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Development of an Effective Biosorbent by Fungal Immobilization Technique for Removal of Dyes (Article)

Alam, M.Z.[a], Khan, M.J.H.[ab], Kabbashi, N.A.[a], Sayem, S.M.A.[ac]

[a]Bioenvironmental Engineering Research Centre (BERC), Department of Biotechnology Engineering, Khulliyyah of Engineering, International Islamic University Malaysia, Gombak, Kuala Lumpur, Malaysia
[b]Department of Chemical Engineering, University of Malaya, Kuala Lumpur, Malaysia
[c]Department of Genetic Engineering and Biotechnology, Shahjalal University of Science and Technology, Sylhet, Bangladesh

Abstract

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Charcoal activated carbon was modified through immobilization techniques on fungal biomass. Two fungal strains i.e. Aspergillus niger and Penicillium sp. were selected to immobilize the charcoal activated carbon on fungal biomass. The percentage of biomass production onto activated carbon was 88% for A. niger while it was 75% for Penicillum sp. The results of scanning electron microscope (SEM) showed clear changes between the external surfaces of charcoal activated carbon (AC) and activated carbon immobilized biomass (ACIB) which also indicated the formation of matrix onto AC by fungal mycelia. The ACIBs showed more functional groups as compared to the AC. The functional groups determined by the Fourier transform infrared spectroscopy (FTIR) for the ACIBs by A. niger and Penicillium sp. indicated various changes in achieving additional functional groups (phosphate ester, cyclic ether, alcoholic and phenolic groups) as compared to the AC. The results revealed that AC was morphologically modified by the immobilization techniques. Maximum adsorption capacity by ACIB of A. niger was achieved at a dosage of 15 mg/L for Reactive Black (98.2%), Congo Red (84.6%) and Malachite Green (82.6%) while 20 mg/L dosage was required for Methylene Blue to achieve highest decolorization (92.3%). The results of individual effect of ACIB, AC and biomass on the removal of reactive black 5 showed that maximum removal was obtained at 98.2, 88 and 75% respectively. The modified biosorbents as ACIBs developed by the A. niger and Penicillium sp. in an immobilized culturing process could be a potential agent for decolorization and removal of pollutants. © 2017, Springer Science+Business Media Dordrecht.

Reaxys Database Information

View Compounds

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Activated carbon Aspergillus niger Decolorization Fungal immobilization Penicillium

Indexed keywords

Engineering controlled terms: Activated carbon Aromatic compounds Aspergillus Azo dyes Biomass Charcoal Dyes Fourier transform infrared spectroscopy Scanning electron microscopy Stripping (dyes)

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References (46)

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1 ALAM, Md.Z., MUYIBI, S.A., MANSOR, M.F., WAHID, R.

Activated carbons derived from oil palm empty-fruit bunches: Application to environmental problems

(2007) *Journal of Environmental Sciences*, 19 (1), pp. 103-108. Cited 56 times.
doi: 10.1016/S1001-0742(07)60017-5

View at Publisher

2 Bohli, T., Ouederni, A., Fiol, N., Villaescusa, I.

Evaluation of an activated carbon from olive stones used as an adsorbent for heavy metal removal from aqueous phases

(2015) *Comptes Rendus Chimie*, 18 (1), pp. 88-99. Cited 33 times.
http://www.elsevier.com/journals/comptes-rendus-chimie/1631-0748
doi: 10.1016/j.crci.2014.05.009

View at Publisher

3 Magriotis, Z.M., Leal, P.V.B., de Sales, P.F., Papini, R.M., Viana, P.R.M., Arroyo, P.A.

A comparative study for the removal of mining wastewater by kaolinite, activated carbon and beta zeolite

(2014) *Applied Clay Science*, 91-92, pp. 55-62. Cited 10 times.
doi: 10.1016/j.clay.2014.02.007

View at Publisher

4 Navarro, M.V., Seaton, N.A., Mastral, A.M., Murillo, R.

Analysis of the evolution of the pore size distribution and the pore network connectivity of a porous carbon during activation

