

## DAFTAR PUSTAKA

- Abasalizadeh, F., Moghaddam, S.V., Alizadeh, E., Akbari, E., Kashani, E., Fazljou, S.M.B., Torbati, M., and Akbarzadeh, A., 2020, Alginate-based hydrogels as drug delivery vehicles in cancer treatment and their applications in wound dressing and 3D bioprinting, *J. Biol. Eng.*, 14, 1–22.
- Abbas, M., Harrache, Z., and Trari, M., 2019, Removal of gentian violet in aqueous solution by activated carbon equilibrium, kinetics, and thermodynamic study, *Adsorpt. Sci. Technol.*, 37, 566–589.
- Abd-Elhamid, A.I., Abu Elgoud, E.M., and Aly, H.F., 2023, Adsorption of palladium from chloride aqueous solution using silica alginate nanomaterial, *Int. J. Biol. Macromol.*, 253, 126754.
- Abdelrahman, E.A. and Basha, M.T., 2025, SrCO<sub>3</sub>/MgO/CaO/CaCO<sub>3</sub> nanocomposite; adsorption; adsorption kinetics and isotherms; crystal violet dye, *Inorganics (Basel)*, 13, 112.
- Ahmad, R. and Ansari, K., 2022, Fabrication of alginate@silver nanoparticles (Alg@AgNPs) bionanocomposite for the sequestration of crystal violet dye from aqueous solution, *Int. J. Biol. Macromol.*, 218, 157–167.
- Aichour, A., Djafer Khodja, H., Zaghouane-Boudiaf, H., Iborra, C.V., and Polo, M.S., 2025, Kinetic adsorption studies of methylene blue and crystal violet dyes removal in single and competitive systems using lemon peels/activated carbon/alginate composite, *React. Kinet., Mech. Catal.*, 138, 303–322.
- Alfuraydi, R.T., Al-Harby, N.F., Alminderej, F.M., Elmehbad, N.Y., and Mohamed, N.A., 2023, Poly (Vinyl Alcohol) Hydrogels Boosted with Cross-Linked Chitosan and Silver Nanoparticles for Efficient Adsorption of Congo Red and Crystal Violet Dyes, *Gels*, 9, .
- Al-Hassan, H.A., Salih, R.M., Jasim, L.S., and Maryam, B., 2025, Adsorptive Removal of Crystal Violet Dye Using Sodium Alginate-g-Poly (Acrylic Acid-Co-Itaconic Acid)/Titanium Dioxide [SA-g-p(AA-IA)/ TiO<sub>2</sub>] Hydrogel Nanocomposite, *J. Nanostruct.*, 15, 1253–1267.
- Aljar, M.A.A., Rashdan, S., and El-Fattah, A.A., 2021, Environmentally friendly polyvinyl alcohol–alginate/ bentonite semi-interpenetrating polymer network nanocomposite hydrogel beads as an efficient adsorbent for the removal of methylene blue from aqueous solution, *Polymers (Basel)*, 13, 1–19.
- An, B., Wang, Y., Guo, Z., Chu, F., Li, Y., Liu, X., Liu, B., Liu, H., Liang, Z., and Zuo, Y., 2025, Constructing graphene oxide/sodium alginate aerogel for efficient purification of dye wastewater, *Mater. Today Commun.*, 42, 111157.
- Arshad, R., Javed, T., and Thumma, A., 2024, Exploring the efficiency of sodium alginate beads and Cedrus deodara sawdust for adsorptive removal of crystal violet dye, *J. Dispers. Sci. Technol.*, 45, 2330–2343.
- Bello, A., Adetunji, A., Balogun, D., Aloko, S., Oyeyemi, S., Kumapayi, T., Odey, E., Oladayo, S., Adedokun, S., Babatunde, P., Kayode, A., Adeyemi, H., Adetunji, D., Adeniyi, C., and Ushahemba, D., 2024, Investigation into the

- optimization process of adsorbent dosage on heavy metal removal, *CUJoSTech.*, 1, 1.
