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DAFTAR PUSTAKA

Abo Elsoud, M. M., & El Kady, E. M. (2019). Current trends in fungal biosynthesis of chitin and chitosan. *Bulletin of the National Research Centre*, *43*(1), 59. https://doi.org/10.1186/s42269-019-0105-y

Ahmed, S., & Ikram, S. (2016). Chitosan Based Scaffolds and Their Applications in Wound Healing. *Achievements in the Life Sciences*, *10*(1), 27–37. https://doi.org/10.1016/j.als.2016.04.001

Alam, J., Alhoshan, M., Shukla, A. K., Aldalbahi, A., Ali, F. A. A., Dass, L. A., & Muthumareeswaran, M. R. (2017). κ-Carrageenan as a promising pore-former for the preparation of a highly porous polyphenylsulfone membrane. *Materials Letters*, *204*, 108–111. https://doi.org/10.1016/j.matlet.2017.06.017

Alavi, T., Rezvanian, M., Ahmad, N., Mohamad, N., & Ng, S. F. (2017). Pluronic-F127 composite film loaded with erythromycin for wound application: formulation, physicomechanical and in vitro evaluations. *Drug Delivery and Translational Research*, *9*(2), 508–519. https://doi.org/10.1007/s13346-017-0450-z

Alavi, A., & Kirsner, R. S. (2020). The Basic Principles in Local Wound Care. In A. Alavi & H. I. Maibach (Eds.), *Local Wound Care for Dermatologists* (pp. 1–4). Springer International Publishing. https://doi.org/10.1007/978-3-030-28872-3_

Aljghami, M. E., Saboor, S., & Amini-Nik, S. (2019). Emerging Innovative Wound Dressings. *Annals of Biomedical Engineering*, *47*(3), 659–675. https://doi.org/10.1007/s10439-018-02186-w

Allan, G.G., Altman, L.C., Bensinger, R.E., Ghosh, D.K., Hirabayashi, Y., Neogi, A.N., Neogi, S. (1984). Biomedical applications of chitin and chitosan. In: Zikakis, J.P. (Ed), *Chitin, Chitosan, and Related Enzymes.* (pp. 119-133). Orlando: Academic Press.

Alqahtani, M., & Lalonde, D. H. (2006). Sterile Versus Nonsterile Clean Dressings. *Canadian Journal of Plastic Surgery*, *14*(1), 25–27. https://doi.org/10.1177/229255030601400110

Angel D. (2019). Slough: what does it mean and how can it be managed. *Wound Practice and Research*, *27*(4):164-167. https://doi.org/10.33235/wpr.27.4.164-167

antaranews.com. (2021, August 24). *Dirjen KKP ajak manfaatkan potensi sumber daya laut Rp132 triliun*. Antara News. https://www.antaranews.com/berita/2346982/dirjen-kkp-ajak-manfaatkan-potensi-sumber-daya-laut-rp132-triliun

Azad, A. K., Sermsintham, N., Chandrkrachang, S., & Stevens, W. F. (2004). Chitosan membrane as a wound-healing dressing: Characterization and clinical application. *Journal of Biomedical Materials Research. Part B, Applied Biomaterials*, *69*(2), 216–222. https://doi.org/10.1002/jbm.b.30000

Bahadoran, M., Shamloo, A., & Nokoorani, Y. D. (2020). Development of a polyvinyl alcohol/sodium alginate hydrogel-based scaffold incorporating bFGF-encapsulated microspheres for accelerated wound healing. *Scientific Reports*, *10*, 7342. https://doi.org/10.1038/s41598-020-64480-9

UNIVERSITAS
GADJAH MADA

Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Bahram, M., Mohseni, N., & Moghtader, M. (2016). An Introduction to Hydrogels and Some Recent Applications. In S. B. Majee (Ed.), *Emerging Concepts in Analysis and Applications of Hydrogels*. InTech. https://doi.org/10.5772/64301

Bajpai, S. K., Daheriya, P., Ahuja, S., & Gupta, K. (2016). Water absorption and antimicrobial behavior of physically cross linked poly (vinyl alcohol)/carrageenan films loaded with minocycline. *Designed Monomers and Polymers*, *19*(7), 630–642. https://doi.org/10.1080/15685551.2016.1187444

Baranoski, S. (2020). *Wound Care Essentials*. Lippincott Williams & Wilkins.

Bashir, S., Hina, M., Iqbal, J., Rajpar, A. H., Mujtaba, M. A., Alghamdi, N. A., Wageh, S., Ramesh, K., & Ramesh, S. (2020). Fundamental Concepts of Hydrogels: Synthesis, Properties, and Their Applications. *Polymers*, *12*(11), Article 11. https://doi.org/10.3390/polym12112702

Bäumgen, M., Dutschei, T., & Bornscheuer, U. T. (2021). Marine Polysaccharides: Occurrence, Enzymatic Degradation and Utilization. *ChemBioChem*, *22*, 2247. https://doi.org/10.1002/cbic.202100078

Beard, M. C., Cobb, L. H., Grant, C. S., Varadarajan, A., Henry, T., Swanson, E. A., Kundu, S., & Priddy, L. B. (2021). Autoclaving of Poloxamer 407 hydrogel and its use as a drug delivery vehicle. *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, *109*(3), 338–347. https://doi.org/10.1002/jbm.b.34703

Bertuzzi, M. A., Castro Vidaurre, E. F., Armada, M., & Gottifredi, J. C. (2007). Water vapor permeability of edible starch based films. *Journal of Food Engineering*, *80*(3), 972–978. https://doi.org/10.1016/j.jfoodeng.2006.07.016

Boateng, J. S., Matthews, K. H., Stevens, H. N., & Eccleston, G. M. (2008). Wound Healing Dressings and Drug Delivery Systems: A Review. *Journal of Pharmaceutical Sciences*, *97*(8), 2892–2923. https://doi.org/10.1002/jps.21210

Boateng, J., & Catanzano, O. (2015). Advanced Therapeutic Dressings for Effective Wound Healing—A Review. *Journal of Pharmaceutical Sciences*, *104*(11), 3653–3680. https://doi.org/10.1002/jps.24610

Broussard, K. C., & Powers, J. G. (2013). Wound dressings: Selecting the most appropriate type. *American Journal of Clinical Dermatology*, *14*(6), 449–459. https://doi.org/10.1007/s40257-013-0046-4

Brown, A. (2017). Managing exudate and maceration in venous leg ulceration within the acute health setting. *British Journal of Nursing*, *26*(20), 18–24. https://doi.org/10.12968/bjon.2017.26.Sup20.S18

Brumberg, V., Astrelina, T., Malivanova, T., & Samoilov, A. (2021). Modern Wound Dressings: Hydrogel Dressings. *Biomedicines*, *9*(9). https://doi.org/10.3390/biomedicines9091235

Chai J. (2021). FAO: Global status of seaweed production, trade and utilization. *Seaweed Innovation Forum Belize.*

Chaudhari, V. K., Singh, P., Chauhan, D. K., & Singh, A. (2014). Formulation and evaluation of multiunit floating drug delivery system of levofloxacin hemihydrate for eradication of H. Pylori. *International Journal of Drug Development and Research*, *6*(4), 196–207.

