

Reference

- Abdullah, M. Z., Mohd Ali, J., Abolmaesoomi, M., Abdul-Rahman, P. S., & Hashim, O. H. (2017). Anti-proliferative, *in vitro* antioxidant, and cellular antioxidant activities of the leaf extracts from *polygonum minus* huds: Effects of solvent polarity. *International Journal of Food Properties*, 20(sup1), 846–862. <https://doi.org/10.1080/10942912.2017.1315591>
- Abeyrathne, E. D., Nam, K., & Ahn, D. U. (2021). Analytical methods for lipid oxidation and antioxidant capacity in food systems. *Antioxidants*, 10(10), 1587. <https://doi.org/10.3390/antiox10101587>
- Abral, H., Pratama, A. B., Handayani, D., Mahardika, M., Aminah, I., Sandrawati, N., Sugiarti, E., Muslimin, A. N., Sapuan, S. M., & Ilyas, R. A. (2021). Antimicrobial edible film prepared from bacterial cellulose nanofibers/starch/chitosan for a food packaging alternative. *International Journal of Polymer Science*, 2021, 1–11. <https://doi.org/10.1155/2021/6641284>
- Alipal, J., Mohd Pu'ad, N. A. S., Lee, T. C., Nayan, N. H. M., Sahari, N., Basri, H., Idris, M. I., & Abdullah, H. Z. (2021). A review of gelatin: Properties, sources, process, applications, and commercialisation. *Materials Today: Proceedings*, 42, 240–250. <https://doi.org/10.1016/j.matpr.2020.12.922>
- Alirezalu, K., Movlan, H. S., Yaghoubi, M., Pateiro, M., & Lorenzo, J. M. (2021). ϵ -polylysine coating with stinging nettle extract for fresh beef preservation. *Meat Science*, 176, 108474. <https://doi.org/10.1016/j.meatsci.2021.108474>
- Anis, A., Pal, K., & Al-Zahrani, S. M. (2021). Essential oil-containing polysaccharide-based edible films and coatings for Food Security Applications. *Polymers*, 13(4), 575. <https://doi.org/10.3390/polym13040575>
- Aziman, N., Abdullah, N., Noor, Z. M., Kamarudin, W. S., & Zulkifli, K. S. (2014). Phytochemical profiles and antimicrobial activity of aromatic Malaysian herb extracts against food-borne pathogenic and food spoilage microorganisms. *Journal of Food Science*, 79(4). <https://doi.org/10.1111/1750-3841.12419>
- Azmi, N. S., Kadir Basha, R., Tajul Arifin, N. N., Othman, S. H., & P. Mohammed, M. A. (2020). Functional properties of Tilapia's fish scale gelatin film: Effects of different type of plasticizers. *Sains Malaysiana*, 49(09), 2221–2229. <https://doi.org/10.17576/jsm-2020-4909-19>
- Baharum, S. N., Bunawan, H., Ghani, M. Abd., Mustapha, W. A., & Noor, N. M. (2010). Analysis of the chemical composition of the essential oil of *Polygonum minus* Huds. using two-dimensional gas chromatography-time-of-flight mass spectrometry (GC-TOF MS). *Molecules*, 15(10), 7006–7015. <https://doi.org/10.3390/molecules15107006>

- Behbahani, B. A., Shahidi, F., Yazdi, F. T., Mortazavi, S. A., & Mohebbi, M. (2017). Use of plantago major seed mucilage as a novel edible coating incorporated with Anethum graveolens essential oil on shelf life extension of beef in refrigerated storage. *International Journal of Biological Macromolecules*, *94*, 515–526. <https://doi.org/10.1016/j.ijbiomac.2016.10.055>
- Bekhit, A. E.-D., Holman, B. W. B., Giteru, S. G., & Hopkins, D. L. (2021). Total volatile basic nitrogen (TVB-N) and its role in meat spoilage: A Review. *Trends in Food Science & Technology*, *109*, 280–302. <https://doi.org/10.1016/j.tifs.2021.01.006>
- Bojorges, H., Ríos-Corripio, M. A., Hernández-Cázares, A. S., Hidalgo-Contreras, J. V., & Contreras-Oliva, A. (2020). Effect of the application of an edible film with turmeric (*Curcuma longa* L.) on the oxidative stability of meat. *Food Science & Nutrition*, *8*(8), 4308–4319. <https://doi.org/10.1002/fsn3.1728>
