mS/cm)	8.9	3.5	= 3.0
3	Turbidity (NTU)	55	5	= 25
4	Chloride (mg/L)	459	321	= 350
5	Bicarbonate (ppm)	458	298	= 180
6	Carbonate (ppm)	0	4	= 30
7	Nitrate (ppm)	38	26	= 30
8	BOD (mg/L)	28	13	= 30
9	Salinity (ppt)	3.8	1.5	= 3

The results from the analysis of the quality of water have shown that the effluents released by the practice of aquaculture cause increased pollution in canal water. Turbidity, electrical conductivity (EC), salinity, chloride and biological oxygen demand (BOD) levels were high, which signifies the presence of excessive amount of organic waste, salt and other particles suspended in the water body. Water had slightly acidic pH and microbial testing suggested high degree of contamination, making canal water unfit for any irrigation purposes.

After using the chemical treatment procedure and sand filter, there have been considerable changes to be observed in the quality of water. The pH came closer to the required levels, while turbidity and suspended solids got reduced. Levels of EC, salinity and chloride reduced, suggesting the presence of less quantity of salts in water. Reduction in BOD and microbial content also signified successful removal of organic pollutants and microorganisms from water.

VIII. CONCLUSION

From the experiment, it can be concluded that the wastewater discharged from aquaculture has serious adverse effects on canal water, leading to increased salinity, organic material, and microbial contamination. It is not fit for use in irrigation without proper treatment.

It is found that the chemical treatment approach, in combination with sand filtration, can be successfully applied to improve the quality of the wastewater, with a reduction in parameters such as pH, turbidity, salinity, BOD, and microbial content.

Therefore, this combination treatment process is efficient, economical, and effective for mitigating water pollution.

REFERENCES

[1] Xiaojing Liu ., (2024). A systematic review on aquaculture wastewater: Pollutants, impacts, and treatment technology. Environmental Research,Volume 262, Part 1, 1 December 2024, 119793

[2] Sanni Leea Aalto.,(2020). Nitrate removal microbiology in woodchip bioreactors: A case-study with full-scale bioreactors treating aquaculture effluents. Science of The Total Environment.Volume 723, 25 June 2020, 138093

[3] Azmi Ahmad., Siti Rozaimah Sheikh Abdullah (2021). Aquaculture industry: Supply and demand, best practices, effluent and its current issues and treatment technology.

Journal of Environmental Management.Volume 287, 1 June 2021, 112271.

[4] Abdul Latif Ahmad ., (2022).Environmental impacts and imperative technologies towards sustainable treatment of aquaculture wastewater: Journal of Water Process Engineering.Volume 46, April 2022, 102553

[5] Azmi Ahmad ., Siti Rozaimah Sheikh Abdullah.,(2021). Plant-based versus metal-based coagulants in aquaculture wastewater treatment: Effect of mass ratio and settling time. Journal of Water Process Engineering.Volume 43, October 2021, 102269

[6] Wojciech Mrozik,Soydoa Vinitnantharat., (2019) .The food-water quality nexus in periurban aquacultures downstream of Bangkok, Thailand. Science of The Total Environment.Volume 695, 10 December 2019, 133923

[7] M.Jyanthi.,T.Ravisanker.,(2019). Is aquaculture abandonment a threat to sustainable coastal resource use? – A case study of Andhra Pradesh, India, with options for reuse. Land Use Policy 86 (2019) 54–66

[8] Joanna Wolska., Marek Bryjak (2013). Methods for boron removal from aqueous solutions. Desalination.Volume 310, 1 February 2013, Pages 18-24

[9] Minghui Qiu., Kaiyun .,(2019). Ceramic nanofiltration and membrane distillation hybrid membrane processes for the purification and recycling of boric acid from simulative radioactive waste water. Journal of Membrane Science.Volume 579, 1 June 2019, Pages 294-301

[10] Hinenye Adaobi Igwegbe., Aiman Eid Al-Rawajfeh , (2019). Utilization of Calcined Gypsum in Water and Wastewater Treatment: Removal of Phenol. Journal of Ecological Engineering Volume 20, Issue 7, July 2019, pages 1–10.

[11] Suleiman K. Bello., Abdullah H. Alayafi.,(2021). Mitigating Soil Salinity Stress with Gypsum and Bio-Organic Amendments. Journals ,Agronomy ,Volume11 .Issue 9 .10.3390/agronomy11091735

[12] Hannah M. Zinnert., (2024). Impacts of flue gas desulfurization (FGD) gypsum on water quality and the algal community in catfish aquaculture ponds. Aquaculture,Volume 581, 25 February 2024, 740406.

[13] Kaldibek Abdiyev.,(2022).Review of Slow Sand Filtration for RawWater Treatment with Potential Application in Less-Developed Countries .Journals ,Water ,Volume15 ,Issue 11 ,10.3390/w15112007

[14] Halyna BLAHODARNA.,(2025).The use of effective coagulants and flocculants to intensify the process of water purification at coke plants. Slovak Journal of Civil Engineering Vol. 27, 2019, No. 2, 21 – 28 DOI: 10.2478/sjce-2019-0012

[15] Roop Singh Sinsinwar.,(2023). Analysis of pH Value of Water for Treatment Plant of Kekri and Surajpura (Rajasthan) India. EVERGREEN Joint Journal of Novel Carbon Resource Sciences & Green Asia Strategy, Vol. 10, Issue 01, pp324-328, March 2023'

[16] Azmi Ahmad .,().Aquaculture wastewater treatment using plant-based coagulants: Evaluating removal efficiency through the coagulation-flocculation process. Results in Chemistry,Volume 7, January 2024, 101390.

[17] Asha P Tom., Jayalekshmi S Jayakumar., (2021). Aquaculture wastewater treatment technologies and their sustainability: A review. Energy Nexus,Volume 4, 30 December 2021, 100022

[18] Sigit Kurniawan .,(2023). Greywater treatment technologies for aquaculture safety: Review. Journal of King Saud University - Engineering Sciences,Volume 35, Issue 5, July 2023, Pages 327-334

[19] Nai-Yun Zheng.,(2026). Innovative PANI composite modified conductive FO membranes for electro-assisted aquaculture wastewater recovery. Journal of Water Process Engineering,Volume 87, May 2026, 110068

[20] Rodrigo Schveitzer.,(2020). The role of sedimentation in the structuring of microbial communities in biofloc-dominated aquaculture tanks. Aquaculture,Volume 514, 1 January 2020, 734493