- Berradi, M., Hsissou, R., Khudhair, M., Assouag, M., Cherkaoui, O., El Bachiri, A., and El Harfi, A., 2019, Textile finishing dyes and their impact on aquatic environs, *Heliyon*, 5, e02711.
- Bibi, S., Bibi, A., Mullungal, M.N., Abu-Dieyeh, M., and Al-Ghouti, M.A., 2023, Macroalgae as an eco-friendly and successful green technology for the removal of crystal violet from synthetic and real wastewater, *Arab. J. Chem.*, 16, 105191.
- Blachnio, M., Zienkiewicz-Strzalka, M., Derylo-Marczewska, A., Nosach, L. V., and Voronin, E.F., 2023, Chitosan–Silica Composites for Adsorption Application in the Treatment of Water and Wastewater from Anionic Dyes, *Int. J. Mol. Sci.*, 24, 11818.
- Ceylan, M., Hizal, J., Özer, E.N., Tankov, I., and Yankova, R., 2025, Adsorption of crystal violet using thiazolium ionic liquid-crosslinked alginate hydrogels: Modelling using Box-Behnken experimental design, *Int. J. Biol. Macromol.*, 318, 144951.
- del-Bosque, D., Vila-Crespo, J., Ruipérez, V., Fernández-Fernández, E., and Rodríguez-Nogales, J.M., 2023, Silica-Calcium-Alginate Hydrogels for the Co-Immobilization of Glucose Oxidase and Catalase to Reduce the Glucose in Grape Must, *Gels*, 9, 320.
- Djelad, A., Mokhtar, A., Khelifa, A., Bengueddach, A., and Sassi, M., 2019, Alginate-whey an effective and green adsorbent for crystal violet removal: Kinetic, thermodynamic and mechanism studies, *Int. J. Biol. Macromol.*, 139, 944–954.
- Eltaweil, A.S., Abd El-Monaem, E.M., Elshishini, H.M., El-Aqapa, H.G., Hosny, M., Abdelfatah, A.M., Ahmed, M.S., Hammad, E.N., El-Subruiti, G.M., Fawzy, M., and Omer, A.M., 2022, Recent developments in alginate-based adsorbents for removing phosphate ions from wastewater: a review, *RSC Adv.*, 12, 8228–8248.
- Fabryanty, R., Valencia, C., Soetaredjo, F.E., Putro, J.N., Santoso, S.P., Kurniawan, A., Ju, Y.H., and Ismadji, S., 2017, Removal of crystal violet dye by adsorption using bentonite – alginate composite, *J. Environ. Chem. Eng.*, 5, 5677–5687.
- Felicia, W.X., Rovina, K., Supri, S., Matanjun, P., Mohd Amin, S.F., and Abdul Rahman, M.N., 2025, Next-generation sodium alginate hydrogels for heavy metal ion removal: properties, dynamic adsorption–desorption mechanisms, and sustainable application potential, *Polymer Bulletin*, 4, 1–51.
- Gautam, L., Warkar, S.G., Ahmad, S.I., Kant, R., and Jain, M., 2022, A review on carboxylic acid cross-linked polyvinyl alcohol: Properties and applications, *Polym. Eng. Sci.*, 62, 225–246.
- Gong, X.L., Lu, H.Q., Li, K., and Li, W., 2022, Effective adsorption of crystal violet dye on sugarcane bagasse–bentonite/sodium alginate composite aerogel: Characterisation, experiments, and advanced modelling, *Sep. Purif. Technol.*, 286, 120478.

- Gupta, S., Prajapati, A., Kumar, A., and Acharya, S., 2023, Synthesis of silica aerogel and its application for removal of crystal violet dye by adsorption, *Watershed Ecol. Environ.*, 5, 241–254.
- Hu, T., Liu, Q., Gao, T., Dong, K., Wei, G., and Yao, J., 2018, Facile Preparation of Tannic Acid-Poly(vinyl alcohol)/Sodium Alginate Hydrogel Beads for Methylene Blue Removal from Simulated Solution, *ACS Omega*, 3, 7523–7531.
