Treatment Process of 1000m3/d Aquatic Product Processing Wastewater

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Abstract: In this paper, according to the characteristics of high COD, high ammonia nitrogen and high total phosphorus of aquatic processing wastewater, "air flotation +A/A/O" is adopted to carry out process design and engineering practice for the wastewater of an aquatic processing enterprise. Coagulation air flotation pretreatment can reduce SS, COD and total phosphorus, and A/A/O combined process can effectively remove COD and ammonia nitrogen. After the completion of the project, the operation is stable and the treated effluent meets the three-level standard of the integrated wastewater discharge standard (GB8978-1996).

Introduction

China's aquatic product market is rich in varieties. In 2018, the output of aquatic products reached 64.58 million tons, ranking first in the world for 30 consecutive years. With the continuous increase of the output of aquatic products, the amount of wastewater from aquatic products processing is also increasing. The wastewater from aquatic products processing contains a large number of pollutants, such as blood, oil, meat scraps, visceral sundries, protein, etc. The content of organic matter and suspended matter is high, the content of ammonia nitrogen and total phosphorus is also high, but it is easy to be biochemical treated, and the B/C is basically above 0.5 [1]. Generally, the process design is based on the actual situation of wastewater, which usually needs to be combined with physicochemical treatment and biochemical treatment. Ye Shengquan et used hydrolytic acidification and SBR process to treat aquatic product processing wastewater. The COD, BOD and SS of influent water were 1100-1650mg/L, 500-750mg/L and 250-400mg/L; after treatment the COD, BOD and SS of effluent water were 55.5mg/L, 19.8mg/L and 20.0mg/L. The average removal rates were over 95%, 96% and 92% respectively [2]. Cai mingtiaojin used coagulation air flotation + pulse anaerobic reactor + A/O process to treat the wastewater of an aquatic product company. The COD of influent and effluent were 6500mg/L and 71mg/L respectively, and the removal rate reached 98.9% [3]. Zhou Ronggang et al. used hydrolytic acidification + CASS process to treat wastewater from aquatic products processing. The removal rates of COD, BOD and SS all reached 90% [4]. In this project, coagulation air flotation is used for pretreatment of wastewater from aquatic processing to remove part of SS, COD and total phosphorus, and then A/A/O Biochemical unit is used to further remove COD and ammonia nitrogen, which will be discharged after reaching the standard.

1. Introduction to Wastewater

The production wastewater of an enterprise is divided into raw seafood cleaning wastewater, raw seafood processing cleaning wastewater, salt rinse wastewater, cooking wastewater, cooling and washing wastewater, thawing wastewater, equipment cleaning wastewater, ground cleaning

wastewater and workshop staff cleaning wastewater. The wastewater treatment capacity is 1000m^3/d, i.e. 42m^3/h. Raw water COD ≈5000mg/L, BOD ≈ 2600mg/L, ammonia nitrogen ≈ 260mg/L, total phosphorus ≈80mg/L, SS ≈ 1000mg/L, pH 6-9. The treated effluent shall meet the three-level standard of the integrated wastewater discharge standard (GB8978-1996): COD < 500mg/L, BOD < 300mg / L, SS < 400mg/L, ammonia nitrogen < 35mg / L, and total phosphorus < 8mg/L.[5]

