ID 6052

Quantification of Pollution Parameters of Real Textile Effluents Before and After Photocatalytic Treatment: Improvement of the Biodgradability By Adjusting pH and Organic Load

Guettaï Nadia[1*], Sabba Nassila[1], Kadmi Yassine[2] , Bouargane Brahim[3]

[1]Laboratory of Matter's Valorization and Recycling for Sustainable Development (VRMDD), University of Sciences and Technology Houari Boumediene, Bab-Ezzouar, Algiers, Algeria.

[2]LASIRE, Equipe Physico-Chimie de l'Environnement, CNRS UMR 8516, Université de Lille, France.S

[3]Faculty of Sciences, Laboratory of Process Engineering (LGP), Ibn Zohr University, Agadir

*gnadia_fr@yahoo.fr , nguettai@usthb.dz

ABSTRACT

The present study aims to characterize real textile effluents before and after treatment and to evaluate the effectiveness of photocatalytic treatment in the removing biorecalcitrant dyes. The results showed levels higher than the standard guidelines. All effluents have a slightly acidic character. The values of the COD/BOD_5 ratios, ranging from 4.89 to 6.75, indicate that all effluents are not biodegradable. The treatment of these waters by heterogeneous photocatalysis on TiO_2 gave different results depending on the natures ofthe effluents. Characterization after treatment showed a fairly good efficiency, with reduction rates ranging from 18.76% to 75.89%. By adjusting some operational factors, the removal of organic load by photocatalysis was significantly improved for the most recalcitrant effluents.

Keywords: Real textile effluent, physico-chemical characterization, emerging dyes, AOPs, Photocatalysis.

1.Introduction

Pollution of aquatic environments by dyes from various industrial sectors has become a major environmental scourge. The dyes used in the textile industry are mostly of synthetic origin, with complex aromatic and heterocyclic structures. Due to their stability and excellent solubility in water, dyes severely affect the photosynthesis of aquatic media and threaten the ecological balance by reducing light penetration and dissolved oxygen levels [1]. Treatment of these effluents prior to release into the receiving environment has become a crucial step. Several conventional techniques such as membrane processes, coagulation, have shown high efficiency in the removal of dyes [2]. However, heterogeneous photocatalysis, particularly on TiO_2, appears to be an emerging solution and a new sustainable approach to remove recalcitrant dyes. This innovative technique is both eco-friendly and energy efficient to control the degradation process. It has the ability to decompose complex and toxic pollutants into smaller and harmless compounds, easily biodegradable, thanks to highly oxidizing entities, including the hydroxyl radical (•OH) [3]. The present study is devoted to the physicochemical characterization of different textile effluents before and after photocatalytic treatment and to demonstrate the effectiveness of the process.

2.Experimental

Five textile effluents, each characterized by its composition , were collected directly at the outlet of the dyeing bath. Approximately 1.5 L were placed in brown bottles, which had previously been washed and steamed for 24 h before use. Sampling and preservation procedures were followed to preserve sample integrity and ensure the representativeness of the rejection. The untreated samples were then subjected to physicochemical analyses of pollution parameters, including pH, T°, MES, COD, BOD and some ions such as Cl^-, NO_3^- , PO_4^{3-},... All these measurements were carried out using standard methods. Photocatalytic degradation experiments were carried out on a laboratory scale, after filtering the samples. Initially, the five effluents were treated in their raw state, without adjusting the operating conditions. Depending on the results obtained, photocatalysis tests were carried out on the most recalcitrant samples, adjusting certain operating conditions. The evolution of the degradation was followed by UV-Visible spectrophotometry, at appropriate wavelengths.

DOI: 10.21467/abstracts.170 ISBN: 978-81-970666-1-0 (eBook)

3.Results and Discussion

The analysis results relating to the physicochemical characterization and the photocatalytic degradation of the various effluents are given below pollution are present.