- Bonilla, J., & Sobral, P. J. A. (2020). Disintegrability under composting conditions of films based on gelatin, chitosan and/or sodium caseinate containing Boldo-of-chile leaves extract. *International Journal of Biological Macromolecules*, *151*, 178–185. <https://doi.org/10.1016/j.ijbiomac.2020.02.051>
- Calva-Estrada, S. J., Jiménez-Fernández, M., & Lugo-Cervantes, E. (2019). Protein-based films: Advances in the development of biomaterials applicable to food packaging. *Food Engineering Reviews*, *11*(2), 78–92. <https://doi.org/10.1007/s12393-019-09189-w>
- Campo, M. M., Nute, G. R., Hughes, S. I., Enser, M., Wood, J. D., & Richardson, R. I. (2006). Flavour perception of oxidation in beef. *Meat Science*, *72*(2), 303–311. <https://doi.org/10.1016/j.meatsci.2005.07.015>
- Cao, W., Yan, J., Liu, C., Zhang, J., Wang, H., Gao, X., Yan, H., Niu, B., & Li, W. (2020). Preparation and characterization of Catechol-grafted chitosan/gelatin/modified chitosan-agnp blend films. *Carbohydrate Polymers*, *247*, 116643. <https://doi.org/10.1016/j.carbpol.2020.116643>
- Cao, Y., Gu, W., Zhang, J., Chu, Y., Ye, X., Hu, Y., & Chen, J. (2013). Effects of chitosan, aqueous extract of ginger, onion and garlic on quality and shelf life of stewed-pork during refrigerated storage. *Food Chemistry*, *141*(3), 1655–1660. <https://doi.org/10.1016/j.foodchem.2013.04.084>
- Cardoso, G. P., Andrade, M. P., Rodrigues, L. M., Massingue, A. A., Fontes, P. R., Ramos, A. de, & Ramos, E. M. (2019). Retail display of beef steaks coated with monolayer and bilayer chitosan-gelatin composites. *Meat Science*, *152*, 20–30. <https://doi.org/10.1016/j.meatsci.2019.02.009>

- Christapher, P. V., Parasuraman, S., Christina, J. M. A., Vikneswaran, M., & Asmawi, M. Z. (2015). Review on *polygonum minus*. Huds, a commonly used food additive in Southeast Asia. *Pharmacognosy Research*, 7(1), 1. <https://doi.org/10.4103/0974-8490.147125>
- Coles, R., McDowell, D., & Kirwan, M. J. (2004). *Food Packaging Technology*. Blackwell.
- Czerwiński, K., Rydzkowski, T., Wróblewska-Krepsztul, J., & Thakur, V. K. (2021). Towards impact of modified atmosphere packaging (MAP) on shelf-life of polymer-film-packed food products: Challenges and sustainable developments. *Coatings*, 11(12), 1504. <https://doi.org/10.3390/coatings11121504>
- Devi, N., Sarmah, M., Khatun, B., & Maji, T. K. (2017). Encapsulation of active ingredients in polysaccharide–protein complex coacervates. *Advances in Colloid and Interface Science*, 239, 136–145. <https://doi.org/10.1016/j.cis.2016.05.009>
- Dewi, S., Assegaf, S. N. Y. R. S., Natalia, D., & Mahyarudin, M. (2019). Efek Ekstrak Etanol Daun Kesum (*Polygonum minus* Huds.) sebagai antifungi TERHADAP *Trichophyton Rubrum*. *Jurnal Kesehatan Andalas*, 8(2), 198. <https://doi.org/10.25077/jka.v8i2.992>
- Dille, M. J., Haug, I. J., & Draget, K. I. (2021). Gelatin and collagen. *Handbook of Hydrocolloids*, 1073–1097. <https://doi.org/10.1016/b978-0-12-820104-6.00028-0>
- Elsabee, M. Z., & Abdou, E. S. (2013). Chitosan based edible films and coatings: A Review. *Materials Science and Engineering: C*, 33(4), 1819–1841. <https://doi.org/10.1016/j.msec.2013.01.010>
- Erkmen, O., & Bozoglu, T. F. (2016). Spoilage of meat and meat products. *Food Microbiology: Principles into Practice*, 279–295. <https://doi.org/10.1002/9781119237860.ch16>
