Malaysian Journal of Chemistry • Volume 25, Issue 3, Pages 431 - 439 • 29 June 2023

Document type
Conference Paper

Source type
Journal

ISSN
15112292

DOI
10.55373/MJCHEM.V25I3.431

Publisher
Malaysian Institute of Chemistry

Original language
English

View less

Modification of Carica papaya Seeds with NaOH for Copper Removal from Water

Shuhaimen, Muhammad Shahrain[a]; Abdullah, Erna Normaya[b]; Zubir, Aisyah[b]; Shamsuri, Syamimi Sulfiza[b]; Salim, Rosliza Mohd[b]; Iqbal, Anwar[c]; Piah, Mohd Bijarimi Mat[d]; Ahmad, Mohammad Norazmi[b]

Save all to author list

[a] Department of Biotechnology, Kulliyyah of Science, International Islamic University of Malaysia, Kuantan, Pahang, 25200, Malaysia

[b] Department of Chemistry, Kulliyyah of Science, International Islamic University of Malaysia, Kuantan, Pahang, 25200, Malaysia

[c] School of Chemical Science, Universiti Sains Malaysia, Penang, 11800, Malaysia

[d] Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Kuantan, Pahang, 26300, Malaysia

Full text options Export

Abstract

Author keywords

SciVal Topics

Funding details

Abstract

As people work to create a sustainable future, initiatives to improve the state of the environment have recently taken precedence. Due to the persistence of heavy metals in the environment and their nonbiodegradable nature, heavy metal contamination has become a global issue. In conjunction with the Sustainable Development Goals, this study proposes a green method of heavy metal removal by applying Carica papaya seeds (CPS) as an environmentally friendly and highly efficient adsorbent to remove copper (Cu) from the environment. To increase its potential in adsorbing copper(II) ions, CPS were treated with sodium hydroxide (NaOH). The effects of the adsorbent mass, pH, initial metal solution concentrations, and contact time were investigated in batch experiments. The optimum pH

and contact time for CPS are pH 3-5 and 120 min, respectively, and the highest percentage of removal achieved is 82%. The adsorbent was characterized with scanning electron microscopy (SEM) and Fourier transform-infrared (FT-IR) spectroscopy to analyze the Cu adsorption process. In conclusion, the chemically treated CPS can be utilized as a potential bio-adsorbent for Cu removal from aqueous solutions.

Author keywords

Carica papaya seeds (CPS); copper (Cu); green adsorbent; heavy metals; water treatment

SciVal Topics

Funding details

References (38)

View in search results format >

All

Export Print E-mail Save to PDF Create bibliography

1 Ali, H., Khan, E., Ilahi, I.

Environmental chemistry and ecotoxicology of hazardous heavy metals: Environmental persistence, toxicity, and bioaccumulation

(2019) *Journal of Chemistry*, 2019, art. no. 6730305. Cited 1361 times.
http://www.hindawi.com/journals/chem/contents/
doi: 10.1155/2019/6730305

View at Publisher

2 Saleh, H. E. M., Aglan, R. F.
Environ-mental Contamination by Heavy Metals
(2018) *Heavy Metals*, 7. Cited 592 times.

3 Vardhan, K.H., Kumar, P.S., Panda, R.C.

A review on heavy metal pollution, toxicity and remedial measures: Current trends and future perspectives

(2019) *Journal of Molecular Liquids*, 290, art. no. 111197. Cited 721 times.
https://www.journals.elsevier.com/journal-of-molecular-liquids
doi: 10.1016/j.molliq.2019.111197

View at Publisher

4 Lan, A.P., Chen, J., Chai, Z.F., Hu, Y.

The neurotoxicity of iron, copper and cobalt in Parkinson's disease through ROS-mediated mechanisms

(2016) *BioMetals*, 29 (4), pp. 665-678. Cited 59 times.
www.wkap.nl/journalhome.htm/0966-0844
doi: 10.1007/s10534-016-9942-4

View at Publisher

5 Saka, C., Şahin, O., Küçük, M.M.

Applications on agricultural and forest waste adsorbents for the removal of lead (II) from contaminated waters

(2012) *International Journal of Environmental Science and Technology*, 9 (2), pp. 379-394. Cited 124 times.
doi: 10.1007/s13762-012-0041-y

