UNIVERSITAS
GADJAH MADA
**Penggunaan biochar-Fe3O4-beeswax sebagai adsorben hidrofobik dalam mitigasi tumpahan minyak (diesel,
CO, dan CPO)**
Suci Nuraini, Dr. rer. nat. Adhitasari Suratman, S.Si., M.Si.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Ababneh, H. and Hameed, B.H., 2023, Chitosan and chitosan composites for oil spills treatment: Review of recent literature, *J. of Water Process Eng.*, 55, 1–26.

Adofo, Y.K., Nyankson, E., and Agyei-Tuffour, B., 2022, Dispersants as an oil spill clean-up technique in the marine environment: A review, *Heliyon*, 8, 1–19.

Ahlawat, D., Poonia, D., Ahlawat, M., and Ahlawat, S.S., 2018, Effect of drying techniques on functional and physico-chemical properties of okara, *Int. J. Curr. Microbiol. Appl. Sci.*, 7, 582–590.

Ariyanti, D., Purbasari, A., Sugianto, D.N., Lesdantina, D., and Widiyanti, M., 2024, Rice husk-based magnetic biochar produced via hydrothermal route for petroleum spills adsorption: characterization, adsorption kinetics, and isotherms, *Adsorption*, 30, 2175–2187.

Aussanasuwannakul, A., Puntaburt, K., and Pantoa, T., 2024, Enhancing Gluten-Free Crispy Waffles with Soybean Residue (Okara) Flour: Rheological, Nutritional, and Sensory Impacts, *Foods*, 13, 1–26.

Bayraktaroglu, S., Kizil, S., and Bulbul Sonmez, H., 2021, A highly reusable polydimethylsiloxane sorbents for oil/organic solvent clean-up from water, *J. Environ. Chem. Eng.*, 9, 1–9.

Belgacem, S. Ben, Trigui, A., jedidi, I., Loukil, M.S., Calmunger, M., and Abdmouleh, M., 2024, Enhancing thermal energy storage properties of blend phase change materials using beeswax, *Environ. Sci. Pollut. Res.*, 31, 51504–51520.

Ben Belgacem, S., Trigui, A., Zghal, S., Jedidi, I., Loukil, M.S., Calmunger, M., and Abdelmouleh, M., 2026, Beeswax/LDPE/carbon graphite composites for thermal energy storage applications: Impact of CNTs on thermophysical performance and stability, *Compos. Commun.*, 61, 1–14.

Benjelloun, M., Miyah, Y., Akdemir Evrendilek, G., Zerrouq, F., and Lairini, S., 2021, Recent advances in adsorption kinetic models: their application to dye types, *Arabian J. of Chem.*, 14, 1–24.

Bouchenafa-Saïb, N., Mekarzia, A., Bouzid, B., Mohammedi, O., Khelifa, A., Benrachedi, K., and Belhaneche, N., 2014, Removal of malathion from polluted water by adsorption onto chemically activated carbons produced from coffee grounds, *Desalination Water Treat.*, 52, 4920–4927.

UNIVERSITAS
GADJAH MADA
**Penggunaan biochar-Fe3O4-beeswax sebagai adsorben hidrofobik dalam mitigasi tumpahan minyak (diesel,
CO, dan CPO)**
Suci Nuraini, Dr. rer. nat. Adhitasari Suratman, S.Si., M.Si.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Chen, Z. and Zeng, B., 2017, Characteristics of micro-interface adsorption kinetics between sediments and Cu ions, *Int. J. of Sediment Res.*, 32, 1–89.

Effendi, H., Mursalin, M., and Hariyadi, S., 2022, Rapid water quality assessment as a quick response of oil spill incident in coastal area of Karawang, Indonesia, *Front. Environ. Sci.*, 10, 1–7.

Febrianto, J., Kosasih, A.N., Sunarso, J., Ju, Y.H., Indraswati, N., and Ismadji, S., 2009, Equilibrium and kinetic studies in adsorption of heavy metals using biosorbent: A summary of recent studies, *J. Hazard. Mater.*, 162, 616–645.

Fritt-Rasmussen, J., Wegeberg, S., Lassen, P., Wilms, L.B., Renvald, L., Larsen, M.B., Geertz-Hansen, O., Wiktor, J., and Gustavson, K., 2023, Coastline in-situ burning of oil spills, analysis of a Greenland field experiment, *J. Hazard. Mater.*, 441, 1–11.

Gaur, N., Kukreja, A., Yadav, M., and Tiwari, A., 2018, Adsorptive removal of lead and arsenic from aqueous solution using soya bean as a novel biosorbent: equilibrium isotherm and thermal stability studies, *Appl. Water Sci.*, 8:98, 1–12.