Table I.1: *Parameter analysis results physicochemical aspects of textile effluents in*

Average values	(I) Brown effluent	(II) Honey effluent	(III) Beige effluent	(IV) Blue effluent	(V) Red effluent
pH	5.23	5.78	5.23	5.99	6.3
T° (°C)	53.4	59	55.8	67	58
DCO (mg L^{-1})	1602.4	1100	1687.6	1253	979.2
DBO_5 (mg L^{-1})	250	200	250	200	200
MES (mg L^{-1})	514	450	1082.5	1003.8	501
MVS (mg L^{-1})	328.5	303	726.84	712.5	318.12
K (mS cm^{-1})	7.23	5.07	6.19	7.53	7.81

Sample	$\frac{DCO}{DBO5}$
Samp. 1 (Brown)	6.41
Samp. 2 (Honey)	5.50
Samp. 3 (Beige)	6.75
Samp. 4 (Blue)	6.27
Samp. 5 (Red)	4.89

TableI.2 : Biodegradability their raw state of bthe analyzed effluents

Table II: *Comparison of pollution parameters before and after treatment*

Chemical parameters	State	Brown sample	Honey sample	Blue sample	Beige sample	Red sample
NO_3^- (mg L^{-1})	Before treatment	39.48	51.41	57.87	57.14	36.68
	After treatment	34.78	47.14	52.1	47.50	49.2
NO_2^- (mg L^{-1})	Before treatment	0.268	0.463	0.643	0.196	1.71
	After treatment	0.287	0.429	0.613	0.206	2.358
NH_4^+ (mg L^{-1})	Before treatment	40.70	41.415	33.56	46.21	43.54
	After treatment	33.11	29.11	29.09	32.90	38.80
PO_4^{3-} (mg L^{-1})	Before treatment	2.27	2.41	4.59	0	0
	After treatment	0	0	0	0	0
DCO (mg L^{-1})	Before treatment	1602.40	1100	1253	1687.6	979.2
	After treatment	1301.8	816.3	1005.2	1437.1	236.1
Abattement DCO (%)	After treatment	**18.76**	**25.79**	**19.78**	**14.84**	**75.89**

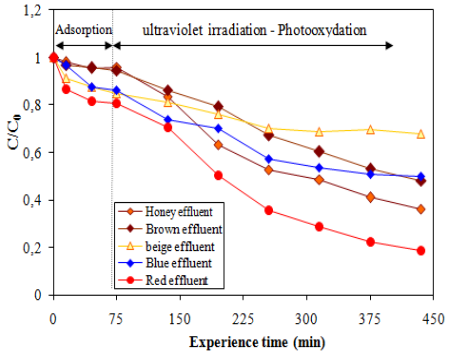

Figure I: Evolution of C/C_0 as function of the photocatalytic degradation time

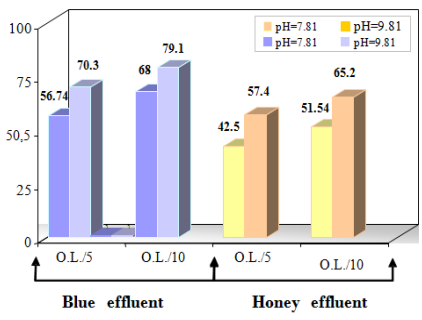

Figure II : Evolution of C/C_0 as a function of photodegradation time of blue and beige **e**ffluents

ISBN: 978-81-970666-1-0
Series: AIJR Abstracts
DOI: 10.21467/abstracts.170

The effluents analyzed show a slightly acidic character, this is related to the dyeing process and the reagents used. With discolouration rates, ranging from 18.76% to 75.89%, it can be concluded that the photocatalytic treatment of textile effluents depends on the type of dyes, the organic load and the operating conditions.

4. Conclusion

The results obtained and discussed in this study show a recalcitrant and non-biodegradable nature of the textile effluents, despite fairly satisfactory rates of pollutant load reduction. This confirms that the presence of synthetic dyes in water poses a threat to the environment and human health, and that immediate action is required

References

[1] Ahmad, M.N., Anjum, M.N., Farid, M.F., Atta-ul Haq, Ali, A., Rehman,M.F., Assiri, M.A. kram, M.S. (2024). Water pollution remediation: Synthesis and characterization of poly(*o*-methylaniline)/ZnO/rGO composite for photocatalytic degradation of dyes, Polym Adv Technol.2024;35:e6269.

[2] Azanaw A, Birlie B, Teshome B, Jemérie M (2022). Textile effluent treatment methods and eco-friendly resolution of textile wastewater. Case Stud Chem Environ Eng. 6 100230.

[3] Al-Mamun MR, Kader S, Islam MS, Khan MZH (2019) Photocatalytic activity improvement and application of UV-TiO2 photocatalysis in textile wastewater treatment: A review. J Environ Chem Eng. 7:103248.

ISBN: 978-81-970666-1-0

Series: AIJR Abstracts

DOI: 10.21467/abstracts.170