View at Publisher

6 Bandmann, O., Weiss, K.H., Kaler, S.G.
Wilson's disease and other neurological copper disorders

(2015) *The Lancet Neurology*, 14 (1), pp. 103-113. Cited 597 times.
http://www.journals.elsevier.com/the-lancet-neurology/
doi: 10.1016/S1474-4422(14)70190-5

View at Publisher

7 Govindaraju, M., Shekar, H.S., Sateesha, S.B., Vasudeva Raju, P., Sambasiva Rao, K.R., Rao, K.S.J., Rajamma, A.J.
Copper interactions with DNA of chromatin and its role in neurodegenerative disorders

(2013) *Journal of Pharmaceutical Analysis*, 3 (5), pp. 354-359. Cited 32 times.
http://www.journals.elsevier.com/journal-of-pharmaceutical-analysis
doi: 10.1016/j.jpha.2013.03.003

View at Publisher

8 Abd. Hadi, N., Rohaizar, A., Sien, W. C.
Removal of Cu (II) from Water by Adsorption on Papaya Seed
(2011) *Asian Transactions on Engineering*, 1, pp. 49-55. Cited 20 times.
N (05)

9 Abas, S.N.A., Ismail, M.H.S., Kamal, M.L., Izhar, S.
Adsorption process of heavy metals by low-cost adsorbent: A review

(2013) *World Applied Sciences Journal*, 28 (11), pp. 1518-1530. Cited 121 times.
http://idosi.org/wasj/wasj28(11)13/7.pdf
doi: 10.5829/idosi.wasj.2013.28.11.1874

View at Publisher

10 Ong, S. T., Yip, S. P., Keng, P. S., Lee, S. L., Hung, Y. T.
Papaya (Carica papaya) Seed as a Low-Cost Sorbent for Zinc Removal
(2012) *African Journal of Agricultural Research*, 7, pp. 810-819. Cited 22 times.

11 Zwain, H.M., Vakili, M., Dahlan, I.
Waste material adsorbents for zinc removal from wastewater: A comprehensive review

(2014) *International Journal of Chemical Engineering*, 2014, art. no. 347912. Cited 87 times.
http://www.hindawi.com/journals/ijce/
doi: 10.1155/2014/347912

View at Publisher

12 (2018) *Main information of papaya planted area and production. Crop Statistics Booklet (Food Crop Sub-Sector)*, p. 47. Cited 2 times.
Department of Agriculture Malaysia, Ministry of Agriculture and Agro-based Industry: Putrajaya, Malaysia

13 Chan, Y.K., Baharuddin, A.G.

Rejuvenating the flagging papaya industry in malaysia: The role of MAFC (Open Access)

(2010) *Acta Horticulturae*, 851, pp. 37-40. Cited 8 times.
http://www.actahort.org/members/showpdf?session=25628
ISBN: 978-906605065-5
doi: 10.17660/ActaHortic.2010.851.2

View at Publisher

14 Kyzas, G.Z., Kostoglou, M.

Green adsorbents for wastewaters: A critical review

(2014) *Materials*, 7 (1), pp. 333-364. Cited 273 times.
http://www.mdpi.com/1996-1944/7/1/333/pdf
doi: 10.3390/ma7010333

View at Publisher

15 Kanyal, M., Bhatt, A. A.
Removal of Heavy Metals from Water (Cu and Pb) Using Household Waste as an Adsorbent
(2015) *Journal of Bioremediation & Biodegradation*, 6 (1), pp. 1-6. Cited 27 times.

16 Zafar, S., Khan, M.I., Lashari, M.H., Khraisheh, M., Almomani, F., Mirza, M.L., Khalid, N.

Removal of copper ions from aqueous solution using NaOH-treated rice husk

(2020) *Emergent Materials*, 3 (6), pp. 857-870. Cited 34 times.
springer.com/journal/42247
doi: 10.1007/s42247-020-00126-w

View at Publisher

17 Dan, Y., Xu, L., Qiang, Z., Dong, H., Shi, H.

Preparation of green biosorbent using rice hull to preconcentrate, remove and recover heavy metal and other metal elements from water

(2021) *Chemosphere*, 262, art. no. 127940. Cited 31 times.
www.elsevier.com/locate/chemosphere
doi: 10.1016/j.chemosphere.2020.127940