Guan, Y., liu, Y., Cao, S., Zhang, W., Wang, Z., Li, Y., and Zeng, H., 2024, Remediation of seawater polluted by oil spills via integrating porous materials with phase-change materials, *Desalination*, 591, 1–12.

Gurav, R., Bhatia, S.K., Choi, T.R., Choi, Y.K., Kim, H.J., Song, H.S., Park, S.L., Lee, H.S., Lee, S.M., Choi, K.Y., and Yang, Y.H., 2021, Adsorptive removal of crude petroleum oil from water using floating pinewood biochar decorated with coconut oil-derived fatty acids, *Sci. of the Total Environ.*, 781, 1–9.

Hammouda, S. ben, Chen, Z., An, C., Lee, K., and Zaker, A., 2022, Buoyant oleophilic magnetic activated carbon nanoparticles for oil spill cleanup, *Clean. Chem. Eng.*, 2, 1–7.

Hiew, B.Y.Z., Lee, L.Y., Lee, X.J., Thangalazhy-Gopakumar, S., and Gan, S., 2021, Utilisation of environmentally friendly okara-based biosorbent for cadmium(II) removal, *Environ. Sci. and Pollut. Res.*, 28, 40608–40622.

Hu, K., Lyu, H., Duan, H., Hu, Z., and Shen, B., 2024, Facilitate the preparation of naturally modified and self-healing superhydrophobic/superoleophilic biochar-based foams for efficient oil-water separation, *J. Hazard. Mater.*, 465, 1–13.

Kandanelli, R., Meesala, L., Kumar, J., Raju, C.S.K., Peddy, V.C.R., Gandham, S., and Kumar, P., 2018, Cost effective and practically viable oil spillage

UNIVERSITAS
GADJAH MADA
**Penggunaan biochar-Fe3O4-beeswax sebagai adsorben hidrofobik dalam mitigasi tumpahan minyak (diesel,
CO, dan CPO)**
Suci Nuraini, Dr. rer. nat. Adhitasari Suratman, S.Si., M.Si.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

mitigation: Comprehensive study with biochar, *Mar. Pollut. Bull.*, 128, 32–40.

Kazak, O., Eker, Y.R., and Tor, A., 2020, In-situ magnetization of porous carbon beads by pyrolysis of waste red mud doped polysulfone beads for efficient oil sorption, *Chem. Eng. and Processing - Process Intensif.*, 158, 1–8.

Khanalilou, P., Naji, L., Mehdipour-Ataei, S., and Abdouss, M., 2024, Superoleophobic polyethylene glycol grafted graphene oxide/polyamide 6 nanofibrous composite membrane for highly efficient separation of oil/water emulsion, *J. Environ. Chem. Eng.*, 12, 1–14.

Kuta, A.A., Grebby, S., and Boyd, D.S., 2025, Remote monitoring of the impact of oil spills on vegetation in the niger delta, Nigeria, *Appl. Sci. (Switzerland)*, 15, 1–24.

Li, S., Zhu, D., Li, K., Yang, Y., Lei, Z., and Zhang, Z., 2013, Soybean curd residue: composition, utilization, and related limiting factors, *ISRN Ind. Eng.*, 2013, 1–8.

Li, Yali, Li, Yanhui, Zang, H., Chen, L., Meng, Z., Li, Hong, Ci, L., Du, Q., Wang, D., Wang, C., Li, Hongliang, and Xia, Y., 2020, ZnCl2-activated carbon from soybean dregs as a high efficiency adsorbent for cationic dye removal: isotherm, kinetic, and thermodynamic studies, *Environ. Technol. (United Kingdom)*, 41, 1–23.

Liu, C., Wang, W., Wu, R., Liu, Y., Lin, X., Kan, H., and Zheng, Y., 2020, Preparation of acid- and alkali-modified biochar for removal of methylene blue pigment, *ACS Omega*, 5, 30906–30922.

Meez, E., Hosseini-Bandegharaei, A., Rahdar, A., Thysiadou, A., Matis, K.A., and Kyzas, G.Z., 2021, Synthetic oil-spills decontamination by using sawdust and activated carbon from aloe vera as absorbents, *Biointerface Res. Appl. Chem.*, 11, 11778–11796.

Mensah, E.O. and Abaliya, P.A., 2026, Incorporation of crude palm oil: Influence on physicochemical, carotenoid, and consumer acceptance of dark chocolate, *Food and Humanity*, 6, 1–7.

Motta, F.L., Stoyanov, S.R., and Soares, J.B.P., 2019, Development and application of an amylopectin-graft-poly(methyl acrylate) solidifier for rapid and efficient containment and recovery of heavy oil spills in aqueous environments, *Chemosphere*, 236, 1–7.

Mukhlis, Hidayat, B., and Sabrina, 2023, Biochar (Arang Hitam Pembenah Tanah Pertanian), USUpress (ed) USUpress.

