Bioremediation Journal • *Open Access* • 2021

Document type
Note • *Hybrid Gold Open Access*

Source type
Journal

ISSN
10889868

DOI
10.1080/10889868.2021.1984197

Publisher
Taylor and Francis Ltd.

Original language
English

View less

A new technique to estimate percentage decolorization of synthetic dyes on solid media by extracellular laccase from white-rot fungus

Shah, Harmen[a]; Yusof, Faridah[a, b]; Alam, Md Zahangir[a, c]

Save all to author list

[a] Faculty of Engineering, Department of Biotechnology Engineering, International Islamic University Malaysia, Kuala Lumpur, Selangor, Malaysia

[b] Department of Biotechnology Engineering, International Islamic University Malaysia, Bioprocess and Molecular Engineering Research Unit (BPMERU), Kuala Lumpur, Selangor, Malaysia

[c] Department of Biotechnology Engineering, International Islamic University Malaysia, Bioenvironmental Engineering Research Center (BERC), Kuala Lumpur, Selangor, Malaysia

Abstract

The enormous colored effluent discharges due to increased usage of synthetic dyes in textile and other chemical industries pollute both freshwater and marine reservoirs and cause ecotoxicity and serious health problems. This issue needs to be addressed skillfully and demands an ecofriendly and economically feasible technique . Pertaining to this, the current study was focused on the use of a

white rot fungus , Resinicium bicolor to decolorize and degrade a recalcitrant dye , Congo red (CR) through its extracellular laccase enzyme secreted by mycelia. This work was also intended to develop a simple mathematical formula to calculate decolorization (%) of various dye categories usually tested on the solid medium plate involving different white rot fungi. The fungus was grown on malt extract agar (MEA) plate containing media supplemented with CR, 1% (g/l) to check the extent of decolorization and hence efficacy of Resinicium bicolor laccase at an interval of 24 hours (hrs). Decolorization (%) was determined by a formula derived from 'Plate Volume Method' (PVM). The maximum decolorization achieved on solid medium was 97.79% and 96.79% in liquid culture medium by the end of 96 hrs without the involvement of any chemical mediators which are generally toxic and expensive. Efficient decolorization achieved in the liquid medium validated the accuracy of 'PVM'.

Author keywords

Biodegradation; bioremediation; Congo red; dye effluents; fungal laccase ; pollutants; wastewater treatment

Sustainable Development Goals 2022 New

SciVal Topics

Metrics

References (35) View in search results format >

All

Export Print E-mail Save to PDF Create bibliography

1 Asgher, M., Ahmed, N., Iqbal, H.M.N.
Hyperproductivity of extracellular enzymes from indigenous white rot fungi (P. chrysosporium IBL-03) by utilizing agro-wastes
(2011) *BioResources*, 6 (4), pp. 4454-4467. Cited 24 times.
http://www.ncsu.edu/bioresources/BioRes_06/BioRes_06_4_4454_Asgher_AI_Hyperproduc_Enzymes_WRFungi_Agrowastes_1951.pdf
View at Publisher

2 Borokhov, O., Rothenburger, S.
Rapid dye decolorization method for screening potential wood preservatives (Open Access)
(2000) *Applied and Environmental Microbiology*, 66 (12), pp. 5457-5459. Cited 14 times.
doi: 10.1128/AEM.66.12.5457-5459.2000
View at Publisher

3 Chaturvedi, S.
Azo dyes decolorization using white rot fungi
(2019) *International Journal of Applied and Natural Sciences (IJANS)*, 8 (4), pp. 33-46.