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Chinma, C. E., Ariahu, C. C., & Alakali, J. S. (2015). Effect of temperature and relative humidity on the water vapour permeability and mechanical properties of cassava starch and soy protein concentrate based edible films. *Journal of Food Science and Technology*, *52*(4), 2380–2386. https://doi.org/10.1007/s13197-013-1227-0

Chopra, H., Bibi, S., Kumar, S., Khan, M.S., Kumar, P., Singh, I. (2022). Preparation and Evaluation of Chitosan/PVA Based Hydrogel Films Loaded with Honey for Wound Healing Application. *Gels*, *8*, 111. https://doi.org/10.3390/ gels8020111

Chu, Y., Chai, S., Li, F., Han, C., Sui, X., & Liu, T. (2022). Combined Strategy of Wound Healing Using Thermo-Sensitive PNIPAAm Hydrogel and CS/PVA Membranes: Development and In-Vivo Evaluation. *Polymers*, *14*(12), 2454. https://doi.org/10.3390/polym14122454

Dang, Q. F., Yan, J. Q., Li, J. J., Cheng, X. J., Liu, C. S., & Chen, X. G. (2011). Controlled gelation temperature, pore diameter and degradation of a highly porous chitosan-based hydrogel. *Carbohydrate Polymers*, *83*(1), 171–178. https://doi.org/10.1016/j.carbpol.2010.07.038

Das, N. (2019). Biodegradable Hydrogels for Controlled Drug Delivery. *Polymers and Polymeric Composites: A Reference Series*, 1433–1472. https://doi.org/10.1007/978-3-319-77830-3_47

Dea, Firda & Purbowati, Ike & Wibowo, Condro. (2022). Karakteristik *edible film* yang dihasilkan dengan bahan dasar pektin kulit buah kopi robusta dan glukomanan. Agrointek: *Jurnal Teknologi Industri Pertanian*, *16*, 446-456. 10.21107/agrointek.v16i3.11480.

de Souza, R. F. B., de Souza, F. C. B., & Moraes, N. M. (2016). Polysaccharide-based membranes loaded with erythromycin for application as wound dressings. *Journal of Applied Polymer Science*, *133*(22), 43428. https://doi.org/10.1002/app.43428

Desrizal, Karina, I., & Noviani, I. (2022). Pengaruh perbandingan penggunaan karagenan dan kitosan terhadap analisis proksimat dodol rumput laut cokelat (*Sargassum sp*). *Teknologi Pangan: Media Informasi Dan Komunikasi Ilmiah Teknologi Pertanian*, *13*(1), 38-43. https://doi.org/10.35891/tp.v13i1.2737

Dhivya, S., Padma, V. V., & Santhini, E. (2015). Wound dressings—A review. *BioMedicine*, *5*(4), 22. https://doi.org/10.7603/s40681-015-0022-9

Dillow, A. K., Dehghani, F., Hrkach, J. S., Foster, N. R., & Langer, R. (1999). Bacterial inactivation by using near- and supercritical carbon dioxide. *Proceedings of the National Academy of Sciences*, *96*(18), 10344–10348. https://doi.org/10.1073/pnas.96.18.10344

Distantina S., Fadilah F., & Kaavessina M. (2016). *Swelling Behaviour Of Kappa Carrageenan Hydrogel In Neutral Salt Solution*. https://doi.org/10.5281/ZENODO.1125851

Dong, R., & Guo, B. (2021). Smart wound dressings for wound healing. *Nano Today*, *41*, 101290. https://doi.org/10.1016/j.nantod.2021.101290

Dong, J., Yu, D., Yu, Z., Zhang, L., & Xia, W. (2022). Thermally-induced crosslinking altering the properties of chitosan films: Structure, physicochemical characteristics and antioxidant activity. *Food Packaging and*

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Shelf Life, *34*, 100948. https://doi.org/10.1016/j.fpsl.2022.100948

Dul, M., Paluch, K. J., Kelly, H., Healy, A. M., Sasse, A., & Tajber, L. (2015). Self-assembled carrageenan/protamine polyelectrolyte nanoplexes—Investigation of critical parameters governing their formation and characteristics. *Carbohydrate Polymers*, *123*, 339–349. https://doi.org/10.1016/j.carbpol.2015.01.066

Estiasih, T., K. Ahmadi, dan F. Kusumastuti. (2009). Optimasi Kondisi Pemurnian Asam Lemak Omega-3 dari Minyak Hasil Samping Penepungan Tuna (Thunnus sp.) dengan Kristalisasi. *Jurnal Teknologi dan Industri Pangan*, *20*(2), 135-142.

Febianti, M., Ghozali, A. A., Redjeki, S., & Iriani, I. (2020). Edible Film dari Tepung Kappa Karagenan dan Kitosan Cangkang Rajungan dengan Gliserol. *ChemPro*, *1*(01), 16–21. https://doi.org/10.33005/chempro.v1i01.28

Feng, D., Bai, B., Wang, H., & Suo, Y. (2016). Enhanced mechanical stability and sensitive swelling performance of chitosan/yeast hybrid hydrogel beads. *New Journal of Chemistry*, *40*(4), 3350–3362. https://doi.org/10.1039/C5NJ02404H

Franzén, H. M., Draget, K. I., Langebäck, J., & Nilsen-Nygaard, J. (2015). Characterization and Properties of Hydrogels Made from Neutral Soluble Chitosans. *Polymers*, *7*(3), Article 3. https://doi.org/10.3390/polym7030373

Fried, J. R. (2014). *Polymer Science and Technology*. Prentice Hall.

Fromstein, Joanna Dawn. (2001). *Development and characterization of fibrin and hyaluronan coated biodegradable polyurethane films*. National Library of Canada.

