

REFERENCES

- Al-Zebari, N., Best, S.M. and Cameron, R.E. (2018). Effects of Reaction pH on self-crosslinked chitosan-carrageenan Polyelectrolyte Complex Gels and Sponges. *Journal of Physics: Materials*, 2(1), p.015003. doi:<https://doi.org/10.1088/2515-7639/aae9ab>.
- Abou-Okeil, A., Fahmy, H.M., El-Bisi, M.K. and Ahmed-Farid, O.A. (2018). Hyaluronic acid/Na-alginate films as topical bioactive wound dressings. *European Polymer Journal*, 109, pp.101–109. doi:10.1016/j.eurpolymj.2018.09.003.
- Al-Zebari, N., Best, S.M. and Cameron, R.E. (2018). Effects of Reaction pH on self-crosslinked chitosan-carrageenan Polyelectrolyte Complex Gels and Sponges. *Journal of Physics: Materials*, 2(1), p.015003. doi:<https://doi.org/10.1088/2515-7639/aae9ab>.
- Arda, O., Göksügür, N. and Tüzün, Y. (2014). Basic histological structure and functions of facial skin. *Clinics in Dermatology*, [online] 32(1), pp.3–13. doi:10.1016/j.clindermatol.2013.05.021.
- Auf dem Keller, U. and Sabino, F. (2015) ‘Matrix metalloproteinases in impaired wound healing’, *Metalloproteinases In Medicine*, p. 1. doi:10.2147/mnm.s68420.
- Cabral-Pacheco, G.A., Garza-Veloz, I., Castruita-De la Rosa, C., Ramirez-Acuña, J.M., Perez-Romero, B.A., Guerrero-Rodriguez, J.F., Martinez-Avila, N. and Martinez-Fierro, M.L. (2020). The Roles of Matrix Metalloproteinases and Their Inhibitors in Human Diseases. *International Journal of Molecular Sciences*, 21(24), p.9739. doi:<https://doi.org/10.3390/ijms21249739>.
- Caley, M.P., Martins, V.L.C. and O’Toole, E.A. (2015). Metalloproteinases and Wound Healing. *Advances in Wound Care*, [online] 4(4), pp.225–234. doi:<https://doi.org/10.1089/wound.2014.0581>.
- Caridade, S.G., Monge, C., Gilde, F., Boudou, T., Mano, J.F. and Picart, C. (2013). Free-Standing Polyelectrolyte Membranes Made of Chitosan and Alginate. *Biomacromolecules*, 14(5), pp.1653–1660. doi:10.1021/bm400314s.
- Chang, S.-H., Wu, C.-H. and Tsai, G.-J. (2018). Effects of Chitosan Molecular Weight on Its Antioxidant and Antimutagenic Properties. *Carbohydrate Polymers*, 181, pp.1026–1032. doi:<https://doi.org/10.1016/j.carbpol.2017.11.047>.
- Chen, X., Zhang, M., Wang, X., Chen, Y., Yan, Y., Zhang, L. and Zhang, L. (2017). Peptide-modified chitosan hydrogels promote skin wound healing by enhancing wound angiogenesis and inhibiting inflammation. *American*

journal of translational research, [online] 9(5), pp.2352–2362. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5446517/> [Accessed 7 May 2022].