- Eurostat. (2023). *Statistics explained*. Statistics Explained. Retrieved February 19, 2023, from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Packaging_waste_statistics
- Gómez-Estaca, J., Gómez-Guillén, M. C., Fernández-Martín, F., & Montero, P. (2011). Effects of gelatin origin, bovine-hide and tuna-skin, on the properties of compound gelatin–Chitosan films. *Food Hydrocolloids*, 25(6), 1461–1469. <https://doi.org/10.1016/j.foodhyd.2011.01.007>
- Hassan, K. Z., Noor, H. M., & Kader, J. (2015). Antibacterial efficacy of three different extracts of *Polygonum minus* (Huds.). *Int'l Conference on Waste Management, Ecology and Biological Sciences*. <https://doi.org/10.17758/er1515231>
- Höll, L., Behr, J., & Vogel, R. F. (2016). Identification and growth dynamics of meat spoilage microorganisms in modified atmosphere packaged poultry meat by MALDI-Tof MS. *Food Microbiology*, 60, 84–91. <https://doi.org/10.1016/j.fm.2016.07.003>

- Horbańczuk, O. K., Kurek, M. A., Atanasov, A. G., Brnčić, M., & Rimac Brnčić, S. (2019). The effect of natural antioxidants on quality and shelf life of beef and beef products. *Food Technology and Biotechnology*, 57(4), 439–447. <https://doi.org/10.17113/ftb.57.04.19.6267>
- Hosseini, S. F., Rezaei, M., Zandi, M., & Ghavi, F. F. (2013). Preparation and functional properties of fish gelatin–chitosan blend edible films. *Food Chemistry*, 136(3-4), 1490–1495. <https://doi.org/10.1016/j.foodchem.2012.09.081>
- Ibrahim, H. M., & El-Zairy, E. M. R. (2015). Chitosan as a biomaterial — structure, properties, and Electrospun nanofibers. *Concepts, Compounds and the Alternatives of Antibacterials*. <https://doi.org/10.5772/61300>
- Jeya Jeevahan, J., Chandrasekaran, M., Venkatesan, S. P., Sriram, V., Britto Joseph, G., Mageshwaran, G., & Durairaj, R. B. (2020). Scaling up difficulties and commercial aspects of edible films for Food Packaging: A Review. *Trends in Food Science & Technology*, 100, 210–222. <https://doi.org/10.1016/j.tifs.2020.04.014>
- Khalaf, H., Sharoba, A., El-Tanahi, H., & Morsy, M. (2013). Stability of antimicrobial activity of Pullulan edible films incorporated with nanoparticles and essential oils and their impact on Turkey deli meat quality. *Journal of Food and Dairy Sciences*, 4(11), 557–573. <https://doi.org/10.21608/jfds.2013.72104>
- Kim, H. J., Kim, D., Kim, H. J., Song, S. O., Song, Y. H., & Jang, A. (2018). Evaluation of the Microbiological Status of Raw Beef in Korea: Considering the Suitability of Aerobic Plate Count Guidelines. *Korean journal for food science of animal resources*, 38(1), 43–51. <https://doi.org/10.5851/kosfa.2018.38.1.043>
- Kong, I., Degraeve, P., & Pui, L. P. (2022). Polysaccharide-based edible films incorporated with essential oil nanoemulsions: Physico-Chemical, mechanical properties and its application in Food Preservation—a review. *Foods*, 11(4), 555. <https://doi.org/10.3390/foods11040555>
- Kong, I., Heng, Z. W., & Pui, L. P. (2022). Development of chitosan edible film incorporated with curry leaf and Kesum for the packaging of Chicken Breast Meat. *Asia Pacific Journal of Molecular Biology and Biotechnology*, 91–104. <https://doi.org/10.35118/apjmbb.2022.030.3.08>
- Lestari, R. B., Hartanti, L., & Permadi, E. (2020). EFFECTS OF KESUM LEAF EXTRACT SUPPLEMENTATION ON CHARACTERISTICS OF DURIAN SEEDS STARCH (DURIO ZIBETHINUS) - CHITOSAN EDIBLE FILM. *Scientific Study & Research. Chemistry & Chemical Engineering, Biotechnology, Food Industry*, 21(4), 473–482.