Galante, R., Pinto, T. J. A., Colaço, R., & Serro, A. P. (2017). Sterilization of hydrogels for biomedical applications: A review. *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, *106*(6), 2472–2492. https://doi.org/10.1002/jbm.b.34048

Gonçalves, M. M., Carneiro, J., Justus, B., Espinoza, J. T., Budel, J. M., Farago, P. V., & Paula, J. P. D. (2020). Preparation and characterization of a novel antimicrobial film dressing for wound healing application. *Brazilian Journal of Pharmaceutical Sciences*, *56*, e18784. https://doi.org/10.1590/s2175-97902020000118784

Gantwerker, E. A., & Hom, D. B. (2011). Skin: Histology and physiology of wound healing. *Facial Plastic Surgery Clinics of North America*, *19*(3), 441–453. https://doi.org/10.1016/j.fsc.2011.06.009

Gasperz, V. (1995). *Teknik Analisis dalam Penelitian Percobaan*. Bandung: Tarsito.

Gohil, S. V., Padmanabhan, A., Kan, H. M., Khanal, M., & Nair, L. S. (2021). Degradation-Dependent Protein Release from Enzyme Sensitive Injectable Glycol Chitosan Hydrogel. *Tissue Engineering Part A*, *27*(13–14), 867–880. https://doi.org/10.1089/ten.tea.2020.0124

Gosai, H., Patel, P., Trivedi, H., & Joshi, U. (2021). Role of Biodegradable Polymer-Based Biomaterials in Advanced Wound Care. In P. Kumar & V. Kothari (Eds.), *Wound Healing Research* (pp. 599–620). Springer Singapore. https://doi.org/10.1007/978-981-16-2677-7_18

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Greener B, Hughes AA, Bannister NP, Douglass J. (2005). Proteases and pH in chronic wounds. *Journal of Wound Care*, *14*(2), 59–61

Halpern, J. M., Gormley, C. A., Keech, M. A., & Von Recum, H. A. (2014). Thermomechanical properties, antibiotic release, and bioactivity of a sterilized cyclodextrin drug delivery system. *J. Mater. Chem. B*, *2*(18), 2764–2772. https://doi.org/10.1039/C4TB00083H

Hermansson, A.-M. (1989). Rheological and microstructural evidence for transient states during gelation of kappa-carrageenan in the presence of potassium. *Carbohydrate Polymers*, *10*(3), 163–181. https://doi.org/10.1016/0144-8617(89)90009-X

Hezaveh, H., & Muhamad, I. I. (2013). Modification and swelling kinetic study of kappa-carrageenan-based hydrogel for controlled release study. *Journal of the Taiwan Institute of Chemical Engineers*, *44*(2), 182–191. https://doi.org/10.1016/j.jtice.2012.10.011

Hu, P., Raub, C. B., Choy, J. S., & Luo, X. (2020). Modulating the properties of flow-assembled chitosan membranes in microfluidics with glutaraldehyde crosslinking. *Journal of Materials Chemistry B*, *8*(12), 2519–2529. https://doi.org/10.1039/c9tb02527h

Husni, P., Junaedi, J., & Gozali, D. (2020). Potensi Kitosan Bersumber dari Limbah Cangkang Rajungan (Portunus pelagicus) dalam Bidang Farmasi. *Majalah Farmasetika*, *5*(1). https://doi.org/10.24198/mfarmasetika.v5i1.23804

Ikeda, S., Morris, V. J., & Nishinari, K. (2001). Microstructure of Aggregated and Nonaggregated κ-Carrageenan Helices Visualized by Atomic Force Microscopy. *Biomacromolecules*, *2*(4), 1331–1337. https://doi.org/10.1021/bm015610l

Irfan-Maqsood, M. (2016). Classification of Wounds: Know before Research and Clinical Practice. *Cell Therapy and Regenerative Medicine Journal*, *1*(2), 79. https://doi.org/10.15562/ctrm.21

Jacob, S., Nair, A. B., Shah, J., Sreeharsha, N., Gupta, S., & Shinu, P. (2021). Emerging Role of Hydrogels in Drug Delivery Systems, Tissue Engineering and Wound Management. *Pharmaceutics*, *13*(3), 357. https://doi.org/10.3390/pharmaceutics13030357

Juan, A. S., Montembault, A., Gillet, D., Say, J. P., Rouif, S., Bouet, T., Royaud, I., & David, L. (2012). Degradation of chitosan-based materials after different sterilization treatments. *IOP Conference Series: Materials Science and Engineering*, *31*, 012007. https://doi.org/10.1088/1757-899X/31/1/012007

Jung, C., Kim, S. J., Jang, J., Ko, J. H., Kim, D., Ko, B., Song, Y. M., Hong, S. H., & Rho, J. (2022). Disordered-nanoparticle-based etalon for ultrafast humidity-responsive colorimetric sensors and anti-counterfeiting displays. *Science advances*, *8*(10), eabm8598. https://doi.org/10.1126/sciadv.abm8598

Kamath, K. R., & Park, K. (1993). Biodegradable hydrogels in drug delivery. *Advanced Drug Delivery Reviews*, *11*(1–2), 59–84. https://doi.org/10.1016/0169-409x(93)90027-2

Kanber A.A & Kadhim E.F. (2022). Efficacy of Locally Applied K-Carrageenan on the Healing of Thermal Burn in Rat-Experimental Model: Histological Study. *Journal of Research in Medical and Dental Science*, *10*(9), 160–165.

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Kartika, R., Gadri, A & Eka Darma, G, C. (2015). Formulasi Basis Sediaan Pembalut Luka Hidrogel dengan Teknik Beku Leleh menggunakan Polimer Kappa Karagenan. *Prosiding Penelitian SPeSIA UNISBA*,643-648.

