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Study of the hydrolytic acidification-SBR process in aquatic products processing wastewater treatment

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Abstract

A new method of hydrolytic acidification-sequencing batch reactor (SBR) process in aquatic products processing wastewater treatment is given. In the stage of the pretreatment, the hydrolysis-acidification technology was adopted, it is effective to improve the biodegradability of the wastewater. The SBR method was used in the stage of biochemical treatment.

The experimental results show that the quality of aquatic products processing wastewater can attain to the national requirements of the first grade of integrated wastewater discharge standard (GB 8978 - 1996). When wastewater temperature was 20°C, HRT was over 6 h and influent COD, BOD_5 and SS was 1100–1650 mg/L, 500–750 mg/L and 250–400 mg/L respectively, with more 95%, 96% and 92% of average removal rate respectively, the average effluent COD, BOD_5 and SS was 55.5 mg/L, 19.8 mg/L and 20.0 mg/L. The largest organic loading was 4.1 kg COD/m^3 d. The BOD_5/COD value of aquatic product processing wastewater can be raised from 0.50 to 0.64 via hydrolytic acidification treatment.

Keywords: Wastewater treatment; Hydrolytic acidification; SBR; Aquatic products processing wastewater

1. Introduction

The aquatic products processing industry, like most other agro-industries, generates strong wastewaters characterized by high biological oxygen demand (BOD) and chemical oxygen demand (COD) concentrations representing their high organic content [1]. Furthermore, the aquatic products processing industry is one of the largest sources of industrial effluents in Zhanjiang. A typical Zhanjiang aquatic products processing generates approximately 600 m^3 of waste effluent daily [2]. Aquatic products processing waste effluents are concentrated in nature, and the main

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contributors of organic load to these effluents are proteins and lipids originating from the fish [3,4]. Since aquatic products processing waste streams contain high concentrations of organic matter, these effluents may cause serious problems, in terms of organic load on the local municipal sewage treatment systems [3]. In addition to environmental problems that can result from discharge of aquatic products processing wastewater. Most of the wastewater volume generated in the aquatic products processing industry results from cleaning of transport lines and equipment between production cycles, cleaning of fish, washing of fish and equipment malfunctions or operational errors [4,5]. Aquatic products processing wastewater are treated using physical–chemical and biological treatment methods. However, since the reagent costs are high and the soluble COD removal is poor in physical–chemical treatment processes, biological processes are usually preferred [6]. Among biological treatment processes, treatment in ponds, activated sludge plants and anaerobic treatment are commonly employed for aquatic products processing wastewater treatment [7]. In the contrary, high energy requirements of aerobic treatment plants is a significant drawback of these processes. COD concentrations of aquatic products processing effluents vary significantly; moreover, aquatic products processing effluents are warm and strong, enabling them ideal for anaerobic treatment [2]. Furthermore, no requirement for aeration, low amount of excess sludge production and low area demand are additional advantages of anaerobic treatment processes, in comparison to aerobic processes. The aim of this paper is to summarize the recent research efforts and case studies in SBR treatment of aquatic products processing waste effluents. In the paper, the general characteristics of aquatic products processing waste streams are identified and the hydrolytic acidification-sequencing batch reactor (SBR) degradation mechanisms of the main constituents of aquatic products processing wastewater [8], namely proteins and lipids, are explained. Hydrolytic acidification-SBR treatment practices of aquatic products processing wastewater. Combined (hydrolytic acidification-SBR) treatment systems for aquatic products processing wastewater are also summarized briefly. Finally, areas where particular research and more attention required in the near future are identified.

2. General characteristics of aquatic products processing wastewater

Wastewaters from the aquatic products processing industry are usually generated in an intermittent way, so the flow rates of these effluents change significantly. High seasonal variations are also encountered frequently and correlate with the volume of aquatic products received for processing; which is typically high in summer and low in winter months [9]. Moreover, since the aquatic products industry produces different products, such as fish, shellfish and shrimp, the characteristics of these effluents also vary greatly, depending on the type of system and the methods of operation used [6]. The use of acid and alkaline cleaners and sanitizers in the aquatic products industry additionally influences wastewater characteristics and typically results in a highly variable pH [4,5,10]. Actually, information about the general characteristics of aquatic products wastewaters from full-scale operations in literature is scarce. Only one comprehensive study has been encountered, which provides extensive information about the particular characteristics of aquatic products wastewaters from various full-scale operations [5]. High COD concentrations indicate that aquatic products industry wastewaters are strong and fluctuating in nature. Significant fractions of the organic components and nutrients in aquatic products waste streams are derived from aquatic products. In industrial aquatic products wastewaters, nitrogen originates mainly from fish proteins, and is present in various forms; either an organic nitrogen (proteins, urea, nucleic acids), or as ions such as NH_4^+, NO_2^-