- Lestari, R. B., Permadi, E., & Harahap, R. P. (2020). Decrease quality during storage packaged beef sausage edible coating by durian seeds starch-chitosan with the addition of Kesum Leaf Extract. *IOP Conference Series: Earth and Environmental Science*, 478(1), 012036. <https://doi.org/10.1088/1755-1315/478/1/012036>
- Li, J., & Zhuang, S. (2020). Antibacterial activity of chitosan and its derivatives and their interaction mechanism with bacteria: Current State and Perspectives. *European Polymer Journal*, 138, 109984. <https://doi.org/10.1016/j.eurpolymj.2020.109984>
- Li, Q., Dunn, E. T., Grandmaison, E. W., & Goosen, M. F. A. (1992). Applications and properties of Chitosan. *Journal of Bioactive and Compatible Polymers*, 7(4), 370–397. <https://doi.org/10.1177/088391159200700406>
- Li, Q., Zhu, X., Xie, Y., & Liang, J. (2021). Antifungal properties and mechanisms of three volatile aldehydes (Octanal, nonanal and Decanal) on aspergillus flavus. *Grain & Oil Science and Technology*, 4(3), 131–140. <https://doi.org/10.1016/j.gaost.2021.07.002>
- Liu, Q., Han, J. C., Zhang, Y. G., Li, S. M., & Li, J. (2012). Antimicrobial and antioxidant activities of carboxymethyl cellulose edible films incorporated with rosemary extracts on fresh beef during refrigerated storage. *Advanced Materials Research*, 554-556, 1187–1194. <https://doi.org/10.4028/www.scientific.net/amr.554-556.1187>
- Luong, N.-D. M., Coroller, L., Zagorec, M., Membré, J.-M., & Guillou, S. (2020). Spoilage of chilled fresh meat products during storage: A quantitative analysis of literature data. *Microorganisms*, 8(8), 1198. <https://doi.org/10.3390/microorganisms8081198>
- Ly, B. C., Dyer, E. B., Feig, J. L., Chien, A. L., & Del Bino, S. (2020). Research techniques made simple: Cutaneous colorimetry: A reliable technique for objective skin color measurement. *Journal of Investigative Dermatology*, 140(1). <https://doi.org/10.1016/j.jid.2019.11.003>
- Major Muscles of The Carcass*. Animal Biosciences. (n.d.). Retrieved March 24, 2023, from https://animalbiosciences.uoguelph.ca/~swatland/ch4_1.htm#:~:text=The%20loin%20muscles%20give%20rise,anterior%20of%20the%20ilium.
- Mazzola, N., & I.G.L. Sarantopoulos, C. (2020). Packaging design alternatives for Meat Products. *Food Processing*. <https://doi.org/10.5772/intechopen.88586>
- Miller, M. (n.d.). *Dark firm and Dry Beef*. Beef Research. Retrieved March 24, 2023, from <https://www.beefresearch.org/resources/product-quality/fact-sheets/dark-firm-and-dry-beef>
- Mousavi Khaneghah, A., Hashemi, S. M., & Limbo, S. (2018). Antimicrobial agents and packaging systems in antimicrobial active food packaging: An overview of approaches and interactions. *Food and Bioproducts Processing*, 111, 1–19. <https://doi.org/10.1016/j.fbp.2018.05.001>

- Naqvi, Z. B., Thomson, P. C., Ha, M., Campbell, M. A., McGill, D. M., Friend, M. A., & Warner, R. D. (2021). Effect of sous vide cooking and ageing on tenderness and water-holding capacity of low-value beef muscles from young and older animals. *Meat Science*, *175*, 108435. <https://doi.org/10.1016/j.meatsci.2021.108435>
- Ninan, G., Joseph, J., & Abubacker, Z. (2010). Physical, mechanical, and barrier properties of carp and mammalian skin gelatin films. *Journal of Food Science*, *75*(9). <https://doi.org/10.1111/j.1750-3841.2010.01851.x>
- OECD. (2023). *Agricultural output - meat consumption - OECD data*. theOECD. Retrieved February 19, 2023, from <https://data.oecd.org/agroutput/meat-consumption.htm>