Kasmi, F. A., Zailani, M. A., Abu Bakar, A. J., Mat Amin, K. A. (2020). Kinetic Release of Acetaminophen from Cross-Linked Carrageenan Hydrogel for Wound Dressing Application. *Journal of Pure and Applied Microbiology*, *14*(1), 271–278. https://doi.org/10.22207/JPAM.14.1.28

Khabbaz, B., Solouk, A., & Mirzadeh, H. (2019). Polyvinyl alcohol/soy protein isolate nanofibrous patch for wound-healing applications. *Progress in Biomaterials*, *8*(3), 185–196. https://doi.org/10.1007/s40204-019-00120-4

Khaliq, T., Sohail, M., Minhas, M. U., Ahmed Shah, S., Jabeen, N., Khan, S., Hussain, Z., Mahmood, A., Kousar, M., & Rashid, H. (2022). Self-crosslinked chitosan/κ-carrageenan-based biomimetic membranes to combat diabetic burn wound infections. *International Journal of Biological Macromolecules*, *197*, 157–168. https://doi.org/10.1016/j.ijbiomac.2021.12.100

Kim, H., Song, D., Kim, M., Ryu, S., Um, I., Ki, C., & Park, Y. (2016). Effect of silk fibroin molecular weight on physical property of silk hydrogel. *Polymer*, *90*, 26–33. https://doi.org/10.1016/j.polymer.2016.02.054

Kim, S., Cui, Z. K., Koo, B., Zheng, J., Aghaloo, T., & Lee, M. (2018). Chitosan–Lysozyme Conjugates for Enzyme-Triggered Hydrogel Degradation in Tissue Engineering Applications. *ACS Applied Materials & Interfaces*, *10*(48), 41138–41145. https://doi.org/10.1021/acsami.8b15591

Kementerian Kesehatan. (2018). *Laporan Nasional Riskesdas Tahun 2018*. Jakarta : Kemenkes RI.

Kouchak, M., Handali, S., & Naseri Boroujeni, B. (2015). Evaluation of the Mechanical Properties and Drug Permeability of Chitosan/Eudragit RL Composite Film. *Osong Public Health and Research Perspectives*, *6*(1), 14–19. https://doi.org/10.1016/j.phrp.2014.12.001

Kruse, C. R., Nuutila, K., Lee, C. C., Kiwanuka, E., Singh, M., Caterson, E. J., Eriksson, E., & Sørensen, J. A. (2015). The external microenvironment of healing skin wounds. *Wound repair and regeneration : official publication of the Wound Healing Society [and] the European Tissue Repair Society*, *23*(4), 456–464. https://doi.org/10.1111/wrr.12303

Kumar S.P. T., Lakshmanan, V. K., Anilkumar, T., Ramya, C., Reshmi, P., Unnikrishnan, A., Jayakumar, R. (2012). Flexible and Microporous Chitosan Hydrogel/Nano ZnO Composite Bandages for Wound Dressing: In Vitro and In Vivo Evaluation. *ACS Applied Materials & Interfaces*, *4*(5), 2618–2629. https://doi.org/10.1021/am300292v

Kumar, A., Sharma, S., & Kumar, R. (2020). The graft copolymerization of N-vinyl-2-pyrrolidone onto carboxymethyl cellulose and its application for controlled release of water-soluble levofloxacin. *Journal of Polymer Research*, *27*(3). https://doi.org/10.1007/s10965-020-2023-y

Lai, W. F., & Shum, H. C. (2015). Hypromellose-graft-chitosan and Its Polyelectrolyte Complex as Novel Systems for Sustained Drug Delivery. *ACS Applied Materials & Interfaces*, *7*(19), 10501–10510. https://doi.org/10.1021/acsami.5b01984

UNIVERSITAS
GADJAH MADA

Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Laurano, R., Boffito, M., Ciardelli, G., & Chiono, V. (2022). Wound dressing products: A translational investigation from the bench to the market. *Engineered Regeneration*, *3*(2), 182–200. https://doi.org/10.1016/j.engreg.2022.04.002

Lee, J. I., Kim, H. S., & Yoo, H. S. (2009). DNA nanogels composed of chitosan and Pluronic with thermo-sensitive and photo-crosslinking properties. *International Journal of Pharmaceutics*, *373*(1–2), 93–99. https://doi.org/10.1016/j.ijpharm.2009.01.016

Lefnaoui, S., & Moulai-Mostefa, N. (2011). Formulation and in vitro evaluation of κ-carrageenan-pregelatinized starch-based mucoadhesive gels containing miconazole. *Starch - Stärke*, *63*(8), 512–521. https://doi.org/10.1002/star.201000141

Lei J, Sun L, Li P, Zhu C, Lin Z, dkk. (2019). The Wound Dressings and Their Applications in Wound Healing and Management. *Health Sci J. 13*(4), 662.

Levi-Polyachenko, N., Jacob, R., Day, C., & Kuthirummal, N. (2016). Chitosan wound dressing with hexagonal silver nanoparticles for hyperthermia and enhanced delivery of small molecules. *Colloids and Surfaces B: Biointerfaces*, *142*, 315–324. https://doi.org/10.1016/j.colsurfb.2016.02.038

Li, J., & Mooney, D. J. (2016). Designing hydrogels for controlled drug delivery. *Nature Reviews Materials*, *1*(12), 16071. https://doi.org/10.1038/natrevmats.2016.71

Lindholm, C., & Searle, R. (2016). Wound management for the 21st century: Combining effectiveness and efficiency. *International Wound Journal*, *13*(S2), 5–15. https://doi.org/10.1111/iwj.12623

Liu, J., Zhan, X., Wan, J., Wang, Y., & Wang, C. (2015). Review for carrageenan-based pharmaceutical biomaterials: Favourable physical features versus adverse biological effects. *Carbohydrate Polymers*, *121*, 27–36. https://doi.org/10.1016/j.carbpol.2014.11.063

Liu, Q., Li, Q., Xu, S., Zheng, Q., & Cao, X. (2018). Preparation and Properties of 3D Printed Alginate–Chitosan Polyion Complex Hydrogels for Tissue Engineering. *Polymers*, *10*(6), 664. https://doi.org/10.3390/polym10060664

Liu, Y., Song, S., Liu, S., Zhu, X., & Wang, P. (2022). Application of Nanomaterial in Hydrogels Related to Wound Healing. *Journal of Nanomaterials*, *2022*, 1–11. https://doi.org/10.1155/2022/4656037

Lončarević, A., Ivanković, M., & Rogina, A. (2017). Lysozyme-Induced Degradation of Chitosan: The Characterisation of Degraded Chitosan Scaffolds. *Journal of Tissue Repair and Regeneration*, *1*(1), 12–22. https://doi.org/10.14302/issn.2640-6403.jtrr-17-1840

Loukelis, K., Papadogianni, D., & Chatzinikolaidou, M. (2022). Kappa-carrageenan/chitosan/gelatin scaffolds enriched with potassium chloride for bone tissue engineering. *International Journal of Biological Macromolecules*, *209*, 1720–1730. https://doi.org/10.1016/j.ijbiomac.2022.04.129

Lu, S., Zhang, X., Tang, Z., Xiao, H., Zhang, M., Liu, K., Chen, L., Huang, L., Ni, Y., & Wu, H. (2021). Mussel-inspired blue-light-activated cellulose-based adhesive hydrogel with fast gelation, rapid haemostasis and antibacterial property for wound healing. *Chemical Engineering Journal*, *417*, 129329.