View at Publisher

18 Asghar, U., Irfan, M., Iram, M., Huma, Z., Nelofer, R., Nadeem, M., Syed, Q.

Effect of alkaline pretreatment on delignification of wheat straw

(2015) *Natural Product Research*, 29 (2), pp. 125-131. Cited 42 times.
www.tandf.co.uk/journals/titles/14786419.asp
doi: 10.1080/14786419.2014.964712

View at Publisher

19 Elenga, R.G., Djemia, P., Tingaud, D., Chauveau, T., Maniongui, J.G., Dirras, G.

Effects of alkali treatment on the microstructure, composition, and properties of the Raffia textilis fiber

(2013) *BioResources*, 8 (2), pp. 2934-2949. Cited 40 times.
http://www.ncsu.edu/bioresources/BioRes_08/BioRes_08_2_2934_Elenga_DTCMD_Alk_Treat_Microstruc_Comp_Raffia_Fiber_3767.pdf
doi: 10.15376/biores.8.2.2934-2949

View at Publisher

20 Zeng, G., He, Y., Liang, D., Wang, F., Luo, Y., Yang, H., Wang, Q., (...), Sun, D.

Adsorption of Heavy Metal Ions Copper, Cadmium and Nickel by Microcystis aeruginosa (Open Access)

(2022) *International Journal of Environmental Research and Public Health*, 19 (21), art. no. 13867. Cited 5 times.
http://www.mdpi.com/journal/ijerph
doi: 10.3390/ijerph192113867

View at Publisher

21 Sridharan, K.
IR Spectroscopy
(2016) *Spectral Methods in Transition Metal Complexes*, 3, pp. 69-97. Cited 2 times.

22 Abdel-Ghani, N. T., El-Chaghaby, G. A.
Biosorption for Metal Ions Removal from Aqueous Solutions : A Review of Recent Studies
(2014) *Inter-national Journal of Latest Research in Science and Technology*, 3 (1), pp. 24-42. Cited 95 times.

23 Rivera-Pastrana, D.M., Yahia, E.M., González-Aguilar, G.A.

Phenolic and carotenoid profiles of papaya fruit (Carica papaya L.) and their contents under low temperature storage (Open Access)

(2010) *Journal of the Science of Food and Agriculture*, 90 (14), pp. 2358-2365. Cited 145 times.
http://onlinelibrary.wiley.com/doi/10.1002/jsfa.4092
doi: 10.1002/jsfa.4092

View at Publisher

24 Unuabonah, E.I., Adie, G.U., Onah, L.O., Adeyemi, O.G.

Multistage optimization of the adsorption of methylene blue dye onto defatted Carica papaya seeds (Open Access)

(2009) *Chemical Engineering Journal*, 155 (3), pp. 567-579. Cited 97 times.
doi: 10.1016/j.cej.2009.07.012

View at Publisher

25 Nasuha, N., Zurainan, H. Z., Maarof, H. I., Zubir, N. A., Amri, N.
Effect of cationic and anionic dye adsorption from aqueous solution by using chemically modified papaya seed
(2011) *Inter-national Conference on Environment Science and Engineering*, 8, pp. 50-54. Cited 33 times.

26 Chowdhury, S., Mishra, R., Saha, P., Kushwaha, P.
Adsorption thermodynamics, kinetics and isosteric heat of adsorption of malachite green onto chemically modified rice husk (Open Access)

(2011) *Desalination*, 265 (1-3), pp. 159-168. Cited 817 times.
doi: 10.1016/j.desal.2010.07.047

View at Publisher

27 Pua, F.L., Sajab, M.S., Chia, C.H., Zakaria, S., Rahman, I.A., Salit, M.S.
Alkaline-treated cocoa pod husk as adsorbent for removing methylene blue from aqueous solutions

(2013) *Journal of Environmental Chemical Engineering*, 1 (3), pp. 460-465. Cited 53 times.
doi: 10.1016/j.jece.2013.06.012

View at Publisher

28 Pezoti, O., Cazetta, A.L., Bedin, K.C., Souza, L.S., Martins, A.C., Silva, T.L., Santos Júnior, O.O., (...), Almeida, V.C.
NaOH-activated carbon of high surface area produced from guava seeds as a high-efficiency adsorbent for amoxicillin removal: Kinetic, isotherm and thermodynamic studies (Open Access)