- Hussain, S., Salman, M., Al-Ahmary, K.M., and Ahmed, M., 2025, Synthesis of potential adsorbent for removal of malachite green dye using alginate hydrogel nanocomposites, *Int. J. Biol. Macromol.*, 289, 138816.
- Isawi, H., 2020, Using Zeolite/Polyvinyl alcohol/sodium alginate nanocomposite beads for removal of some heavy metals from wastewater, *Arab. J. Chem.*, 13, 5691–5716.
- İşık, C., Vatansever, Ö., and Teke, M., 2025, Enhanced phenolic compound removal via laccase immobilization on PVA/GG nanofiber membranes: Structural optimization and application, *J. Water Process Eng.*, 77, 108451.
- Jabli, M., 2020, Synthesis, characterization, and assessment of cationic and anionic dye adsorption performance of functionalized silica immobilized chitosan bio-polymer, *Int. J. Biol. Macromol.*, 153, 305–316.
- Jiao, Y., Han, D., Lu, Y., Rong, Y., Fang, L., Liu, Y., and Han, R., 2017, Characterization of pine-sawdust pyrolytic char activated by phosphoric acid through microwave irradiation and adsorption property toward CDNB in batch mode, *Desalin. Water Treat.*, 77, 247–255.
- Khoj, M.A., 2024, Fabrication of silica/calcium alginate nanocomposite based on rice husk ash for efficient adsorption of phenol from water, *RSC Adv.*, 14, 24322–24334.
- Kim, J., Yu, H., Kim, S. Bin, Kim, N.Y., and Joo, J.B., 2025, Synthesis and Property Control of Bead-Shaped Silica Adsorbents for Rhodamine B Dye Adsorption, *Korean J. Chem. Eng.*, 42, 725–736.
- Kosmulski, M., 2023, The pH dependent surface charging and points of zero charge. X. Update, *Adv. Colloid Interface Sci.*, 319, 102973.
- Lahiri, S.K. and Liu, L., 2021, Fabrication of a Nanoporous Silica Hydrogel by Cross-Linking of SiO<sub>2</sub>-H<sub>3</sub>BO<sub>3</sub>-Hexadecyltrimethoxysilane for Excellent Adsorption of Azo Dyes from Wastewater, *Langmuir*, 37, 8753–8764.
- Li, B. and Yin, H., 2020, Excellent biosorption performance of novel alginate-based hydrogel beads crosslinked by lanthanum(III) for anionic azo-dyes from water, *J. Dispers. Sci. Technol.*, 0, 1–13.
- Li, X., Li, K., Wu, J., Li, B., Wang, W., and Tang, J., 2024, Facile preparation of sodium alginate gel beads enhanced by polyamino-modified 3D carbon for efficient remediation of organic dyes in wastewater, *Sep. Purif. Technol.*, 339, 126637.
- Li, Z. and Lin, Z., 2021, Recent advances in polysaccharide-based hydrogels for synthesis and applications, *Aggregate*, 2, 1–26.
- Lin, D., Shi, M., Zhang, Y., Wang, D., Cao, J., Yang, J., and Peng, C., 2019, 3D crateriform and honeycomb polymer capsule with nano re-entrant and screen

- mesh structures for the removal of Multi-component cationic dyes from water, *Chem. Eng. J.*, 375, 121911.
- Lv, B., Ren, J., Chen, Y., Guo, S., Wu, M., and You, L., 2022, Sargassum fusiforme polysaccharide-based hydrogel microspheres enhance crystal violet dye adsorption properties, *Molecules*, 27, 4686.
- Ma, Y., Huo, T., Xiao, X., Yin, T., Lei, Y., Zhang, W., Nie, X., and Huang, Q., 2024, Strength modification of sodium alginate–polyvinyl alcohol gel beads and efficient aqueous phase phosphorus removal, *Polym. Bull.*, 81, 7255–7272.