4 Cheng, W.N., Sim, H.K., Ahmad, S.A., Syed, M.A., Shukor, M.Y., Yusof, M.T.
Characterization of an azo-dye-degrading white rot fungus isolated from Malaysia (Open Access)
(2016) *Mycosphere*, 7 (5), pp. 560-569. Cited 11 times.
http://www.mycosphere.org/pdf/Mycosphere_7_5_3.pdf
doi: 10.5943/mycosphere/7/5/3
View at Publisher

5 Daâssi, D., Zouari-Mechichi, H., Frikha, F., Martinez, M.J., Nasri, M., Mechichi, T.
Decolorization of the azo dye Acid Orange 51 by laccase produced in solid culture of a newly isolated Trametes trogii strain
(2013) *3 Biotech*, 3 (2), pp. 115-125. Cited 30 times.

6 Eichlerová, I., Baldrian, P.
Ligninolytic enzyme production and decolorization capacity of synthetic dyes by saprotrophic white rot, brown rot, and litter decomposing basidiomycetes (Open Access)

(2020) *Journal of Fungi*, 6 (4), art. no. 301, pp. 1-22. Cited 16 times.
https://www.mdpi.com/2309-608X/6/4/301/pdf
doi: 10.3390/jof6040301

View at Publisher

7 Elshafei, A., Othman, A., Hassan, M., Haroun, M., Elsayed, M., Farrag, A.
Catalyzed Mediator-Based Decolorization of Five Synthetic Dyes by Pleurotus ostreatus ARC280 Laccase
(2015) *British Biotechnology Journal*, 9 (2), pp. 1-15. Cited 5 times.
and

8 Forootanfar, H., Moezzi, A., Aghaie-Khozani, M., Mahmoudjanlou, Y., Ameri, A., Niknejad, F., Faramarzi, M.A.
Synthetic dye decolorization by three sources of fungal laccase

(2012) *Journal of Environmental Health Science and Engineering*, 9 (1), art. no. 27. Cited 45 times.

9 Hamad, M.T.M.H., Saied, M.S.S.
Kinetic studies of Congo red dye adsorption by immobilized Aspergillus niger on alginate (Open Access)

(2021) *Applied Water Science*, 11 (2), art. no. 35.
http://www.springer.com/earth+sciences+and+geography/hydrogeology/journal/13201
doi: 10.1007/s13201-021-01362-z

View at Publisher

10 Heinfling, A., Bergbauer, M., Szewzyk, U.
Biodegradation of azo and phthalocyanine dyes by Trametes versicolor and Bjerkandera adusta

(1997) *Applied Microbiology and Biotechnology*, 48 (2), pp. 261-266. Cited 203 times.
doi: 10.1007/s002530051048

View at Publisher

11 Holey, B.A.
Decolourization of Congo Red dye by bacteria and consortium isolated from dye contaminated soil
(2015) *International Research Journal of Science & Engineering*, 3 (3), pp. 107-112. Cited 7 times.

12 Ihssen, J., Schubert, M., Schwarze, F.W.M.R., Thöny-Meyer, L.

Efficient production of $Al(OH)_3$-immobilized laccase with a Heterobasidion annosum strain selected by microplate screening

(2011) *Journal of Applied Microbiology*, 110 (4), pp. 924-934. Cited 5 times.
doi: 10.1111/j.1365-2672.2011.04948.x

View at Publisher

13 John, J., Dineshram, R., Hemalatha, K.R., Dhassiah, M.P., Gopal, D., Kumar, A.

Bio-Decolorization of Synthetic Dyes by a Halophilic Bacterium Salinivibrio sp. (Open Access)

(2020) *Frontiers in Microbiology*, 11, art. no. 594011. Cited 11 times.
https://www.frontiersin.org/journals/microbiology#
doi: 10.3389/fmicb.2020.594011

View at Publisher

14 Kaur, B., Kumar, B., Garg, N., Kaur, N.

Statistical optimization of conditions for decolorization of synthetic dyes by cordyceps militaris MTCC 3936 using RSM (Open Access)

(2015) *BioMed Research International*, 2015, art. no. 536745. Cited 30 times.
http://www.hindawi.com/journals/biomed/
doi: 10.1155/2015/536745