2. Project

2.1 Design of Treatment Process and Main Structures

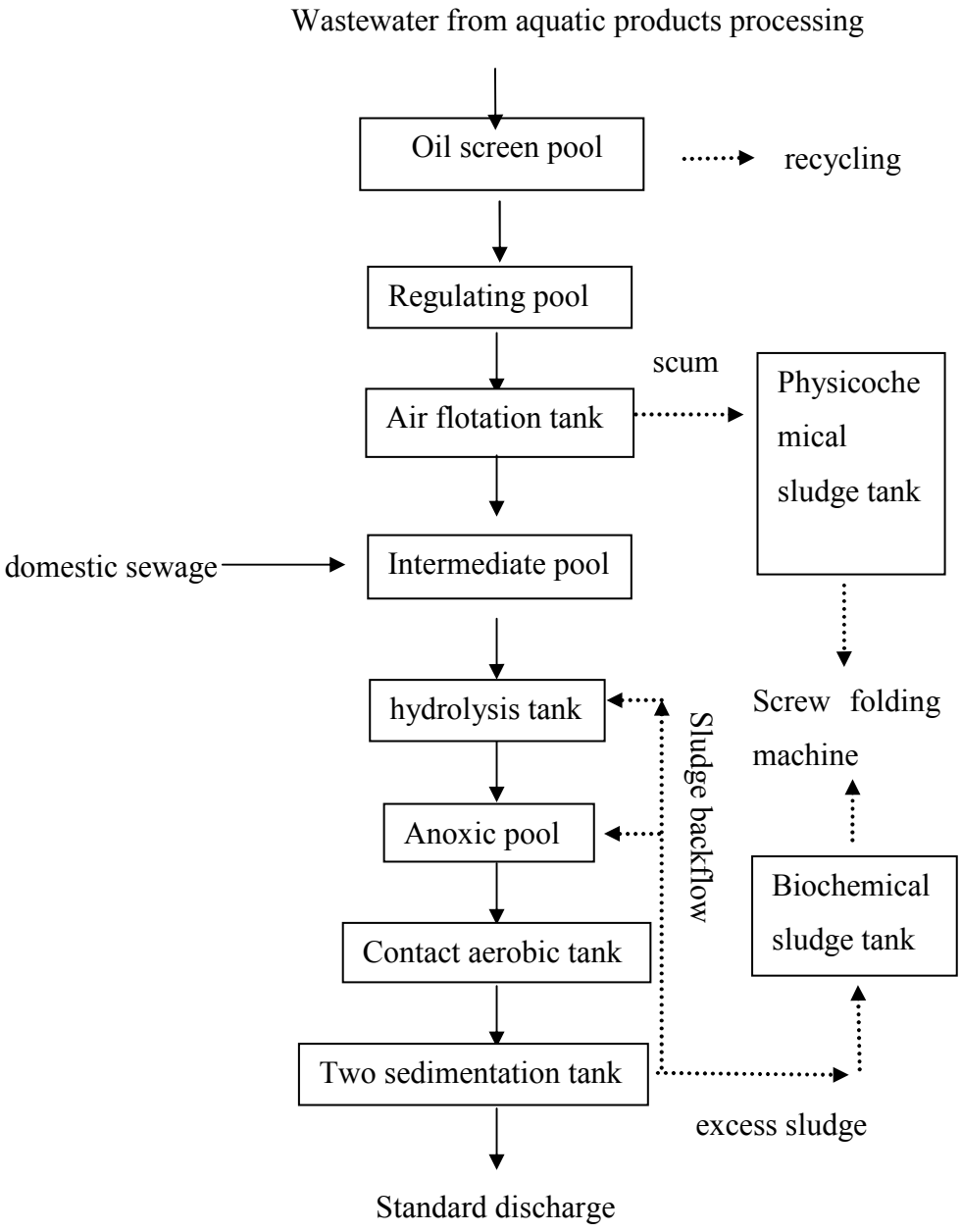

Figure 1. Process flow chart

As shown in the process flow chart in Figure 1, after the production wastewater is collected, it is treated by slag separation and screen microfiltration, and then it is lifted to the air flotation treatment system by the lift pump for physical and chemical pretreatment.[6] After adjusting the pH to about 8.5 and adding $CaCl_2$, PAC and PAM for coagulation, air flotation treatment can effectively remove part of SS, COD and total phosphorus. After the upper scum is collected, it will

enter the physicochemical sludge tank, and the lower clear liquid will be used together with the domestic sewage to lift to the biochemical treatment tank with the lift pump. This project mainly adopts the improved A/A/O process, namely hydrolysis acidification / anoxia / contact oxidation process. All hydrolysis tanks and aerobic tanks are hung with fillers, which can increase the organic load. In the hydrolytic acidification tank, dissolved organic matter is mainly absorbed by microbial cells, which makes the concentration of organic matter in the wastewater decrease.[7] At the same time, macromolecular organic matter is decomposed into micromolecule organic matter, which continues to improve the biochemical property of wastewater. A submersible mixer is arranged in the anoxic tank. Denitrifying bacteria use the organic matter in the sewage as the carbon source to reduce a large number of nitrate nitrogen and nitrite nitrogen brought into the reflux mixture into nitrogen for release, so the total nitrogen concentration in this stage is greatly reduced. In the aerobic tank, the organic matter is degraded by microorganism, and the organic nitrogen is ammoniated and then nitrated, which makes the ammonia nitrogen concentration decrease obviously.[8] After the aerobic tank treatment, the waste water flows into the secondary sedimentation tank for sludge water separation, the supernatant is discharged to the standard, the sludge is returned to the hydrolysis tank and the anoxic tank, and the remaining sludge is discharged into the biochemical sludge tank. The sludge of the project mainly comes from the flotation scum and the residual sludge of the biochemical treatment system. In order to improve the operability and simplicity of operation and management, the physicochemical sludge and biochemical sludge are collected separately, and two sludge processors are used.[9]

2.2 Main Structures

See Table 1 for main structures.