UNIVERSITAS
GADJAH MADA
**Penggunaan biochar-Fe3O4-beeswax sebagai adsorben hidrofobik dalam mitigasi tumpahan minyak (diesel,
CO, dan CPO)**
Suci Nuraini, Dr. rer. nat. Adhitasari Suratman, S.Si., M.Si.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Navarathna, C.M., Bombuwala Dewage, N., Keeton, C., Pennisson, J., Henderson, R., Lashley, B., Zhang, X., Hassan, E.B., Perez, F., Mohan, D., Pittman, C.U., and Mlsna, T., 2020, Biochar adsorbents with enhanced hydrophobicity for oil spill removal, *ACS Appl. Mater. Interfaces*, 12, 9248–9260.

Nguyen, T.A.H., Ngo, H.H., Guo, W.S., Zhang, J., Liang, S., and Tung, K.L., 2013, Feasibility of iron loaded "okara" for biosorption of phosphorous in aqueous solutions, *Bioresour. Technol.*, 150, 42–49.

Pan, X., Kuang, S., and Wang, X., 2024, Effective strategy for alleviation of oil contamination in marine via the superhydrophobic biochar: Performances, mechanisms and environmental recalcitrance, *J. Clean. Prod.*, 462, 1–10.

Purohit, B.K., Tewari, S., Prasad, K.S.N.V., Talari, V.K., Pandey, N., Choudhury, P., and Panda, S.S., 2024, Marine oil spill clean-up: A review on technologies with recent trends and challenges, *Reg. Stud. Mar. Sci.*, 80, 1–20.

Rizki, A., Syahputra, E., and Pandia, S., 2019, Pengaruh waktu kontak dan massa adsorben biji asam jawa (tamarindus indica) dengan aktivator h3po4 terhadap kapasitas adsorpsi zat warna methylene blue the effect of contact time and mass of tamarind seeds (tamarindus indica) adsorbent using h3po4 activator against adsorption capacity of methylene blue, *Jurnal Teknik Kimia USU*, 08, 54–60.

Sandzhieva, D.A., Baskakov, S.A., Ubushaeva, B. V., Kuznetsova, O. V., Buznik, V.M., and Dedov, A.G., 2024, Superhydrophobic graphene aerogel as a new oil sorbent, *Petroleum Chemistry*, 1317–1326.

Sayed, K., Baloo, L., and Sharma, N.K., 2021, Bioremediation of total petroleum hydrocarbons (Tph) by bioaugmentation and biostimulation in water with floating oil spill containment booms as bioreactor basin, *Int. J. Environ. Res. Public Health*, 18, 1–27.

Shan, D., Shao, Z., Liu, X., Wang, Y., Liu, Y., and Dai, Y., 2022, Efficient adsorption of three dyes by soybean residue (okara) biochar in an aqueous solution, *Desalination Water Treat.*, 266, 212–225.

Siregar, S.H., 2018, Disertasi Sintesis Bentonit Termodifikasi Ctab-Magnetit (Fe 3 O 4 @(Ctab-Bentonit)) Dan Aplikasinya Untuk Remediasi Limbah Minyak Pada Badan Air Program Studi S3 Kimia Departemen Kimia Fakulatas Matematika Dan Ilmu Pengetahuan Alam Universitas Gadjah Mada Yogyakarta 2018,.

Sohni, S., Rashid, O., Ali, S.H., Khan, S.B., Akhtar, K., Mazhar, F., Hossain, M.S., Sayed, M., and Ullah, N., 2024, Magnetically separable sorbent based on

UNIVERSITAS
GADJAH MADA
**Penggunaan biochar-Fe3O4-beeswax sebagai adsorben hidrofobik dalam mitigasi tumpahan minyak (diesel,
CO, dan CPO)**
Suci Nuraini, Dr. rer. nat. Adhitasari Suratman, S.Si., M.Si.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

activated carbon derived from a new precursor Rhizoclonium hookeri for facile oil spill clean-up, *Algal Res.*, 84, 1–11.

Sun, X., Fu, H., Bao, M., Liu, W., Luo, C., Li, Yang, Li, Yiming, and Lu, J., 2022, Development of a new hydrophobic magnetic biochar for removing oil spills on the water surface, *Biochar*, 4:60, 1–17.

Sun, Y., Li, C., Zhang, S., Li, Q., Gholizadeh, M., Wang, Y., Hu, S., Xiang, J., and Hu, X., 2021, Pyrolysis of soybean residue: Understanding characteristics of the products, *Renew. Energy*, 174, 487–500.

Suratman, A., Astuti, D.N., Kusumastuti, P.P., and Sudiono, S., 2024, Okara biochar immobilized calcium-alginate beads as eosin yellow dye adsorbent, *Results Chem.*, 7, 1–9.