- Del Gaudio, P., Amante, C., Civale, R., Bizzarro, V., Petrella, A., Pepe, G., Campiglia, P., Russo, P. and Aquino, R.P. (2020). In situ gelling alginate-pectin blend particles loaded with Ac2-26: A new weapon to improve wound care armamentarium. *Carbohydrate Polymers*, 227, p.115305. doi:10.1016/j.carbpol.2019.115305.
- Deng, Y., Yang, N., Valentine Okoro, O., Shavandi, A. and Nie, L. (2022). Alginate-Based Composite and Its Biomedical Applications. *Properties and Applications of Alginates*. doi:10.5772/intechopen.99494.
- Du, X., Wu, L., Yan, H., Qu, L., Wang, L., Wang, X., Ren, S., Kong, D. and Wang, L. (2019). Multifunctional Hydrogel Patch with Toughness, Tissue Adhesiveness, and Antibacterial Activity for Sutureless Wound Closure. *ACS Biomaterials Science & Engineering*, 5(5), pp.2610–2620. doi:10.1021/acsbomaterials.9b00130.
- Ehterami, A., Salehi, M., Farzamfar, S., Samadian, H., Vaez, A., Ghorbani, S., Ai, J. and Sahrapeyma, H. (2019). Chitosan/alginate hydrogels containing Alpha-tocopherol for wound healing in rat model. *Journal of Drug Delivery Science and Technology*, 51, pp.204–213. doi:10.1016/j.jddst.2019.02.032.
- Elangwe, C.N., Morozkina, S.N., Olekhovich, R.O., Krasichkov, A., Polyakova, V.O. and Uspenskaya, M.V. (2022). A Review on Chitosan and Cellulose Hydrogels for Wound Dressings. *Polymers*, [online] 14(23), p.5163. doi:10.3390/polym14235163.
- Elbially, Z.I., Assar, D.H., Abdelnaby, A., Asa, S.A., Abdelhice, E.Y., Ibrahim, S.S., Abdel-Daim, M.M., Almeer, R. and Atiba, A. (2021). Healing potential of *Spirulina platensis* for skin wounds by modulating bFGF, VEGF, TGF- β 1 and α -SMA genes expression targeting angiogenesis and scar tissue formation in the rat model. *Biomedicine & Pharmacotherapy*, 137, p.111349. doi:<https://doi.org/10.1016/j.biopha.2021.111349>.
- Flanagan, M. (2013). *Wound Healing and Skin Integrity : Principles and Practice*. Oxford: John Wiley & Sons.
- Fiskina Zulfa Kamala, Wiratni Budhijanto, Eko Priyo Purnomo and Prihati Sih Nugraheni (2022). Optimization Concentration of Irgacure® 2959 as Photo-initiator on Chitosan-Kappa-Carrageenan Based Hydrogel for Tissue Sealant. *International Journal of Technology: IJ Tech*, 13(8), pp.1715–1715. doi:<https://doi.org/10.14716/ijtech.v13i8.6166>.

- Gao, M., Nguyen, T.T., Suckow, M.A., Wolter, W.R., Gooyit, M., Mobashery, S. and Chang, M. (2015). Acceleration of Diabetic Wound Healing Using a Novel protease–anti-protease Combination Therapy. *Proceedings of the National Academy of Sciences*, 112(49), pp.15226–15231. doi:<https://doi.org/10.1073/pnas.1517847112>.
- Grzela, T., Krejner, A. and Litwiniuk, M. (2016). Matrix metalloproteinases in the wound microenvironment: therapeutic perspectives. *Chronic Wound Care Management and Research*, p.29. doi:<https://doi.org/10.2147/cwcmr.s73819>.
- Gutiérrez-Fernández, A., Inada, M., Balbín, M., Fueyo, A., Pitiot, A.S., Astudillo, A., Hirose, K., Hirata, M., Shapiro, S.D., Noël, A., Werb, Z., Krane, S.M., López-Otín, C. and Puente, X.S. (2007). Increased inflammation delays wound healing in mice deficient in collagenase-2 (MMP-8). *The FASEB Journal*, 21(10), pp.2580–2591. doi:<https://doi.org/10.1096/fj.06-7860com>.
- Hamed, H., Moradi, S., Hudson, S.M., Tonelli, A.E. and King, M.W. (2022). Chitosan based bioadhesives for biomedical applications: A review. *Carbohydrate Polymers*, [online] 282, p.119100. doi:[10.1016/j.carbpol.2022.119100](https://doi.org/10.1016/j.carbpol.2022.119100).
- Kandhwal, M., Behl, T., Singh, S., Sharma, N., Arora, S., Bhatia, S., Al-Harrasi, A., Sachdeva, M. and Bungau, S. (2022). Role of matrix metalloproteinase in wound healing. *American Journal of Translational Research*, [online] 14(7), pp.4391–4405. Available at: <https://pubmed.ncbi.nlm.nih.gov/35958464>.
- Kabanov, Alexander V. and Vinogradov, Serguei V. (2009). Nanogels as Pharmaceutical Carriers: Finite Networks of Infinite Capabilities. *Angewandte Chemie International Edition*, 48(30), pp.5418–5429. doi:<https://doi.org/10.1002/anie.200900441>.
- Landén, N.X., Li, D. and Ståhle, M. (2016). Transition from Inflammation to proliferation: a Critical Step during Wound Healing. *Cellular and Molecular Life Sciences*, 73(20), pp.3861–3885. doi:<https://doi.org/10.1007/s00018-016-2268-0>.
- Liang, X., Perez, M.A.M.-J., Nwoko, K.C., Egbers, P., Feldmann, J., Csetenyi, L. and Gadd, G.M. (2019). Fungal formation of selenium and tellurium nanoparticles. *Applied Microbiology and Biotechnology*, 103(17), pp.7241–7259. doi:<https://doi.org/10.1007/s00253-019-09995-6>.
- Liu, H., Zhang, Y., Zhang, J., Xiong, Y., Peng, S., David Julian McClements, Liang, R. and Liu, W. (2022). Utilization of protein nanoparticles to improve the dispersibility, stability, and functionality of a natural pigment: Norbixin. *Food Hydrocolloids*, 124, pp.107329–107329. doi:<https://doi.org/10.1016/j.foodhyd.2021.107329>.