(2006) *Carbon*, 44 (11), pp. 2281-2288. Cited 16 times.
doi: 10.1016/j.carbon.2006.02.029

View at Publisher

5 Messele, S.A., Soares, O.S.G.P., Órfão, J.J.M., Bengoa, C., Stüber, F., Fortuny, A., Fabregat, A., (...), Font, J.

Effect of activated carbon surface chemistry on the activity of ZVI/AC catalysts for Fenton-like oxidation of phenol

(2015) *Catalysis Today*, 240 (PA), pp. 73-79. Cited 22 times.
http://www.sciencedirect.com/science/journal/09205861
doi: 10.1016/j.cattod.2014.03.063

View at Publisher

6 Chingombe, P., Saha, B., Wakeman, R.J.

Surface modification and characterisation of a coal-based activated carbon

(2005) *Carbon*, 43 (15), pp. 3132-3143. Cited 325 times.
doi: 10.1016/j.carbon.2005.06.021

View at Publisher

7 Dąbrowski, A., Podkościelny, P., Hubicki, Z., Barczak, M.

Adsorption of phenolic compounds by activated carbon - A critical review

(2005) *Chemosphere*, 58 (8), pp. 1049-1070. Cited 676 times.
doi: 10.1016/j.chemosphere.2004.09.067

View at Publisher

8 Gokce, Y., Aktas, Z.

Nitric acid modification of activated carbon produced from waste tea and adsorption of methylene blue and phenol

(2014) *Applied Surface Science*, 313, pp. 352-359. Cited 60 times.
http://www.journals.elsevier.com/applied-surface-science/
doi: 10.1016/j.apsusc.2014.05.214

View at Publisher

9 Monser, L., Adhoum, N.

Modified activated carbon for the removal of copper, zinc, chromium and cyanide from wastewater

(2002) *Separation and Purification Technology*, 26 (2-3), pp. 137-146. Cited 397 times.
doi: 10.1016/S1383-5866(01)00155-1

View at Publisher

10 Tovar-Gómez, R., Moreno-Virgen, M.D.R., Moreno-Pérez, J., Bonilla-Petriciolet, A., Hernández-Montoya, V., Durán-Valle, C.J.

Analysis of synergistic and antagonistic adsorption of heavy metals and acid blue 25 on activated carbon from ternary systems

(2015) *Chemical Engineering Research and Design*, 93, pp. 755-772. Cited 12 times.
http://www.elsevier.com/wps/find/journaldescription.cws_home/713871/description#description
doi: 10.1016/j.cherd.2014.07.012

View at Publisher

11 Alam, Md.Z., Ameem, E.S., Muyibi, S.A., Kabbashi, N.A.

The factors affecting the performance of activated carbon prepared from oil palm empty fruit bunches for adsorption of phenol

(2009) *Chemical Engineering Journal*, 155 (1-2), pp. 191-198. Cited 60 times.
doi: 10.1016/j.cej.2009.07.033

View at Publisher

12 Alslaibi, T.M., Abustan, I., Ahmad, M.A., Foul, A.A.

A review: Production of activated carbon from agricultural byproducts via conventional and microwave heating

(2013) *Journal of Chemical Technology and Biotechnology*, 88 (7), pp. 1183-1190. Cited 57 times.
doi: 10.1002/jctb.4028

View at Publisher

13 Pereira, L., Pereira, R., Pereira, M.F.R., van der Zee, F.P., Cervantes, F.J., Alves, M.M.

Thermal modification of activated carbon surface chemistry improves its capacity as redox mediator for azo dye reduction

(2010) *Journal of Hazardous Materials*, 183 (1-3), pp. 931-939. Cited 38 times.
doi: 10.1016/j.jhazmat.2010.08.005

View at Publisher

14 Nabais, J.M.V., Carrott, P.J.M., Carrott, M.M.L.R., Menéndez, J.A.

Preparation and modification of activated carbon fibres by microwave heating

(2004) *Carbon*, 42 (7), pp. 1309-1314. Cited 90 times.
doi: 10.1016/j.carbon.2004.01.033