Suratman, A., Astuti, D.N., Kusumastuti, P.P., Sudiono, S., Wijaya, H.W., and Wibowo, A.H., 2024, Comprehensive study of thermochemical conversion of biomass okara into biochar, *J. Anal. Appl. Pyrolysis*, 181, 1–12.

Tan, J., Sun, Z., Huang, H., Zhou, G., and Xie, S., 2023, Salting-out: A novel purification technique in biorefinery, *Desalination*, 564, 1–9.

Tangsathitkulchai, Sittichaitaweekul, and Tangsathitkulchai, 2004, Temperature effect on the viscosities of palm oil and coconut oil blended with diesel oil, *JAOCS*, 81, 401–405.

Wang, J. and Guo, X., 2020, Adsorption kinetic models: Physical meanings, applications, and solving methods, *J. Hazard. Mater.*, 390, 1–18.

Wang, J. and Guo, X., 2025, Adsorption kinetic models: Physical meanings, applications, and solving methods, *J. Hazard. Mater.*, 390, .

Wang, Z., Fan, S., Liang, P., Fan, W., Tang, L., and Zhang, Z., 2023, Preparation of superhydrophobic magnetic biomass for oil/water separation, *Bull., Series B*, 85, 157–169.

Wen, X., Wu, Y., Xu, J., Zhou, Y., Jia, L., and Yuan, B., 2024, A facile strategy for improving the hydrophobicity and photo-thermal conversion capability of biochar and its application in the absorption of hazardous chemicals and viscous oil, *Mater. Lett.*, 360, 1–4.

Xiao, B., Jia, J., Wang, W., Zhang, B., Ming, H., Ma, S., Kang, Y., and Zhao, M., 2023, A review on magnetic biochar for the removal of heavy metals from contaminated soils: Preparation, application, and microbial response, *J. of Hazard. Mater. Adv.*, 10, 1–13.

Xu, K., Li, Y., Yang, F., Yang, W., Zhang, L., Xu, C., Kaneko, T., and Hatakeyama, R., 2014, Controllable synthesis of single-and double-walled

UNIVERSITAS
GADJAH MADA
**Penggunaan biochar-Fe3O4-beeswax sebagai adsorben hidrofobik dalam mitigasi tumpahan minyak (diesel,
CO, dan CPO)**
Suci Nuraini, Dr. rer. nat. Adhitasari Suratman, S.Si., M.Si.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

carbon nanotubes from petroleum coke and their application to solar cells, *Carbon N. Y.*, 68, 511–519.

Yi, Y., Huang, Z., Lu, B., Xian, J., Tsang, E.P., Cheng, W., Fang, J., and Fang, Z., 2020, Magnetic biochar for environmental remediation: A review, *Bioresour. Technol.*, 298, 1–15.

Yin, Z., Li, Yuhang, Song, T., Bao, M., Li, Yiming, Lu, J., and Li, Yang, 2020, Preparation of superhydrophobic magnetic sawdust for effective oil/water separation, *J. Clean. Prod.*, 253, 1–13.

Ying, Z., Chen, X., Li, H., Liu, X., Zhang, C., Zhang, J., and Yi, G., 2021, Efficient adsorption of methylene blue by porous biochar derived from soybean dreg using a one-pot synthesis method, *Molecules*, 26, .

Yu, J., Feng, H., Tang, L., Pang, Y., Wang, Jiajia, Zou, J., Xie, Q., Liu, Y., Feng, C., and Wang, Jingjing, 2021, Insight into the key factors in fast adsorption of organic pollutants by hierarchical porous biochar, *J. Hazard. Mater.*, 403, 1–10.

Zaker, A., Chen, Z., Lee, K., and ben Hammouda, S., 2023, Development of sludge-based activated char sorbent with enhanced hydrophobicity for oil spill cleanup, *Environ. Technol. (United Kingdom)*, 44, 1772–1781.

Zeng, G., Huang, X., Yue, J., Fan, B., Liu, Y., and Tang, X.Z., 2022, Solar-assisted efficient cleanup of high-viscosity oil spills using magnetic porous biochar, *J. Alloys Compd.*, 924, 1–9.

Zhang, X., Lv, D., Liu, Z., Xu, D., Yang, F., Tang, Q., Zhong, L., Liang, Z., and Jia, Q., 2025, From waste to Resource: Engineering biochar through optimized HCl activation for microplastic mitigation, *Chem. Eng. Sci.*, 304, 1–10.

Zhou, Y., Jin, X.Y., Lin, H., and Chen, Z.L., 2011, Synthesis, characterization and potential application of organobentonite in removing 2,4-DCP from industrial wastewater, *Chem. Eng. J.*, 166, 176–183.