- Olivera, D. F., Bambicha, R., Laporte, G., Cárdenas, F. C., & Mestorino, N. (2012). Kinetics of colour and texture changes of beef during storage. *Journal of Food Science and Technology*, *50*(4), 821–825. <https://doi.org/10.1007/s13197-012-0885-7>
- Page, J. K., Wulf, D. M., & Schwotzer, T. R. (2001). A survey of beef muscle color and pH. *Journal of Animal Science*, *79*(3), 678. <https://doi.org/10.2527/2001.793678x>
- Pavlath, A. E., & Orts, W. (2009). Edible films and coatings: Why, what, and how? *Edible Films and Coatings for Food Applications*, 1–23. https://doi.org/10.1007/978-0-387-92824-1_1
- Pellissery, A. J., Vinayamohan, P. G., Amalaradjou, M. A., & Venkitanarayanan, K. (2020). Spoilage bacteria and meat quality. *Meat Quality Analysis*, 307–334. <https://doi.org/10.1016/b978-0-12-819233-7.00017-3>
- Purwaningsih, I., Sapriani, R., & Indrawati, R. (2018). Antioxidant activity of methanol extract of Kesum leaves (*Polygonum minus* Huds.) DPPH Methodaktivitas Antioksidan Ekstrak metanol Daun Kesum (*Polygonum minus* Huds.) Metode DPPH. *Jurnal Laboratorium Khatulistiwa*, *1*(2), 161. <https://doi.org/10.30602/jlk.v1i2.156>
- Rahmawati, S., Pathuddin, Nuryanti, S., Dia Afrianti Sangkota, V., Afadil, Anggraini, & Syawaliah, N. (2022). Characteristics and antioxidants of edible film from durian seeds (*durio zibethinus*) with additions to rosella flower extract (*Hibiscus Sabdariffa* L.). *Materials Today: Proceedings*, *65*, 3109–3115. <https://doi.org/10.1016/j.matpr.2022.07.162>
- Ramos, M., Valdés, A., Beltrán, A., & Garrigós, M. (2016). Gelatin-based films and coatings for Food Packaging Applications. *Coatings*, *6*(4), 41. <https://doi.org/10.3390/coatings6040041>
- Rodrigues, J. B., Brunelli, K., Sarantopoulos, C. I., & Oliveira, L. M. (2018). Properties of barrier shrink bags made with EVOH and polyamide for fresh beef meat preservation. *Polímeros*, *28*(2), 125–130. <https://doi.org/10.1590/0104-1428.04516>
- Rusdi, N. A., Goh, H.-H., & Baharum, S. N. (2016). GC-MS/olfactometric characterisation and aroma extract dilution analysis of aroma active compounds in *Polygonum minus* essential oil. *Plant Omics*, *9*(4), 289–291. <https://doi.org/10.21475/poj.16.09.04.p7901>

- Scheller, J., & Conrad, U. (2005). Plant-based material, protein and biodegradable plastic. *Current Opinion in Plant Biology*, 8(2), 188–196. <https://doi.org/10.1016/j.pbi.2005.01.010>
- Siracusa, V., Rocculi, P., Romani, S., & Rosa, M. D. (2008). Biodegradable polymers for Food Packaging: A Review. *Trends in Food Science & Technology*, 19(12), 634–643. <https://doi.org/10.1016/j.tifs.2008.07.003>
- Song, D.-H., Hoa, V. B., Kim, H. W., Khang, S. M., Cho, S.-H., Ham, J.-S., & Seol, K.-H. (2021). Edible films on meat and meat products. *Coatings*, 11(11), 1344. <https://doi.org/10.3390/coatings11111344>
- Tajeddin, B., & Arabkhedri, M. (2020). Polymers and food packaging. *Polymer Science and Innovative Applications*, 525–543. <https://doi.org/10.1016/b978-0-12-816808-0.00016-0>
- Team, E. W. (2019). *Decanal*. decanal (CHEBI:31457). <https://www.ebi.ac.uk/chebi/searchId.do?chebiId=CHEBI%3A31457>
- Texture analysis and texture profile analysis*. Rheology Lab. (2023, January 5). Retrieved March 24, 2023, from [https://www.rheologylab.com/services/texture-analysis/#:~:text=Cohesiveness%20%3D%20\(d%2Be\)%2F\(,underneath%20the%20first%20compression%20curve](https://www.rheologylab.com/services/texture-analysis/#:~:text=Cohesiveness%20%3D%20(d%2Be)%2F(,underneath%20the%20first%20compression%20curve).