- Ma, Y., Qi, P., Ju, J., Wang, Q., Hao, L., Wang, R., Sui, K., and Tan, Y., 2019, Gelatin/alginate composite nanofiber membranes for effective and even adsorption of cationic dyes, *Compos. B. Eng.*, 162, 671–677.
- Mashkoor, F. and Nasar, A., 2020, Magsorbents: Potential candidates in wastewater treatment technology – A review on the removal of methylene blue dye, *J. Magn. Water*, 500, 166408.
- Messaoudi, N., El Khomri, M., El Mouden, A., Bouich, A., Jada, A., Lacherai, A., Iqbal, H.M.N., Mulla, S.I., Kumar, V., and Américo-Pinheiro, J.H.P., 2024, Regeneration and reusability of non-conventional low-cost adsorbents to remove dyes from wastewaters in multiple consecutive adsorption–desorption cycles: a review, *Biomass Convers. Biorefin.*, 14, 11739–11756.
- Miyah, Y., Lahrichi, A., Idrissi, M., Boujraf, S., Taouda, H., and Zerrouq, F., 2017, Assessment of adsorption kinetics for removal potential of Crystal Violet dye from aqueous solutions using Moroccan pyrophyllite, *J. Assoc. Arab Univ. Basic Appl.*, 23, 20–28.
- Mok, C.F., Ching, Y.C., Muhamad, F., Abu Osman, N.A., Hai, N.D., and Che Hassan, C.R., 2020, Adsorption of Dyes Using Poly(vinyl alcohol) (PVA) and PVA-Based Polymer Composite Adsorbents: A Review, *J. Polym. Environ.*, 28, 775–793.
- Mukherjee, K., Dutta, P., Saha, A., Dey, S., Sahu, V., Badwaik, H., and Giri, T.K., 2024, Alginate based semi-IPN and IPN hydrogel for drug delivery and regenerative medicine, *J. Drug Deliv. Sci. Technol.*, 92, 105402.
- Mulushewa, Z., Dinbore, W.T., and Ayele, Y., 2021, Removal of methylene blue from textile waste water using kaolin and zeolite-x synthesized from Ethiopian kaolin., *Environ. Anal. Health Toxicol.*, 36, e2021007-0.
- Najafi, H., Asasian-Kolur, N., and Sharifian, S., 2021, Adsorption of chromium(VI) and crystal violet onto granular biopolymer-silica pillared clay composites from aqueous solutions, *J. Mol. Liq.*, 344, 117822.
- Nguyen, P.X.T., Pham, A.P.N., Nguyen, H.T.T., Do, T.C., and Le, P.K., 2024, Flexible aerogel composites for the elimination of crystal violet and methyl orange, *J. Porous Mater.*, 31, 2003–2016.
- Nie, J., Pei, B., Wang, Z., and Hu, Q., 2019, Construction of ordered structure in polysaccharide hydrogel: A review., *Carbohydr. Polym.*, 205, 225–235.
- Noori, M. and Tahmasebpour, M., 2023, Novel low-cost magnetic clinoptilolite powders/granules for the removal of crystal violet in single and binary systems, *Iran. J. Chem. Chem. Eng.*, 42, 3601–3623.

- Ogata, F., Sugimura, K., Nagai, N., Saenjurng, C., Nishiwaki, K., and Kawasaki, N., 2023, Adsorption efficiency of crystal violet from the aqueous phase onto a carbonaceous material prepared from waste cotton and polyester, *RSC Sustain.*, 2, 179–186.
- Oktor, K., Hasirci, G., and Hilmioglu, N., 2025, Preparation and characterization of renewable biopolymer-based alginate adsorbent for removing of crystal violet dye from water, *J. Indian Chem. Soc.*, 102, 101766.
- Pashaei-Fakhri, S., Peighambaroudost, S.J., Foroutan, R., Arsalani, N., and Ramavandi, B., 2021, Crystal violet dye sorption over acrylamide/graphene oxide bonded sodium alginate nanocomposite hydrogel, *Chemosphere*, 270, 129419.
