

Pollution Load in Bleach Effluent: Technological Effect

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Abstract

Bleach effluent generated from pulp and paper, textile, and related industries is a major source of environmental pollution due to its high content of organic matter, chlorinated compounds, suspended solids, color, and toxic chemicals. The discharge of untreated or inadequately treated bleach effluent can significantly affect water quality, aquatic ecosystems, and human health. Advances in environmental technologies have played a crucial role in reducing the pollution load associated with bleaching processes. Modern technologies such as Elemental Chlorine-Free (ECF) and Totally Chlorine-Free (TCF) bleaching, advanced oxidation processes, membrane filtration, biological treatment, activated carbon adsorption, and zero liquid discharge (ZLD) systems have improved effluent quality by lowering biochemical oxygen demand (BOD), chemical oxygen demand (COD), adsorbable organic halides (AOX), and color. These technologies not only minimize environmental impacts but also enhance resource recovery, water reuse, and compliance with environmental regulations. This paper examines the characteristics of bleach effluent, evaluates the effectiveness of contemporary treatment technologies, and discusses their role in promoting sustainable industrial practices. It concludes that the adoption of advanced treatment technologies is essential for reducing pollution load, protecting ecosystems, conserving water resources, and achieving environmentally responsible industrial development.

Keywords: Bleach Effluent, Pollution Load, Wastewater Treatment, Elemental Chlorine-Free (ECF), Totally Chlorine-Free (TCF), Advanced Oxidation Processes, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Adsorbable Organic Halides (AOX), Sustainable Industrial Technology, Zero Liquid Discharge (ZLD).