- Umaraw, P., & Verma, A. K. (2015). Comprehensive review on application of edible film on meat and meat products: An eco-friendly approach. *Critical Reviews in Food Science and Nutrition*, 57(6), 1270–1279. <https://doi.org/10.1080/10408398.2014.986563>
- Utami, R., Kawiji, Khasanah, L. U., & Nasution, M. I. A. (2017). International Food Research Journal. *Preservative Effects of Kaffir Lime (Citrus Hystrix DC) Leaves Oleoresin Incorporation on Cassava Starch-Based Edible Coatings for Refrigerated Fresh Beef*, 24(4), 1464–1472.
- Vimala, S., Rohana, S., Rashih, A. A., & Juliza, M. (2011). Antioxidant Evaluation in Malaysian Medicinal Plant: *Persicaria minor* (Huds.) Leaf. *Science Journal of Medicine & Clinical Trials*.
- Vital, A. C., Guerrero, A., Monteschio, J. de, Valero, M. V., Carvalho, C. B., de Abreu Filho, B. A., Madrona, G. S., & do Prado, I. N. (2016). Effect of edible and active coating (with rosemary and oregano essential oils) on beef characteristics and consumer acceptability. *PLOS ONE*, 11(8). <https://doi.org/10.1371/journal.pone.0160535>
- Wang, H., Ding, F., Ma, L., & Zhang, Y. (2021). Edible films from chitosan-gelatin: Physical properties and food packaging application. *Food Bioscience*, 40, 100871. <https://doi.org/10.1016/j.fbio.2020.100871>

- Wankhade, V. (2020). Animal-derived biopolymers in food and biomedical technology. *Biopolymer-Based Formulations*, 139–152. <https://doi.org/10.1016/b978-0-12-816897-4.00006-0>
- Yaacob, K. B. (1990). Essential oil of *polygonum minushuds*. *Journal of Essential Oil Research*, 2(4), 167–172. <https://doi.org/10.1080/10412905.1990.9697855>
- Yilmaz Atay, H. (2019). Antibacterial activity of chitosan-based systems. *Functional Chitosan*, 457–489. https://doi.org/10.1007/978-981-15-0263-7_15
- Yim, D.-G., Jin, S.-K., & Hur, S.-J. (2019). Microbial changes under packaging conditions during transport and comparison between sampling methods of Beef. *Journal of Animal Science and Technology*, 61(1), 47–53. <https://doi.org/10.5187/jast.2019.61.1.47>
- Zhang, B., Liu, Y., Wang, H., Liu, W., Cheong, K.-leong, & Teng, B. (2021). Effect of sodium alginate-agar coating containing ginger essential oil on the shelf life and quality of beef. *Food Control*, 130, 108216. <https://doi.org/10.1016/j.foodcont.2021.108216>
- Zhang, Y., Zhou, L., Zhang, C., Show, P. L., Du, A., Fu, J. C., & Ashokkumar, V. (2020). Preparation and characterization of curdlan/polyvinyl alcohol/ thyme essential oil blending film and its application to chilled meat preservation. *Carbohydrate Polymers*, 247, 116670. <https://doi.org/10.1016/j.carbpol.2020.116670>
- Zou, J., Liu, X., Wang, X., Yang, H., Cheng, J., Lin, Y., & Tang, D. (2022). Influence of gelatin-chitosan-glycerol edible coating incorporated with chlorogenic acid, gallic acid, and resveratrol on the preservation of Fresh Beef. *Foods*, 11(23), 3813. <https://doi.org/10.3390/foods11233813>