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Design of coupled solar photo catalytic biosorption process for degradation of dairy effluent

Shanmuga Priya Selvanathan

Manipal Institute of Technology, Manipal University, India.

Abstract

Among food industries, the dairy industry produces the greatest volume of pollutants (generating 2.5 litre of effluent per litre of processed milk) largely attributable to the elevated amounts of water consumed. Dairy wastewater does not generally contain inherently toxic chemical substances. It does, however, host a substantial load of dissolved organic compounds such as proteins, lactose, fat, and minerals. Experiments were performed using effluent from Nandini dairy, Manipal, Karnataka, India having high BOD (2450 mg/l), high COD (4250 mg/l) content, and TOC content (2750 mg/l). Due to the presence of high organic matter, pre-treatment was required before solar photo-catalysis. Apart from developments increasing the photocatalytic reaction rate, the most important progress in solar photocatalysis in recent years has been related to its combination with biological treatment and the application of toxicological analytical methods. Biological treatment using activated Sargassum was used as a post-treatment step resulting in 45% reduction in organic content and decolourization. Parabolic trough reactor was designed for efficient solar photocatalytic oxidation. The reactor consists of aluminium sheet as reflecting medium, acrylic sheet as cover to provide maximum UV transitivity and low ion glass tubes are used as reactor. Parameters affecting the photocatalytic oxidation of organics were investigated. Degussa Nano grade P25 $TiO_2$was used as a photo catalyst. Recirculation mode was designed for flow of effluent through tubes (held at parabola focal line for line tracing of radiation). Optimization of pH and catalyst dose was done. Maximum reduction of organic content was observed at the normal pH value of the wastewater (pH = 6.8).Hence the above studies can be used as a treatment in high organic wastewater treatment as it effectively reduces the COD content by 95% and it's good for efficient solar treatment (secondary treatment) sufficient for in-situ treatment of wastewater and recycling of water for low-grade applications in the industry.