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https://doi.org/10.1016/j.cej.2021.129329

Luthfiana, N. (2022). *Kiat KKP Kembangkan SDM Pembudidaya Rumput Laut untuk Tingkatkan Ekspor*. Kementerian Kelautan dan Perikanan Republik Indonesia. Diambil dari: https://kkp.go.id/artikel/43122-kiat-kkp-kembangkan-sdm-pembudidaya-rumput-laut-untuk-tingkatkan-ekspor.

Mahdavinia, G. R., Mosallanezhad, A., Soleymani, M., & Sabzi, M. (2017). Magnetic- and pH-responsive κ-carrageenan/chitosan complexes for controlled release of methotrexate anticancer drug. *International Journal of Biological Macromolecules*, *97*, 209–217. https://doi.org/10.1016/j.ijbiomac.2017.01.012

Martin, C., Low, W. L., Amin, M. C. I. M., Radecka, I., Raj, P., & Kenward, K. (2013). Current trends in the development of wound dressings, biomaterials and devices. *Pharmaceutical Patent Analyst*, *2*(3), 341–359. https://doi.org/10.4155/ppa.13.18

Martiny, T. R., Pacheco, B. S., Pereira, C. M. P., Mansilla, A., Astorga–España, M. S., Dotto, G. L., Moraes, C. C., & Rosa, G. S. (2020). A novel biodegradable film based on κ-carrageenan activated with olive leaves extract. *Food Science & Nutrition*, *8*(7), 3147–3156. https://doi.org/10.1002/fsn3.1554

Masykur, A., Wibowo, A. H., Martini, T., & Laras, K. C. (2018). Syntheses of Chitosan Macropore and Aplication as Procion Red Dyes Adsorben. *Journal of Physics: Conference Series*, *1028*, 012034. https://doi.org/10.1088/1742-6596/1028/1/012034

Mayet, N., Choonara, Y. E., Kumar, P., Tomar, L. K., Tyagi, C., Du Toit, L. C., & Pillay, V. (2014). A Comprehensive Review of Advanced Biopolymeric Wound Healing Systems. *Journal of Pharmaceutical Sciences*, *103*(8), 2211–2230. https://doi.org/10.1002/jps.24068

Mega, A. P. (2021, August 23). *Menteri Trenggono Terapkan Kebijakan Penangkapan Terukur untuk Tingkatkan Devisa*. Kementerian Kelautan dan Perikanan Republik Indonesia. Diambil dari: https://kkp.go.id/artikel/33536-menteri-trenggono-terapkan-kebijakan-penangkapan-terukur-untuk-tingkatkan-devisa.

Min, J. G., Sanchez Rangel, U. J., Franklin, A., Oda, H., Wang, Z., Chang, J., & Fox, P. M. (2020). Topical Antibiotic Elution in a Collagen-Rich Hydrogel Successfully Inhibits Bacterial Growth and Biofilm Formation In Vitro. *Antimicrobial Agents and Chemotherapy*, *64*(10). https://doi.org/10.1128/aac.00136-20

Moghadas, B., Solouk, A., & Sadeghi, D. (2021). Development of chitosan membrane using non-toxic crosslinkers for potential wound dressing applications. *Polymer Bulletin*, *78*(9), 4919–4929. https://doi.org/10.1007/s00289-020-03352-8

Moon, Christopher & Crabtree, Thomas. (2002). New wound dressing technique to accelerate healing. *Curr Treat Options Infect Dis*. 5.

Mohamed, R. R., Elella, M. H. A., & Sabaa, M. W. (2015). Synthesis, characterization and applications of N- quaternized chitosan/poly(vinyl alcohol) hydrogels. *International Journal of Biological Macromolecules*, *80*, 149–161. https://doi.org/10.1016/j.ijbiomac.2015.06.041

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Mubarok, F., & Pratiwi, D. (2018, November 15). *Eksploitasi Kubur Persistensi Ekspor Rajungan*. Validnews. https://www.validnews.id/ekonomi/Eksploitasi-Kubur-Persistensi-Ekspor-Rajungan-zhY

Napierala, D.M. & Nowotarska. (2006). Water vapour transmission properties of wheat starch-sorbitol film. A. *Acta Agrophysica 7(1)*,151-159.

Nascimento, I. V., Leal, R. D. C. A., Fook, M. V. L., & Meira, R. C. (2014). Sterilization of Chitosan Membranes for Use as Biomaterial. *Materials Science Forum*, *805*, 35–40. https://doi.org/10.4028/www.scientific.net/msf.805.35

National Center for Biotechnology Information. (2022). PubChem Compound Summary for CID 4873, Potassium Chloride. Retrieved November 9, 2022 from *Pubchem*: https://pubchem.ncbi.nlm.nih.gov/compound/Potassium-Chloride.

_____. (2022). PubChem Compound Summary for CID 962, Water. Retrieved November 9, 2022 from *Pubchem*: https://pubchem.ncbi.nlm.nih.gov/compound/Water

Neamtu, B., Barbu, A., Negrea, M. O., Berghea-Neamțu, C. Ștefan, Popescu, D., Zăhan, M., & Mireșan, V. (2022). Carrageenan-Based Compounds as Wound Healing Materials. *International Journal of Molecular Sciences*, *23*(16), 9117. https://doi.org/10.3390/ijms23169117

Necas, J., & Bartosikova, L. (2013). Carrageenan: A review. *Veterinární Medicína*, *58*(No. 4), 187–205. https://doi.org/10.17221/6758-VETMED

Nike, D. U., Katas, H., Mohd, N. F., Hiraoka, Y., Tabata, Y., Idrus, R., & Fauzi, M. B. (2021). Characterisation of Rapid In Situ Forming Gelipin Hydrogel for Future Use in Irregular Deep Cutaneous Wound Healing. *Polymers*, *13*(18), 3152. https://doi.org/10.3390/polym13183152

Ninan, N., Forget, A., Shastri, V. P., Voelcker, N. H., & Blencowe, A. (2016). Antibacterial and Anti-Inflammatory pH-Responsive Tannic Acid-Carboxylated Agarose Composite Hydrogels for Wound Healing. *ACS Applied Materials & Interfaces*, *8*(42), 28511–28521. https://doi.org/10.1021/acsami.6b10491