- Peretz, S., Anghel, D.F., Vasilescu, E., Florea-Spiroiu, M., Stoian, C., and Zgherea, G., 2015, Synthesis, characterization and adsorption properties of alginate porous beads, *Polym. Bull.*, 72, 3169–3182.
- Phu, N.A.M.M., Wi, E., Jeong, G., Kim, H., Singha, N.R., and Chang, M., 2025, Highly efficient dye adsorption by hierarchical porous SA/PVA/ZIF-8 composite microgels prepared via microfluidics, *Carbohydr. Polym.*, 350, 123016.
- Priya, A.S., Premanand, R., Ragupathi, I., Bhaviripudi, V.R., Aepuru, R., Kannan, K., and Shanmugaraj, K., 2024, Comprehensive Review of Hydrogel Synthesis, Characterization, and Emerging Applications, *J. Compos. Sci.*, 8, 457.
- Puscaselu, R.G., Lobiuc, A., Dimian, M., and Covasa, M., 2020, Alginate: From food industry to biomedical applications and management of metabolic disorders, *Polymers (Basel)*, 12, 1–30.
- Qiu, Z., Lu, D., Yu, K., Zhang, Q., He, L., Zhang, S., and Chen, C., 2024, Large-capacity adsorption of the organic dye with surface-silanol-rich hybrid nano silica, *Chem. Phys. Lett.*, 847, 141356.
- Rahman, M.M.K. and Rumon, Md.M.H., 2025, Synthesis of PVA-Based Hydrogels for Biomedical Applications: Recent Trends and Advances, *Gels*, 11, 88.
- Rahman, N.A.A., Musa, M., Kassim, K., and Said, N.R., 2023, a Review of the Synthesis and Modification of Pva-Alginate As Binder of Metal Atom, *Malaysian Journal of Analytical Sciences*, 27, 314–328.
- Ransing, A.A., Wang, Q., Dhavale, R.P., Choi, H., Bangi, U.K.H., Parale, V.G., Lee, W., Kanamori, K., and Park, H.H., 2025, Ionotropically-engineered synthesis of mechanically robust hybrid sodium alginate–silica aerogels with enhanced specific surface area for high-capacity and selective dye adsorption from wastewater, *Chem. Eng. J.*, 507, 160590.
- Rashid, R., Shafiq, I., Akhter, P., Iqbal, M.J., and Hussain, M., 2021, A state-of-the-art review on wastewater treatment techniques: the effectiveness of adsorption method, *Environ. Sci. Pollut. Res.*, 28, 9050–9066.
- Rather, R.A., Bhat, M.A., and Shalla, A.H., 2023, Development of sodium alginate-guar-gum-tannic acid based nanocomposite hydrogel beads for removal of malachite green dye, *Mater. Today Commun.*, 36, 106358.

- Raus, A.R., Wan Nawawi, W.M.F., and Nasaruddin, R.R., 2021, Alginate and alginate composites for biomedical applications, *Asian J. Pharm. Sci.*, 16, 280–306.
- Renu and Sithole, T., 2024, A review on regeneration of adsorbent and recovery of metals: Adsorbent disposal and regeneration mechanism, *S Afr J Chem Eng*, 50, 39–50.
- Rosalina, K.N., Wukirsari, T., Hudiyono, S., and Handayani, S., 2024, Utilization of silica gel for the synthesis of geranyl laurate and citronellyl laurate, *Bull. Chem. React. Eng. Catal.*, 19, 350–360.
- Rozi, S.K.M., Qin, K.Y., Halim, H.N.A., Al-Rajabi, M.M.H., and Ishak, A.R., 2025, Green removal of toxic crystal violet using agricultural wastes: mechanisms, phytotoxicity, economic, and greenness profiling, *Biomass Convers Biorefin*, 0, 1–19.