View at Publisher

15 Zheng, X., Zhang, S., Xu, J., Wei, K.

Effect of thermal and oxidative treatments of activated carbon on its surface structure and suitability as a support for barium-promoted ruthenium in ammonia synthesis catalysts

(2002) *Carbon*, 40 (14), pp. 2597-2603. Cited 86 times.
doi: 10.1016/S0008-6223(02)00167-7

View at Publisher

16 Kodama, S., Sekiguchi, H.

Estimation of point of zero charge for activated carbon treated with atmospheric pressure non-thermal oxygen plasmas

(2006) *Thin Solid Films*, 506-507, pp. 327-330. Cited 22 times.
doi: 10.1016/j.tsf.2005.08.137

View at Publisher

17 Chiang, H.-L., Chiang, P.C, Huang, C.P

Ozonation of activated carbon and its effects on the adsorption of VOCs exemplified by methylethylketone and benzene

(2002) *Chemosphere*, 47 (3), pp. 267-275. Cited 63 times.
doi: 10.1016/S0045-6535(01)00216-8

View at Publisher

18 Chingombe, P., Saha, B., Wakeman, R.J.

Effect of surface modification of an engineered activated carbon on the sorption of 2,4-dichlorophenoxy acetic acid and benazolin from water

(2006) *Journal of Colloid and Interface Science*, 297 (2), pp. 434-442. Cited 81 times.
doi: 10.1016/j.jcis.2005.10.054

View at Publisher

19 Rangel-Mendez, J.R., Cannon, F.S.

Improved activated carbon by thermal treatment in methane and steam: Physicochemical influences on MIB sorption capacity

(2005) *Carbon*, 43 (3), pp. 467-479. Cited 30 times.
doi: 10.1016/j.carbon.2004.09.031

View at Publisher

20 Attia, A.A., Rashwan, W.E., Khedr, S.A.

Capacity of activated carbon in the removal of acid dyes subsequent to its thermal treatment

(2006) *Dyes and Pigments*, 69 (3), pp. 128-136. Cited 106 times.
doi: 10.1016/j.dyepig.2004.07.009

View at Publisher

21 Rivera-Utrilla, J., Sánchez-Polo, M., Gómez-Serrano, V., Álvarez, P.M., Alvim-Ferraz, M.C.M., Dias, J.M.

Activated carbon modifications to enhance its water treatment applications. An overview

(2011) *Journal of Hazardous Materials*, 187 (1-3), pp. 1-23. Cited 217 times.
doi: 10.1016/j.jhazmat.2011.01.033

View at Publisher

22 Domingo-García, M., López-Garzón, F.J., Pérez-Mendoza, M.

Effect of some oxidation treatments on the textural characteristics and surface chemical nature of an activated carbon

(2000) *Journal of Colloid and Interface Science*, 222 (2), pp. 233-240. Cited 80 times.
http://www.elsevier.com/inca/publications/store/6/2/2/8/6/1/index.htt
doi: 10.1006/jcis.1999.6619

View at Publisher

23 Aburub, A., Wurster, D.E.

Phenobarbital interactions with derivatized activated carbon surfaces

(2006) *Journal of Colloid and Interface Science*, 296 (1), pp. 79-85. Cited 15 times.
doi: 10.1016/j.jcis.2005.08.035

View at Publisher

24 Maroto-Valer, M.M., Dranca, I., Lupascu, T., Nastas, R.

Effect of adsorbate polarity on thermodesorption profiles from oxidized and metal-impregnated activated carbons

(2004) *Carbon*, 42 (12-13), pp. 2655-2659. Cited 29 times.
doi: 10.1016/j.carbon.2004.06.007

View at Publisher

25 Rios, R.R.A., Alves, D.E., Dalmázio, I., Bento, S.F.V., Donnici, C.L., Lago, R.M.
Tailoring activated carbon by surface chemical modification with O, S, and N containing molecules
(2003) *Mater. Res*, 6 (2), pp. 129-135. Cited 47 times.