(2016) *Chemical Engineering Journal*, 288, pp. 778-788. Cited 335 times.
www.elsevier.com/inca/publications/store/6/0/1/2/7/3/index.htt
doi: 10.1016/j.cej.2015.12.042

View at Publisher

29 Lalhruaitluanga, H., Jayaram, K., Prasad, M.N.V., Kumar, K.K.
Lead(II) adsorption from aqueous solutions by raw and activated charcoals of Melocanna baccifera Roxburgh (bamboo)-A comparative study (Open Access)

(2010) *Journal of Hazardous Materials*, 175 (1-3), pp. 311-318. Cited 274 times.
doi: 10.1016/j.jhazmat.2009.10.005

View at Publisher

30 Argun, M. E., Dursun, Ş.
Activation of pine bark surface with NaOH for lead removal
(2007) *J. Int. Environmental Application & Science*, 2, pp. 5-10. Cited 11 times.
(1&2)

31 Cruz-Lopes, L.P., Macena, M., Esteves, B., Guiné, R.P.F.
Ideal pH for the adsorption of metal ions Cr^{6+}, Ni^{2+}, Pb^{2+}in aqueous solution with different adsorbent materials (Open Access)

(2021) *Open Agriculture*, 6 (1), pp. 115-123. Cited 32 times.
www.degruyter.com/view/j/opag
doi: 10.1515/opag-2021-0225

View at Publisher

32 El-Ahmady El-Naggar, N., Rabei, N.H., El-Malkey, S.E.
Eco-friendly approach for biosorption of Pb^{2+} and carcinogenic Congo red dye from binary solution onto sustainable Ulva lactuca biomass (Open Access)

(2020) *Scientific Reports*, 10 (1), art. no. 16021. Cited 37 times.
www.nature.com/srep/index.html
doi: 10.1038/s41598-020-73031-1

View at Publisher

33 Cheraghi, E., Ameri, E., Moheb, A.
Adsorption of cadmium ions from aqueous solutions using sesame as a low-cost biosorbent: kinetics and equilibrium studies (Open Access)

(2015) *International Journal of Environmental Science and Technology*, 12 (8), pp. 2579-2592. Cited 75 times.
http://www.springerlink.com/content/1735-1472
doi: 10.1007/s13762-015-0812-3

View at Publisher

34 Rao, G.P., Lu, C., Su, F.
Sorption of divalent metal ions from aqueous solution by carbon nanotubes: A review

(2007) *Separation and Purification Technology*, 58 (1), pp. 224-231. Cited 936 times.
doi: 10.1016/j.seppur.2006.12.006

View at Publisher

35 Chen, C., Wang, X.
Adsorption of Ni(II) from aqueous solution using Oxidized multiwall carbon nanotubes (Open Access)

(2006) *Industrial and Engineering Chemistry Research*, 45 (26), pp. 9144-9149. Cited 515 times.
http://pubs.acs.org/journal/iecred
doi: 10.1021/ie060791z

View at Publisher

36 Bashir, A., Malik, L. A., Ahad, S., Manzoor, T., Bhat, M. A., Dar, G. N., Pandith, A. H.
Removal of heavy metal ions from aqueous system by ion-exchange and biosorption methods
(2018) *Environmental Chemistry Letters*

37 Hossain, M.A., Ngo, H.H., Guo, W.S., Nguyen, T.V.
Removal of copper from water by adsorption onto banana peel as bioadsorbent

(2012) *International Journal of GEOMATE*, 2 (2), pp. 227-234. Cited 137 times.
http://www.gi-j.com/serial%204/227-234-3c-anwar%20hossain.pdf
doi: 10.21660/2012.4.3c

View at Publisher

38 Torapava, N.
(2011) *Hydration, Solvation and Hydrolysis of Multicharged Metal Ions*. Cited 5 times.
Swedish University of Agricultural Sciences

Ahmad, M.N.; Department of Chemistry, Kulliyyah of Science, International Islamic University of Malaysia, Kuantan, Pahang, Malaysia; email:mnorazmi85@gmail.com

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