Niyompanich, J., Chuysinuan, P., Pavasant, P., & Supaphol, P. (2021). Development of thermoresponsive poloxamer in situ gel loaded with gentamicin sulfate for cavity wounds. *Journal of Polymer Research*, *28*(4). https://doi.org/10.1007/s10965-020-02352-6

Nuutila, K., & Eriksson, E. (2021). Moist Wound Healing with Commonly Available Dressings. *Advances in Wound Care*, *10*(12), 685–698. https://doi.org/10.1089/wound.2020.1232

Othman, S. H., Edwal, S. A. M., Risyon, N. P., Basha, R. K., & A. Talib, R. (2017). Water sorption and water permeability properties of edible film made from potato peel waste. *Food Science and Technology*, *37*(suppl 1), 63–70. https://doi.org/10.1590/1678-457x.30216

Pan, Z., Ye, H., & Wu, D. (2021). Recent advances on polymeric hydrogels as wound dressings. *APL Bioengineering*, *5*(1), 011504. https://doi.org/10.1063/5.0038364

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Pan, Z., & Brassart, L. (2022). Constitutive modelling of hydrolytic degradation in hydrogels. *Journal of the Mechanics and Physics of Solids*, *167*, 105016. https://doi.org/10.1016/j.jmps.2022.105016

Papagiannopoulos, A., Nikolakis, S.-P., Pamvouxoglou, A., & Koutsopoulou, E. (2023). Physicochemical properties of electrostatically crosslinked carrageenan/chitosan hydrogels and carrageenan/chitosan/Laponite nanocomposite hydrogels. *International Journal of Biological Macromolecules*, *225*, 565–573. https://doi.org/10.1016/j.ijbiomac.2022.11.113

Parhi, R. (2017). Cross-Linked Hydrogel for Pharmaceutical Applications: A Review. *Advanced Pharmaceutical Bulletin*, *7*(4), 515–530. https://doi.org/10.15171/apb.2017.064

Park, H., Guo, X., Temenoff, J. S., Tabata, Y., Caplan, A. I., Kasper, F. K., & Mikos, A. G. (2009). Effect of Swelling Ratio of Injectable Hydrogel Composites on Chondrogenic Differentiation of Encapsulated Rabbit Marrow Mesenchymal Stem Cells In Vitro. *Biomacromolecules*, *10*(3), 541–546. https://doi.org/10.1021/bm801197m

Patrulea, V., Ostafe, V., Borchard, G., & Jordan, O. (2015). Chitosan as a starting material for wound healing applications. *European Journal of Pharmaceutics and Biopharmaceutics*, *97*, 417–426. https://doi.org/10.1016/j.ejpb.2015.08.004

Peate, I., & Glencross, W. (2015). *Wound care at a glance*. Wiley Blackwell.

Peh, K., Khan, T., & Ch'ng, H. (2000). Mechanical, bioadhesive strength and biological evaluations of chitosan films for wound dressing. *Journal of pharmacy & pharmaceutical sciences : a publication of the Canadian Society for Pharmaceutical Sciences, Societe canadienne des sciences pharmaceutiques*, *3*(3), 303–311.

Percival, S. L., McCarty, S., Hunt, J. A., & Woods, E. J. (2014). The effects of pH on wound healing, biofilms, and antimicrobial efficacy: PH and wound repair. *Wound Repair and Regeneration*, *22*(2), 174–186. https://doi.org/10.1111/wrr.12125

Phillips, G. O. (Ed.). (2009). *Handbook of hydrocolloids* (2. ed). CRC.

Pourjavadi, A., Ghasemzadeh, H., & Hosseinzadeh, H. (2004). Preparation and swelling behaviour of a novel anti-salt superabsorbent hydrogel based on kappa-carrageenan and sodium alginate grafted with polyacrylamide. *e-Polymers*, *4*(1). https://doi.org/10.1515/epoly.2004.4.1.275

Pourjavadi, A., Doroudian, M., Ahadpour, A., & Azari, S. (2019). Injectable chitosan/κ-carrageenan hydrogel designed with au nanoparticles: A conductive scaffold for tissue engineering demands. *International Journal of Biological Macromolecules*, *126*, 310–317. https://doi.org/10.1016/j.ijbiomac.2018.11.256

Pratiwi, R. (2014). Manfaat Kitin dan Kitosan Bagi Kehidupan Manusia. *Oseana*, *39*(1), 35-43.

Prihastuti, D., & Abdassah, M. (2019). Karagenan dan Aplikasinya di Bidang Farmasetika. *Farmasetika.Com (Online)*, *4*(5). https://doi.org/10.24198/farmasetika.v4i5.23066

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Rafael, D., Andrade, F., Martinez-Trucharte, F., Basas, J., Seras-Franzoso, J., Palau, M., Gomis, X., Pérez-Burgos, M., Blanco, A., López-Fernández, A., Vélez, R., Abasolo, I., Aguirre, M., Gavaldà, J., & Schwartz, S. (2019). Sterilization Procedure for Temperature-Sensitive Hydrogels Loaded with Silver Nanoparticles for Clinical Applications. *Nanomaterials*, *9*(3), 380. https://doi.org/10.3390/nano9030380

Reay, S. L., Jackson, E. L., Ferreira, A. M., Hilkens, C. M. U., & Novakovic, K. (2022). In vitro evaluation of the biodegradability of chitosan–genipin hydrogels. *Materials Advances*, *3*(21), 7946–7959. https://doi.org/10.1039/d2ma00536k

Rezvani Ghomi, E., Khalili, S., Nouri Khorasani, S., Esmaeely Neisiany, R., & Ramakrishna, S. (2019). Wound dressings: Current advances and future directions. *Journal of Applied Polymer Science*, *136*(27), 47738. https://doi.org/10.1002/app.47738

Ribeiro, M. P., Espiga, A., Silva, D., Baptista, P., Henriques, J., Ferreira, C., Silva, J. C., Borges, J. P., Pires, E., Chaves, P., & Correia, I. J. (2009). Development of a new chitosan hydrogel for wound dressing. *Wound Repair and Regeneration*, *17*(6), 817–824. https://doi.org/10.1111/j.1524-475X.2009.00538.x

Rippon, M., Waring, M., Bielfeldt, Stephan. (2015). An evaluation of properties related to wear time of four dressings during a five-day period. *Wounds UK*, *11*, 45-54.

Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (2009). *Handbook of Pharmaceutical Excipients*. Pharmaceutical Press.