View at Publisher

15 Khan, R., Bhawana, P., Fulekar, M.H.

Microbial decolorization and degradation of synthetic dyes: A review

(2013) *Reviews in Environmental Science and Biotechnology*, 12 (1), pp. 75-97. Cited 270 times.
http://www.kluweronline.com/issn/1569-1705
doi: 10.1007/s11157-012-9287-6

View at Publisher

16 Khlifi, R., Belbahri, L., Woodward, S., Ellouz, M., Dhouib, A., Sayadi, S., Mechichi, T.

Decolourization and detoxification of textile industry wastewater by the laccase-mediator system

(2010) *Journal of Hazardous Materials*, 175 (1-3), pp. 802-808. Cited 164 times.
doi: 10.1016/j.jhazmat.2009.10.079

View at Publisher

17 Koyani, R.D., Sanghvi, G.V., Sharma, R.K., Rajput, K.S.

Contribution of lignin degrading enzymes in decolourisation and degradation of reactive textile dyes

(2013) *International Biodeterioration and Biodegradation*, 77, pp. 1-9. Cited 50 times.
doi: 10.1016/j.ibiod.2012.10.006

View at Publisher

18 Kulikova, N.A., Klein, O.I., Stepanova, E.V., Koroleva, O.V.
Use of basidiomycetes in industrial waste processing and utilization technologies: Fundamental and applied aspects (review)

(2011) *Applied Biochemistry and Microbiology*, 47 (6), pp. 565-579. Cited 20 times.
doi: 10.1134/S000368381106007X

View at Publisher

19 Lakshmi, K.M.S., Soumya, P.S., Shaji, A.
Lenzites elegans KSG32: a novel white rot fungus for synthetic dye decolourization
(2017) *Journal of Bacteriology and Mycology Open Access*, 5 (3), pp. 311-317. Cited 4 times.

20 Lavanya, C., Dhankar, R., Chhikara, S., Sheoran, S.
Degradation of toxic dyes: a review
(2014) *International Journal of Current Microbiology and Applied Science*, 3 (6), p. 1. Cited 53 times.

21 Mittal, A., Mittal, J., Malviya, A., Gupta, V.K.
Adsorptive removal of hazardous anionic dye "Congo red" from wastewater using waste materials and recovery by desorption (Open Access)

(2009) *Journal of Colloid and Interface Science*, 340 (1), pp. 16-26. Cited 618 times.
doi: 10.1016/j.jcis.2009.08.019

View at Publisher

22 (2021)
PubChem Compound Summary for CID 11313, Congo red. Retrieved August 16, 2021 from
https://pubchem.ncbi.nlm.nih.gov/compound/Congo-red

23 Ramadhan, K., Anita, S., Oktaviani, M., Sari, F., Budi Laksana, R., Nurhayat, O., Yanto, Y.
Biodecolorization of anthraquinone and azo dyes by newly isolated Indonesian white-rot fungi
(2021) *Biosaintifika: Journal of Biology & Biology Education*, 13 (1), pp. 16-25. Cited 6 times.

24 Rani, B., Kumar, V., Singh, J., Bisht, S., Teotia, P., Sharma, S., Kela, R.
Bioremediation of dyes by fungi isolated from contaminated dye effluent sites for bio-usability (Open Access)

(2014) *Brazilian Journal of Microbiology*, 45 (3), pp. 1055-1063. Cited 80 times.
http://www.scielo.br/pdf/bjm/v45n3/39.pdf
doi: 10.1590/S1517-83822014000300039

View at Publisher

25 Rawat, D., Sharma, R.S., Karmakar, S., Arora, L.S., Mishra, V.
Ecotoxic potential of a presumably non-toxic azo dye

(2018) *Ecotoxicology and Environmental Safety*, 148, pp. 528-537. Cited 83 times.
http://www.elsevier.com/inca/publications/store/6/2/2/8/1/9/index.htt
doi: 10.1016/j.ecoenv.2017.10.049