- Shi, C., Zeng, R.G., Yuan, S.C., Zhang, L., Wang, X.Y., Hao, L.T., Hao, X. Di, Zhang, N., and Wu, Y.Y., 2024, Preparing a heavy-metal adsorbent based on alginate-like extracellular polymers from conventional activated sludge via polyethyleneimine grafting, *Sustain. Chem. Pharm.*, 38, 101472.
- Shi, T., Xie, Z., Mo, X., Feng, Y., Peng, T., and Song, D., 2022, Highly efficient adsorption of heavy metals and cationic dyes by smart functionalized sodium alginate hydrogels, *Gels*, 8, 343.
- Siddiqui, V.U., Ilyas, R.A., Sapuan, S.M., Hamid, N.H.A., Khoo, P.S., Chowdhury, A., Atikah, M.S.N., Rani, M.S.A., and Asyraf, M.R.M., 2025, Alginate-based materials as adsorbent for sustainable water treatment, *Int. J. Biol. Macromol.*, 298, 139946.
- Singh, A., Singh, N., and Kaur, N., 2024, Design, Synthesis, and Antimicrobial Activity of Biodegradable Sodium Alginate/COF Polymeric Films for Smart Monitoring of Food Spoilage and Active Food Packaging, *ACS Food Sci. Technol.*, 4, 2233–2243.
- Su, H., Qiu, W., Deng, T., Zheng, X., Wang, H., and Wen, P., 2024, Fabrication of physically multi-crosslinked sodium alginate/carboxylated-chitosan/montmorillonite-base aerogel modified by polyethyleneimine for the efficient adsorption of organic dye and Cu(II) contaminants, *Sep. Purif. Technol.*, 330, 125321.
- Sun, S., Zhu, Y., Gu, Z., Chu, H., Hu, C., Gao, L., and Zhao, X., 2023, Adsorption of crystal violet on activated bamboo fiber powder from water: preparation, characterization, kinetics and isotherms, *RSC Adv.*, 13, 6108–6123.
- Tang, L., Liu, C., Liu, X., Zhang, L., Fan, B., Wang, B., and Wang, F., 2025, Efficient adsorption of crystal violet by different temperature pyrolyzed biochar-based sodium alginate microspheres: A green solution for food industry dye removal, *Food Chem. X*, 26, 102311.
- Tao, J., Xiong, J., Jiao, C., Zhang, D., Lin, H., and Chen, Y., 2017, Cellulose/polymer/silica composite cotton fiber based on a hyperbranch-mesostructure system as versatile adsorbent for water treatment, *Carbohydr. Polym.*, 166, 271–280.

- Vakili, M., Deng, S., Shen, L., Shan, D., Liu, D., and Yu, G., 2019, Regeneration of Chitosan-Based Adsorbents for Eliminating Dyes from Aqueous Solutions, *Sep. Purif. Rev.*, 48, 1–13.
- Venkataraman, S., Viswanathan, V., Thangaiah, S.G., Omine, K., and Mylsamy, P., 2023, Adsorptive exclusion of crystal violet dye using barium encapsulated alginate/carbon composites: characterization and adsorption modeling studies, *Environ. Sci. Pollut. Res.*, 30, 106718–106735.
- Vijayaraghavan, G. and Shanthakumar, S., 2020, Removal of crystal violet dye in textile effluent by coagulation using algal alginate from brown algae sargassum sp., *Desalin. Water Treat.*, 196, 402–408.
- Wang, Y. and Lu, Y., 2023, Sodium alginate-based functional materials toward sustainable applications: water treatment and energy storage, *Ind. Eng. Chem. Res.*, 62, 11279–11304.
- Wang, Y., Su, J., Ali, A., Chang, Q., Bai, Y., and Gao, Z., 2022, Enhanced nitrate, manganese, and phenol removal by polyvinyl alcohol/sodium alginate with biochar gel beads immobilized bioreactor: Performance, mechanism, and bacterial diversity, *Bioresour. Technol.*, 348, 126818.