26 Gerçel, O., Özcan, A., Özcan, A.S., Gerçel, H.F.
Preparation of activated carbon from a renewable bio-plant of Euphorbia rigida by H_2SO_4 activation and its adsorption behavior in aqueous solutions
(2007) *Applied Surface Science*, 253 (11), pp. 4843-4852. Cited 165 times.
doi: 10.1016/j.apsusc.2006.10.053
View at Publisher

27 Shin, E.-J., Lauve, A., Carey, M., Bukovsky, E., Ranville, J.F., Evans, R.J., Herring, A.M.
The development of bio-carbon adsorbents from Lodgepole Pine to remediate acid mine drainage in the Rocky Mountains
(2008) *Biomass and Bioenergy*, 32 (3), pp. 267-276. Cited 14 times.
doi: 10.1016/j.biombioe.2007.09.007
View at Publisher

28 Coelho, C., Oliveira, A.S., Pereira, M.F.R., Nunes, O.C.
The influence of activated carbon surface properties on the adsorption of the herbicide molinate and the bio-regeneration of the adsorbent
(2006) *Journal of Hazardous Materials*, 138 (2), pp. 343-349. Cited 39 times.
doi: 10.1016/j.jhazmat.2006.05.062
View at Publisher

29 Mohan, D., Rajput, S., Singh, V.K., Steele, P.H., Pittman, C.U.
Modeling and evaluation of chromium remediation from water using low cost bio-char, a green adsorbent
(2011) *Journal of Hazardous Materials*, 188 (1-3), pp. 319-333. Cited 167 times.
doi: 10.1016/j.jhazmat.2011.01.127
View at Publisher

30 Rivera-Utrilla, J., Bautista-Toledo, I., Ferro-García, M.A., Moreno-Castilla, C.
Bioadsorption of Pb(II), Cd(II), and Cr(VI) on activated carbon from aqueous solutions
(2003) *Carbon*, 41 (2), pp. 323-330. Cited 86 times.
doi: 10.1016/S0008-6223(02)00293-2
View at Publisher

31 Rivera-Utrilla, J., Prados-Joya, G., Sánchez-Polo, M., Ferro-García, M.A., Bautista-Toledo, I.
Removal of nitroimidazole antibiotics from aqueous solution by adsorption/bioadsorption on activated carbon
(2009) *Journal of Hazardous Materials*, 170 (1), pp. 298-305. Cited 110 times.
doi: 10.1016/j.jhazmat.2009.04.096
View at Publisher

32 Zahangir Alam, M.D., Fakhru'l-Razi, A., Abd-Aziz, S., Molla, A.H.
Optimization of compatible mixed cultures for liquid state bioconversion of municipal wastewater sludge
(2003) *Water, Air, and Soil Pollution*, 149 (1-4), pp. 113-126. Cited 31 times.
doi: 10.1023/A:1025686113945
View at Publisher

33 Alam, M.Z., Bari, M.N., Muyibi, S.A., Jamal, P., Abdullah-Al-Mamun
Solid state bioconversion of oil palm empty fruit bunches for production of citric acid by wild strains of aspergillus niger

(2010) *Food Biotechnology*, 24 (1), pp. 19-36. Cited 5 times.
doi: 10.1080/08905430903320883

View at Publisher

34 Mishra, A., Malik, A.
Novel fungal consortium for bioremediation of metals and dyes from mixed waste stream

(2014) *Bioresource Technology*, 171 (1), pp. 217-226. Cited 28 times.
www.elsevier.com/locate/biortech
doi: 10.1016/j.biortech.2014.08.047

View at Publisher

35 Nilsson, I., Möller, A., Mattiasson, B., Rubindamayugi, M.S.T., Welander, U.
Decolorization of synthetic and real textile wastewater by the use of white-rot fungi

(2006) *Enzyme and Microbial Technology*, 38 (1-2), pp. 94-100. Cited 119 times.
doi: 10.1016/j.enzmictec.2005.04.020