- Maita, K.C., Avila, F.R., Torres-Guzman, R.A., Garcia, J.P., Eldaly, A.S., Palmieri, L., Emam, O.S., Ho, O. and Forte, A.J. (2022). Local anti-inflammatory Effect and Immunomodulatory Activity of chitosan-based Dressing in Skin Wound healing: a Systematic Review. *Journal of Clinical and Translational Research*, 8(6), pp.488–498. doi:<https://doi.org/10.18053/jctres.08.202206.007>.
- Matica, Aachmann, Tøndervik, Sletta and Ostafe (2019). Chitosan as a Wound Dressing Starting Material: Antimicrobial Properties and Mode of Action. *International Journal of Molecular Sciences*, 20(23), p.5889. doi:10.3390/ijms20235889.
- McKnight, G., Shah, J. and Hargest, R. (2021). Physiology of the skin. *Surgery (Oxford)*, 40(1). doi:10.1016/j.mpsur.2021.11.005.
- Mollah, M.Z.I., Zahid, H.M., Mahal, Z., Faruque, M.R.I. and Khandaker, M.U. (2021). The Usages and Potential Uses of Alginate for Healthcare Applications. *Frontiers in Molecular Biosciences*, 8. doi:10.3389/fmolb.2021.719972.
- Neamtu, B., Barbu, A., Negrea, M.O., Berghea-Neamtu, C.Ş., Popescu, D., Zăhan, M. and Mireşan, V. (2022). Carrageenan-Based Compounds as Wound Healing Materials. *International Journal of Molecular Sciences*, [online] 23(16), p.9117. doi:<https://doi.org/10.3390/ijms23169117>.
- Nguyen, T.T., Mobashery, S. and Chang, M. (2016) ‘Roles of matrix metalloproteinases in cutaneous wound healing’, *Wound Healing - New insights into Ancient Challenges* [Preprint]. doi:10.5772/64611.
- Onyekwelu, I., Yakkanti, R., Protzer, L., Pinkston, C.M., Tucker, C. and Seligson, D. (2017). Surgical Wound Classification and Surgical Site Infections in the Orthopaedic Patient. *JAAOS: Global Research and Reviews*, 1(3), p.e022. doi:<https://doi.org/10.5435/jaaosglobal-d-17-00022>.
- Ousey, K., Djohan, R., Dowsett, C., Ferreira, F., Hurd, T., Romanelli, M. and Sandy-Hodgetts, K. (2018). Surgical wound dehiscence: Improving prevention and outcomes. *pure.hud.ac.uk*. [online] Available at: <https://pure.hud.ac.uk/en/publications/surgical-wound-dehiscence-improving-prevention-and-outcomes>.
- Pacheco-Quito, E.-M., Ruiz-Caro, R. and Veiga, M.-D. (2020). Carrageenan: Drug Delivery Systems and Other Biomedical Applications. *Marine Drugs*, 18(11), p.583. doi:10.3390/md18110583.
- Phillips, J.Duncan., Kim, C.S., Fonkalsrud, E.W., Zeng, H. and Dindar, H. (1992). Effects of chronic corticosteroids and vitamin a on the healing of intestinal

anastomoses. *The American Journal of Surgery*, 163(1), pp.71–77.
doi:10.1016/0002-9610(92)90255-p.

Reiss, M.J., Han, Y.-P., Garcia, E., Goldberg, M., Yu, H. and Garner, W.L. (2010). Matrix metalloproteinase-9 Delays Wound Healing in a Murine Wound Model. *Surgery*, 147(2), pp.295–302.
doi:<https://doi.org/10.1016/j.surg.2009.10.016>.

Rhea, L. and Dunnwald, M. (2020). Murine Excisional Wound Healing Model and Histological Morphometric Wound Analysis. *Journal of Visualized Experiments*, (162). doi:<https://doi.org/10.3791/61616>.

Sandhiya, S., Dkhar, S.A. and Surendiran, A. (2009). Emerging Trends of Nanomedicine - an Overview. *Fundamental & Clinical Pharmacology*, 23(3), pp.263–269. doi:<https://doi.org/10.1111/j.1472-8206.2009.00692.x>.