View at Publisher

26 Rawat, D., Mishra, V., Sharma, R.S.
Detoxification of azo dyes in the context of environmental processes

(2016) *Chemosphere*, 155, pp. 591-605. Cited 203 times.
www.elsevier.com/locate/chemosphere
doi: 10.1016/j.chemosphere.2016.04.068

View at Publisher

27 Shah, H., Yusof, F., Alam, Z.
Production of laccase by Resinicium bicolor in submerged cultures: Application of the Plackett-Burman experimental design to screen major factors
(2014) *International Journal of Environmental Engineering-IJEE*, 1 (2), pp. 146-150. Cited 2 times.

28 Si, J., Cui, B.-K., Dai, Y.-C.
Decolorization of chemically different dyes by white-rot fungi in submerged cultures (Open Access)

(2013) *Annals of Microbiology*, 63 (3), pp. 1099-1108. Cited 28 times.
doi: 10.1007/s13213-012-0567-8

View at Publisher

29 Steeve, M., Christiane, A., Jean-Bosco, S.T., Kor, N.M., Stephane, D., Philippe, G.
Discoloration and biodegradation of two dyes by white-rot fungi Perreniporia tephropora MUCL 47500 isolated in Gabon
(2014) *International Journal of Current Microbiology and Applied Science*, 3 (6), pp. 731-741. Cited 14 times.

30 Svobodová, K., Majcherczyk, A., Novotný, C., Kües, U.
Implication of mycelium-associated laccase from Irpex lacteus in the decolorization of synthetic dyes

(2008) *Bioresource Technology*, 99 (3), pp. 463-471. Cited 84 times.
doi: 10.1016/j.biortech.2007.01.019

View at Publisher

31 Tekere, M., Mswaka, A.Y., Zvauya, R., Read, J.S.
Growth, dye degradation and ligninolytic activity studies on Zimbabwean white rot fungi

(2001) *Enzyme and Microbial Technology*, 28 (4-5), pp. 420-426. Cited 113 times.
doi: 10.1016/S0141-0229(00)00343-4

View at Publisher

32 Wang, N., Chu, Y., Wu, F., Zhao, Z., Xu, X.
Decolorization and degradation of Congo red by a newly isolated white rot fungus, Ceriporia lacerata, from decayed mulberry branches

(2017) *International Biodeterioration and Biodegradation*, 117, pp. 236-244. Cited 74 times.
www.elsevier.com/inca/publications/store/4/0/5/8/9/9
doi: 10.1016/j.ibiod.2016.12.015

View at Publisher

33 Zhang, J., Sun, L., Zhang, H., Wang, S., Zhang, X., Geng, A.
A novel homodimer laccase from Cerrena unicolor BBP6: Purification, characterization, and potential in dye decolorization and denim bleaching (Open Access)

(2018) *PLoS ONE*, 13 (8), art. no. e0202440. Cited 24 times.
http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0202440&type=printable
doi: 10.1371/journal.pone.0202440

View at Publisher

34 Zhuo, R., Fan, F.
A comprehensive insight into the application of white rot fungi and their lignocellulolytic enzymes in the removal of organic pollutants

(2021) *Science of the Total Environment*, 778, art. no. 146132. Cited 46 times.
www.elsevier.com/locate/scitotenv
doi: 10.1016/j.scitotenv.2021.146132

View at Publisher

35 Zollinger, H.
(1991) *Color chemistry-synthesis, properties and applications of organic dyes and pigments*. Cited 2472 times.
New York: VCH

Shah, H.; Faculty of Engineering, Department of Biotechnology Engineering, International Islamic University Malaysia, Kuala Lumpur, Selangor, Malaysia

About Scopus

What is Scopus

Content coverage

Scopus blog

Scopus API

Privacy matters

Language

日本語版を表示する

查看简体中文版本

查看繁體中文版本

Просмотр версии на русском языке

Customer Service

Help

Tutorials

Contact us