- Wawszczak, A., Kocki, J., and Kołodyńska, D., 2024, Alginate as a Sustainable and Biodegradable Material for Medical and Environmental Applications—The Case Studies, *J. Biomed. Mater. Res. B. Appl. Biomater.*, 112, e35475.
- Wu, Z., Liao, Q., Chen, P., Zhao, D., Huo, J., An, M., Li, Y., Wu, J., Xu, Z., Sun, B., and Huang, M., 2022, Synthesis, characterization, and methylene blue adsorption of multiple-responsive hydrogels loaded with Huangshui polysaccharides, polyvinyl alcohol, and sodium carboxyl methyl cellulose, *J. Biol. Macromol.*, 216, 157–171.
- Xiang, D., Fang, F., Shi, X., Rao, C., Bao, S., Xian, B., Chu, F., and Fang, T., 2025, Analysis and comparative study of preparation, mechanisms, and application of sodium alginate-based composite materials for highly efficient removal of cadmium cations, *J. Clean. Prod.*, 499, 145234.
- Xie, J., Lin, R., Liang, Z., Zhao, Z., Yang, C., and Cui, F., 2021, Effect of cations on the enhanced adsorption of cationic dye in Fe<sub>3</sub>O<sub>4</sub>-loaded biochar and mechanism, *J. Environ. Chem. Eng.*, 9, 105744.
- Yaqin, A.A.A., Suherman, S., Siswanta, D., and Hosseini-Bandegharai, A., 2025, Fast preconcentration of Pb(II) and Cu(II) in liquid milk by syringe solid-phase extraction using alginate and PVA biopolymer loaded with activated carbon, *Anal. Methods*, 17, 1813–1824.
- Yumin, A., Liguó, D., Yi, Y., and Yongna, J., 2022, Mechanical properties of an interpenetrating network poly(vinyl alcohol)/alginate hydrogel with hierarchical fibrous structures, *RSC Adv.*, 12, 11632–11639.
- Yunusa, U., Usman, B., and Bashir Ibrahim, M., 2020, Adsorptive Removal of Basic Dyes and Hexavalent Chromium from Synthetic Industrial Effluent: Adsorbent Screening, Kinetic and Thermodynamic Studies, *International J. Eng. Manuf.*, 10, 54–74.
- Yunusa, U., Usman, B., and Bashir Ibrahim, M., 2021, Algerian Journal of Chemical Engineering Cationic dyes removal from wastewater by adsorptive method: A systematic in-depth review, *Alger. J. Chem. Eng.*, 02, 6–40.

- Zeng, H., Xu, K., Wang, F., Sun, S., Li, D., and Zhang, J., 2021, Preparation of adsorbent based on water treatment residuals and chitosan by homogeneous method with freeze-drying and its As(V) removal performance, *Int. J. Biol. Macromol. Macromol.*, 184, 313–324.
- Zhang, P., Zou, K., Yuan, L., Liu, J., Liu, B., Qing, T.P., and Feng, B., 2022, A biomass resource strategy for alginate-polyvinyl alcohol double network hydrogels and their adsorption to heavy metals, *Sep. Purif. Technol.*, 301, 122050.
- Zhao, Q., Chen, X., Ji, W., Zhang, J., Li, Xun, Liu, Z., Wang, W., Liu, H., Wang, Yu, Nan, B., Li, Xia, Wang, Yuhua, and Liu, J., 2025, From lab to table: Recent advances in the application of sodium alginate-based hydrogel beads in the food industry, *Food Res. Int.*, 217, 116843.
- Zheng, C., Wu, Q., Sun, K., Xu, B., Sun, Y., and Zheng, H., 2024, Insight into the impact of environmental factors on heavy metal adsorption by sodium alginate hydrogel: Inspiration on applicable scenarios, *Environ. Res.*, 262, 119878.
- Zhou, Yanbo, Lu, J., Zhou, Yi, and Liu, Y., 2019, Recent advances for dyes removal using novel adsorbents: A review, *Environ. Pollut.*, 252, 352–365.