Selvakumari Ulagesan, Krishnan, S., Nam, T. and Choi, Y. (2023). The Influence of κ -Carrageenan-R-Phycoerythrin Hydrogel on in Vitro Wound Healing and Biological Function. *International Journal of Molecular Sciences*, [online] Serra, R., Buffone, G., Falcone, D., Molinari, V., Scaramuzzino, M., Gallelli, L. and de

Serra, R., Buffone, G., Falcone, D., Molinari, V., Scaramuzzino, M., Gallelli, L. and de Francis, S. (2013). Chronic venous leg ulcers are associated with high levels of metalloproteinases-9 and neutrophil gelatinase-associated lipocalin. *Wound Repair and Regeneration*, 21(3), pp.395–401.
doi:<https://doi.org/10.1111/wrr.12035>.

Shahzad, A., Nawaz, M., Dae Sung Lee, Jang, J., Tahir, K., Kim, J., Lim, Y., Verykios, V.S. and Seung Hoon Woo (2019). Ti3C2Tx MXene core-shell spheres for ultrahigh removal of mercuric ions. *Chemical Engineering Journal*, 368, pp.400–408. doi:<https://doi.org/10.1016/j.cej.2019.02.160>.

Teklemariam, B.T., Biyana, C.F. and Asfaw, S.A. (2022). Determinants of Postoperative Abdominal Wound Dehiscence among Patients Operated in a Tertiary Hospital. *Ethiopian Journal of Health Sciences*, [online] 32(4), pp.739–746. doi:<https://doi.org/10.4314/ejhs.v32i4.10>.

Francis, S. (2013). Chronic venous leg ulcers are associated with high levels of metalloproteinases-9 and neutrophil gelatinase-associated lipocalin. *Wound Repair and Regeneration*, 21(3), pp.395–401.
doi:<https://doi.org/10.1111/wrr.12035>, pp.12358–12358.
doi:<https://doi.org/10.3390/ijms241512358>.

Tomal, W. and Ortyl, J. (2020). Water-Soluble Photoinitiators in Biomedical Applications. *Polymers*, 12(5), p.1073.
doi:<https://doi.org/10.3390/polym12051073>.

- Umar, M., Sastry, K.S., Al Ali, F., Al-Khulaifi, M., Wang, E. and Chouchane, A.I. (2018). Vitamin D and the Pathophysiology of Inflammatory Skin Diseases. *Skin Pharmacology and Physiology*, [online] 31(2), pp.74–86. doi:10.1159/000485132.
- Varaprasad, K., Jayaramudu, T., Kanikireddy, V., Toro, C. and Sadiku, E.R. (2020). Alginate-based composite materials for wound dressing application: A mini review. *Carbohydrate Polymers*, 236, p.116025. doi:10.1016/j.carbpol.2020.116025.
- Waugh, A. and Grant, A. (2014). *Ross and Wilson anatomy and physiology in health and illness*. 12th ed. Edinburgh: Elsevier.
- Xu, L., Wang, Y.-Y., Huang, J., Chen, C.-Y., Wang, Z.-X. and Xie, H. (2020). Silver nanoparticles: Synthesis, medical applications and biosafety. *Theranostics*, [online] 10(20), pp.8996–9031. doi:<https://doi.org/10.7150/thno.45413>.
- Yabluchanskiy, A., Ma, Y., Iyer, R.P., Hall, M.E. and Lindsey, M.L. (2013). Matrix Metalloproteinase-9: Many Shades of Function in Cardiovascular Disease. *Physiology*, [online] 28(6), pp.391–403. doi:<https://doi.org/10.1152/physiol.00029.2013>.
- Zhang, M., Qiao, X., Han, W., Jiang, T., Liu, F. and Zhao, X. (2021). Alginate-chitosan oligosaccharide-ZnO composite hydrogel for accelerating wound healing. *Carbohydrate Polymers*, 266, p.118100. doi:10.1016/j.carbpol.2021.118100.
- Zhang, M. and Zhao, X. (2020). Alginate hydrogel dressings for advanced wound management. *International Journal of Biological Macromolecules*, 162. doi:10.1016/j.ijbiomac.2020.07.311.
- Zhao, D., Yu, S., Sun, B., Gao, S., Guo, S. and Zhao, K. (2018). Biomedical Applications of Chitosan and Its Derivative Nanoparticles. *Polymers*, [online] 10(4). doi:10.3390/polym10040462.