Ruffo, M., Parisi, O. I., Dattilo, M., Patitucci, F., Malivindi, R., Pezzi, V., Tzanov, T., & Puoci, F. (2022). Synthesis and evaluation of wound healing properties of hydro-diab hydrogel loaded with green-synthetized AGNPS: In vitro and in ex vivo studies. *Drug Delivery and Translational Research*, *12*(8), 1881–1894. https://doi.org/10.1007/s13346-022-01121-w

Rupert, R., Rodrigues, K. F., Thien, V. Y., & Yong, W. T. L. (2022). Carrageenan From Kappaphycus alvarezii (Rhodophyta, Solieriaceae): Metabolism, Structure, Production, and Application. *Frontiers in Plant Science*, *13*, 859635. https://doi.org/10.3389/fpls.2022.859635

Russell, L. (1999). The importance of wound documentation and classification. *British Journal of Nursing*, *8*(20), 1342–1354. https://doi.org/10.12968/bjon.1999.8.20.1342

Sadeghi, M. (2012). Synthesis of a biocopolymer carrageenan-g-poly(AAm-co-IA)/ montmorilonite superabsorbent hydrogel composite. *Brazilian Journal of Chemical Engineering*, *29*(2), 295–305. https://doi.org/10.1590/S0104-66322012000200010

Sadiq, T., Khalid, S. H., Khan, I. U., Mahmood, H., & Asghar, S. (2022). Designing Deferoxamine-Loaded Flaxseed Gum and Carrageenan-Based Controlled Release Biocomposite Hydrogel Films for Wound Healing. *Gels*, *8*(10), 652. https://doi.org/10.3390/gels8100652

Sahana, T. G., & Rekha, P. D. (2018). Biopolymers: Applications in wound healing and skin tissue engineering. *Molecular Biology Reports*, *45*(6), 2857–2867.

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

https://doi.org/10.1007/s11033-018-4296-3

Sakiyama, T., Chu, C.-H., Fujii, T., & Yano, T. (1993). Preparation of a polyelectrolyte complex gel from chitosan and κ-carrageenan and its pH-sensitive swelling. *Journal of Applied Polymer Science*, *50*(11), 2021–2025. https://doi.org/10.1002/app.1993.070501121

Schultz, H. B., Vasani, R. B., Holmes, A. M., Roberts, M. S., & Voelcker, N. H. (2019). Stimulus-Responsive Antibiotic Releasing Systems for the Treatment of Wound Infections. *ACS applied bio materials*, *2*(2), 704–716. https://doi.org/10.1021/acsabm.8b00577

Şen, M., & Avcı, E. N. (2005). Radiation synthesis of poly(N-vinyl-2-pyrrolidone)-κ-carrageenan hydrogels and their use in wound dressing applications. I. Preliminary laboratory tests. *Journal of Biomedical Materials Research Part A*, *74A*(2), 187–196. https://doi.org/10.1002/jbm.a.30308

Shrimali, H., Mandal, U. K., Nivsarkar, M., & Shrivastava, N. (2019). Fabrication and evaluation of a medicated hydrogel film with embelin from Embelia ribes for wound healing activity. *Future Journal of Pharmaceutical Sciences*, *5*(1), 12. https://doi.org/10.1186/s43094-019-0011-z

Sim, P., Song, Y., Yang, G. N., Cowin, A. J., & Garg, S. (2022). In Vitro Wound Healing Properties of Novel Acidic Treatment Regimen in Enhancing Metabolic Activity and Migration of Skin Cells. *International Journal of Molecular Sciences*, *23*(13), 7188. https://doi.org/10.3390/ijms23137188

Sim, P., Strudwick, X. L., Song, Y., Cowin, A. J., & Garg, S. (2022). Influence of Acidic pH on Wound Healing In Vivo: A Novel Perspective for Wound Treatment. *International Journal of Molecular Sciences*, *23*(21), 13655. https://doi.org/10.3390/ijms232113655

Simatupang, N. F., Pong-Masak, P. R., Ratnawati, P., Agusman, Paul, N. A., & Rimmer, M. A. (2021). Growth and product quality of the seaweed Kappaphycus alvarezii from different farming locations in Indonesia. *Aquaculture Reports*, *20*, 100685. https://doi.org/10.1016/j.aqrep.2021.100685

Singh, B., & Rajneesh. (2018). Gamma radiation synthesis and characterization of gentamicin loaded polysaccharide gum based hydrogel wound dressings. *Journal of Drug Delivery Science and Technology*, *47*, 200–208. https://doi.org/10.1016/j.jddst.2018.07.014

Singh, S., Young, A., & McNaught, C.-E. (2017). The physiology of wound healing. *Surgery (Oxford)*, *35*(9), 473–477. https://doi.org/10.1016/j.mpsur.2017.06.004

Sivaraj, D., Chen, K., Chattopadhyay, A., Henn, D., Wu, W., Noishiki, C., Magbual, N. J., Mittal, S., Mermin-Bunnell, A. M., Bonham, C. A., Trotsyuk, A. A., Barrera, J. A., Padmanabhan, J., Januszyk, M., & Gurtner, G. C. (2021). Hydrogel Scaffolds to Deliver Cell Therapies for Wound Healing. *Frontiers in bioengineering and biotechnology*, *9*, 660145. https://doi.org/10.3389/fbioe.2021.660145

Spear, M. (2012). Wound exudate—The good, the bad, and the ugly. *Plastic Surgical Nursing: Official Journal of the American Society of Plastic and Reconstructive Surgical Nurses*, *32*(2), 77–79.

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

https://doi.org/10.1097/PSN.0b013e318256d638

Stone, A. K., & Nickerson, M. T. (2012). Formation and functionality of whey protein isolate–(kappa-, iota-, and lambda-type) carrageenan electrostatic complexes. *Food Hydrocolloids*, *27*(2), 271–277. https://doi.org/10.1016/j.foodhyd.2011.08.006

Stoppel, W. L., White, J. C., Horava, S. D., Henry, A. C., Roberts, S. C., & Bhatia, S. R. (2014). Terminal sterilization of alginate hydrogels: Efficacy and impact on mechanical properties: Terminal Sterilization of Alginate Hydrogels. *Journal of Biomedical Materials Research Part B: Applied Biomaterials*, *102*(4), 877–884. https://doi.org/10.1002/jbm.b.33070

Tako, M. , Teruya, T. , Tamaki, Y. , Uechi, K. , & Konishi, T. (2021). Molecular Origin for Strong Agarose Gels: Multi-Stranded Hydrogen Bonding. *Journal of Polymer and Biopolymer Physics Chemistry*, *9*(1), 13-19.