View at Publisher

36 Zheng, Z., Levin, R.E., Pinkham, J.L., Shetty, K.
Decolorization of polymeric dyes by a novel Penicillium isolate

(1999) *Process Biochemistry*, 34 (1), pp. 31-37. Cited 89 times.
doi: 10.1016/S0032-9592(98)00061-2

View at Publisher

37 Zhao, X., Lu, Y., Hardin, I.
Determination of biodegradation products from sulfonated dyes by Pleurotus ostreatus using capillary electrophoresis coupled with mass spectrometry

(2005) *Biotechnology Letters*, 27 (1), pp. 69-72. Cited 29 times.
doi: 10.1007/s10529-004-6588-z

View at Publisher

38 Khalaf, S.A., Khalaf, M.A.
Fungal chitosan production from potato processing wastewater and its characterization
(2005) *Isot. Radiat. Res*, 37, pp. 1465-1475. Cited 3 times.

39 Gül, U.D., Dönmez, G.
Influence of surfactants on dye removal and growth of aspergillus versicolor - an effective way to decolorize textile dye

(2014) *Clean - Soil, Air, Water*, 42 (7), pp. 917-922. Cited 3 times.
http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291863-0669
doi: 10.1002/clen.201200579

View at Publisher

40 De Ory, I., Romero, L.E., Cantero, D.
Optimization of immobilization conditions for vinegar production. Siran, wood chips and polyurethane foam as carriers for Acetobacter aceti

(2004) *Process Biochemistry*, 39 (5), pp. 547-555. Cited 47 times.
www.elsevier.com/inca/publications/store/4/2/2/8/5/7
doi: 10.1016/S0032-9592(03)00136-5

View at Publisher

41 Guo, Y., Rockstraw, D.A.

Physical and chemical properties of carbons synthesized from xylan, cellulose, and Kraft lignin by H_3PO_4 activation

(2006) *Carbon*, 44 (8), pp. 1464-1475. Cited 121 times.
doi: 10.1016/j.carbon.2005.12.002

View at Publisher

42 Kaushik, P., Malik, A.

Alkali, thermo and halo tolerant fungal isolate for the removal of textile dyes

(2010) *Colloids and Surfaces B: Biointerfaces*, 81 (1), pp. 321-328. Cited 21 times.
doi: 10.1016/j.colsurfb.2010.07.034

View at Publisher

43 Puziy, A.M., Poddubnaya, O.I., Martínez-Alonso, A., Suárez-García, F., Tascón, J.M.D.

Synthetic carbons activated with phosphoric - Acid I. Surface chemistry and ion binding properties

(2002) *Carbon*, 40 (9), pp. 1493-1505. Cited 283 times.
doi: 10.1016/S0008-6223(01)00317-7

View at Publisher

44 Çetinkaya Dönmez, G., Aksu, Z., Öztürk, A., Kutsal, T.

A comparative study on heavy metal biosorption characteristics of some algae

(1999) *Process Biochemistry*, 34 (9), pp. 885-892. Cited 377 times.
doi: 10.1016/S0032-9592(99)00005-9

View at Publisher

45 Kaushik, P., Mishra, A., Malik, A., Pant, K.K.

Biosorption of textile dye by Aspergillus lentulus pellets: Process optimization and cyclic removal in aerated bioreactor

(2014) *Water, Air, and Soil Pollution*, 225 (6), art. no. 1978. Cited 9 times.
http://www.kluweronline.com/issn/0049-6979/
doi: 10.1007/s11270-014-1978-x

View at Publisher

46 Kaushik, P., Malik, A.

Comparative performance evaluation of Aspergillus lentulus for dye removal through bioaccumulation and biosorption

(2013) *Environmental Science and Pollution Research*, 20 (5), pp. 2882-2892. Cited 15 times.
doi: 10.1007/s11356-012-1190-8

View at Publisher

Alam, M.Z.; Bioenvironmental Engineering Research Centre (BERC), Department of Biotechnology Engineering, Khulliyyah of Engineering, International Islamic University Malaysia, Gombak, Kuala Lumpur, Malaysia; email:zahangir@iium.edu.my