Table 1. Main structures

Name of structure	Length × width × height (m)	Effective volume (m^3)	Structure
Oil screen pool	1.2×6.0×1.5	7.2	Steel concrete fully buried
Regulating pool	8.0×7.4×3.8	195	Steel concrete fully buried
Intermediate pool	6.15×7.4×3.8	150	Steel concrete fully buried
Hydrolysis acidification tank	6.5×15.0×5.5	500	Steel concrete semi overground type
Anoxic pool	6.0×15.0×5.0	405	Steel concrete semi overground type
Oxidation pond	19.0×15.0×5.0	1282	Steel concrete semi overground type
Two sedimentation tank	4.0×15.0×5.0	210	Steel concrete semi overground type
Physicochemical sludge tank	7.5×4.0×5.5	150	Steel concrete semi overground type
Biochemical sludge tank	7.5×4.0×5.5	150	Steel concrete semi overground type

2.3 Treatment Effect and Investment Operation Cost

After wastewater treatment, COD of effluent is less than 220mg/L, the removal rate is 95.6%;

BOD is less than 80mg/L, the removal rate is 96.9%; ammonia nitrogen is less than 10mg/L, the removal rate is 96.1%; total phosphorus is less than 5mg/L, the removal rate is 93.7%.[10]

The total investment of the project (excluding infrastructure construction) is 820,000 yuan, and the investment per ton of water is 820 yuan. The total installed power is 184.05KW, the actual operating power is 142.65KW, and the average daily power consumption is about 1,750 degrees. If the electricity price is calculated as 0.8 yuan /kWh, the electricity fee is 1.40 yuan/m^3. The fixed number of people in the sewage treatment station is 2, and the wage is calculated as 4000 yuan per person per month, so the labor cost is 0.27 yuan/m^3. The drug cost is 0.66 yuan/m^3.The total operation cost of wastewater treatment is 2.33 yuan/m^3.[11, 12]

3. Conclusion

The process of "air flotation + A/A/O" has a good treatment effect on the wastewater from aquatic products processing. The removal rates of COD, BOD, ammonia nitrogen and total phosphorus in the effluent reaches 95.6%, 96.9%, 96.1% and 93.7% respectively. Each index can meet the three-level standard in the integrated wastewater discharge standard.

References

[1] Song Shuang, Chen Jinping, Jiang Hui, Yang linhui, Luo Lingli, he Zhiqiao. Treatment of wastewater from aquatic processing by air flotation-a ~ 2 / O process . China water supply and drainage, 2016,32 (24): 112-115.

[2] Shengquan Y , Hui W , Chaohua Z , et al. Study of the hydrolytic acidification-SBR process in aquatic products processing wastewater treatment. Desalination, 2008, 222(1-3):318-322.

[3] Cai mingtiao. Application of pulse anaerobic reactor + A / O process in wastewater treatment of aquatic products processing . Resource conservation and environmental protection, 2016 (02): 56

[4] Zhou Ronggang, Zhang Ning, Chen Hao, Li Yutang, Xu Zhiqiang. Hydrolytic acidification CASS process for the treatment of wastewater from aquatic products processing . Journal of China Environmental Management Cadre College, 2004 (04): 61-62.

[5] Chen Bibo, Huang Xiaobing. Experimental research and engineering practice of aquatic product processing wastewater treatment technology. Southern Journal of Vocational Education, 2019, 09(05):97-102.

[6] Xu Jiahao, Li Jie, Yang Shuyi, et al. Antibacterial effect of nano-zinc oxide-epoxy resin composite material on wastewater from aquatic product processing. Hunan Agricultural Sciences, 2019(05):56-58.

[7] Li Li. Research on wastewater treatment in aquatic product processing. Environment and Development, 2019, 31 (11):35.

[8] Wang Sheng. On the pollution hazards and treatment technologies of aquaculture wastewater. Agricultural Sciences, 2020, 3(2):29-30.

[9] Sun Liang. A case analysis of abnormal water color environmental monitoring caused by aquatic product processing. Science and Technology Innovation, 2020(11):44-45.

[10] Wei Ya, Hao Zhiming, Jiang Lanlan, et al. Process optimization of aquatic probiotics prepared by mixed fermentation of water chestnut processing waste. Food Industry Science and Technology, 2019, 40(04):166-171.

[11] Wang Jiapan. Research on 300t/d aquatic product processing wastewater treatment. Chemical Management, 2019(27):65.

[12] Li Li. Research on wastewater treatment in aquatic product processing. Northern Environment, 2019(11):25,27.