Tavakoli, S., & Klar, A. S. (2020). Advanced Hydrogels as Wound Dressings. *Biomolecules*, *10*(8), Article 8. https://doi.org/10.3390/biom10081169

Tong, K. T. X., Tan, I. S., Foo, H. C. Y., Chan, S. Y. S., Hadibarata, T., & Lam, M. K. (2023). Emerging technologies for conversion of sustainable macroalgal carrageenan biomass into L-lactic acid: A state-of-the-art review. *MATEC Web of Conferences*, *377*, 01019. https://doi.org/10.1051/matecconf/202337701019

Ujang, Z., Rashid, A. H. A., Suboh, S. K., Halim, A. S., & Lim, C. K. (2014). Physical Properties and Biocompatibility of Oligochitosan Membrane Film as Wound Dressing. *Journal of Applied Biomaterials & Functional Materials*, *12*(3), 155–162. https://doi.org/10.5301/jabfm.5000190

United States Department of Agriculture (USDA). (2011). Carrageenan. *Technical Evaluation Report*. USDA National Organic Program. Diambil dari https://www.ams.usda.gov/sites/default/files/media/Carrageenan%20TR%202011.pdf

Varghese, J. S., Chellappa, N., & Fathima, N. N. (2014). Gelatin–carrageenan hydrogels: Role of pore size distribution on drug delivery process. *Colloids and Surfaces B: Biointerfaces*, *113*, 346–351. https://doi.org/10.1016/j.colsurfb.2013.08.049

Wen, C., Lu, L., & Li, X. (2014). Enzymatic and ionic crosslinked gelatin/K-carrageenan IPN hydrogels as potential biomaterials. *Journal of Applied Polymer Science*, *131*(21). https://doi.org/10.1002/app.40975

Widria, Y. (2019, November 15). *Prospek Pasar Ekspor Rajungan dan Kepiting Indonesia ke China*. Kementerian Kelautan dan Perikanan Republik Indonesia. https://kkp.go.id/djpdspkp/bbp2hp/page/517-visi-misi

Widi, S. (2022, September 15). *Produksi Udang Indonesia Capai 1,21 Juta Ton pada 2021*. Data Indonesia. https://dataindonesia.id/sektor-riil/detail/produksi-udang-indonesia-capai-121-juta-ton-pada-2021

_____. (2022, September 28). *Produksi Rumput Laut Indonesia Capai 9,12 juta ton pada 2021*. Data Indonesia. https://dataindonesia.id/sektor-riil/detail/produksi-rumput-laut-indonesia-capai-912-juta-ton-pada-2021

Wickert, L. E., Pomerenke, S., Mitchell, I., Masters, K. S., & Kreeger, P. K. (2016). Hierarchy of cellular decisions in collective behavior: Implications for wound

UNIVERSITAS
GADJAH MADA
Pengembangan Formula Hidrogel Penutup Luka Berbasis Kombinasi Kappa-karagenan dan Kitosan
Alma Rizki Fadila, Dr. Eng. apt. Khadijah, M.Si.
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

healing. *Scientific Reports*, *6*(1), 20139. https://doi.org/10.1038/srep20139

Wiles, J. L., Vergano, P. J., Barron, F. H., Bunn, J. M., & Testin, R. F. (2000). Water Vapor Transmission Rates and Sorption Behavior of Chitosan Films. *Journal of Food Science*, *65*(7), 1175–1179. https://doi.org/10.1111/j.1365-2621.2000.tb10261.x

Wu, P., Fisher, A. C., Foo, P. P., Queen, D., & Gaylor, J. D. (1995). In vitro assessment of water vapour transmission of synthetic wound dressings. *Biomaterials*, *16*(3), 171–175. https://doi.org/10.1016/0142-9612(95)92114-l

Wu, S., Deng, L., Hsia, H., Xu, K., He, Y., Huang, Q., Peng, Y., Zhou, Z., & Peng, C., 2017, Evaluation of gelatin-hyaluronic acid composite hydrogels for accelerating wound healing, *Journal of biomaterials applications*, 31(10), 1380–1390. https://doi.org/10.1177/0885328217702526

Xie, Y., Park, J., & Kang, S. (2016). Studies on the Effect of Molecular Weight on Biodegradable Polymer Membrane. *International Journal of Bio-Science and Bio-Technology*, *8*(3), 315–322. https://doi.org/10.14257/ijbsbt.2016.8.3.32

Xu, R., Xia, H., He, W., Li, Z., Zhao, J., Liu, B., Wang, Y., Lei, Q., Kong, Y., Bai, Y., Yao, Z., Yan, R., Li, H., Zhan, R., Yang, S., Luo, G., & Wu, J. (2016). Controlled swelling transmission rate promotes wound-healing via wound re-epithelialization and contraction enhancement. *Scientific Reports*, *6*(1), 24596. https://doi.org/10.1038/srep24596

Yu, H. C., Zhang, H., Ren, K., Ying, Z., Zhu, F., Qian, J., Ji, J., Wu, Z. L., & Zheng, Q. (2018). Ultrathin κ-Carrageenan/Chitosan Hydrogel Films with High Toughness and Antiadhesion Property. *ACS Applied Materials & Interfaces*, *10*(10), 9002–9009. https://doi.org/10.1021/acsami.7b18343

Zahiruddin, W., Erungan, A. C., & Wiraswanti, I. (2008). Utilization of Karagenan and Chitosan in Kurisi (*Nemipterus nematophorus*) Fish Meat Ball Manufacturing by Cold Storage and Frozen Temperature. *Jurnal Pengolahan Hasil Perikanan Indonesia*, *11*(1), Article 1. https://doi.org/10.17844/jphpi.v11i1.930

Zainul Armir, N. A., Mohd Salleh, K., Zulkifli, A., & Zakaria, S. (2022). PH-responsive ampholytic regenerated cellulose hydrogel integrated with carrageenan and chitosan. *Industrial Crops and Products*, *178*, 114588. https://doi.org/10.1016/j.indcrop.2022.114588

Zhan, Y., Fu, W., Xing, Y., Ma, X., & Chen, C. (2021). Advances in versatile anti-swelling polymer hydrogels. *Materials Science and Engineering: C*, *127*, 112208. https://doi.org/10.1016/j.msec.2021.112208