



Review

A review on recent advances in the treatment of dye-polluted wastewater



Maira Shabir^{a,1}, Muhammad Yasin^{a,1}, Murid Hussain^{a,1,*}, Iqrash Shafiq^a, Parveen Akhter^b, Abdul-Sattar Nizami^c, Byong-Hun Jeon^d, Young-Kwon Park^{e,*}

^a Department of Chemical Engineering, COMSATS University Islamabad, Lahore Campus, Defence Road, Off Raiwind Road, Lahore, Pakistan

^b Department of Chemistry, The University of Lahore, 1-km Defence Road, Off Raiwind Road, Lahore, Pakistan

^c Sustainable Development Study Center, Government College University, Lahore 54000, Pakistan

^d Department of Earth Resources and Environmental Engineering, Hanyang University, Seoul 04763, Republic of Korea

^e School of Environmental Engineering, University of Seoul, Seoul 02504, Korea

ARTICLE INFO

Article history:

Received 15 April 2022

Revised 6 May 2022

Accepted 9 May 2022

Available online 14 May 2022

Keywords:

Textile wastewater

Types of dyes, Hybrid technologies

Life cycle assessment

ABSTRACT

The textile effluent has an unfavorable effect on the waterbodies as well as on the human health due to the poor penetration of light by increased turbidity and higher oxygen demands. Therefore, the treatment of dye-polluted wastewater is gaining an urgent attention. This review emphasizes on the state-of-the-art technologies that have been developed for treating dye-polluted wastewater, including chemical, physical, and biological techniques alongside their benefits, challenges, and upcoming prospects. The study concludes that the single process alone may not be appropriate for the treatment of a range of dye-polluted wastewaters and approaching the quality demands as these technologies requires more time and are complex. Literature exhibiting a range of approaches for treating large volumes of effluents without producing secondary pollutants are reviewed. Moreover, the ecological impact was among the main concern due to the loss of catalysts and the production of waste sludge. On the other hand, reusability and regeneration are the integrated strategies to deal with such limitations. This review also provides a detailed environmental and techno-economic analysis, life cycle assessment, and practical implications. Moreover, the key bottlenecks requiring a major consideration concerning the universal appreciation of hybrid frameworks are emphasized.

© 2022 The Korean Society of Industrial and Engineering Chemistry. Published by Elsevier B.V. All rights reserved.

Contents

Introduction.....	2
Dye removal by physical methods.....	5
Adsorption.....	5
Membrane filtration.....	5
Coagulation-Flocculation.....	9
Ion exchange resins.....	9
Dye removal by chemical methods.....	10
Oxidation process.....	11
Ozonation.....	11
Fenton reagents.....	11
Electro-chemical destruction.....	11
Photocatalysis.....	11
Photocatalysis.....	12

* Corresponding authors.

E-mail addresses: drmhussain@cuilahore.edu.pk (M. Hussain), catalica@uos.ac.kr (Y.-K. Park).

¹ These authors contributed equally.