

REFERENCES

- Afif, M., Wijayati, N., & Mursiti, S. (2018). Pembuatan dan Karakterisasi Bioplastik dari Pati Biji Alpukat-Kitosan dengan Plasticizeafifir Sorbitol. *Indonesian Journal of Chemical Science*, 7(2), 103–109.
- Agarwal, S. (2021). Major factors affecting the characteristics of starch based biopolymer films. *European Polymer Journal*, 160(September), 110788. <https://doi.org/10.1016/j.eurpolymj.2021.110788>
- Agnihotri, S. A., Mallikarjuna, N. N., & Aminabhavi, T. M. (2004). Recent advances on chitosan-based micro- and nanoparticles in drug delivery. *Journal of Controlled Release*, 100(1), 5–28. <https://doi.org/10.1016/j.jconrel.2004.08.010>
- Amagliani, L., O'Regan, J., Kelly, A. L., & O'Mahony, J. A. (2016). Chemistry, structure, functionality and applications of rice starch. *Journal of Cereal Science*, 70, 291–300. <https://doi.org/10.1016/j.jcs.2016.06.014>
- Aminian, M., Nafchi, A. M., Bolandi, M., & Alias, A. K. (2013). Preparation and characterization of high degree substituted sago (Metroxylon sago) starch with propylene oxide. *Starch/Staerke*, 65(7–8), 686–693. <https://doi.org/10.1002/star.201200137>
- Antoniou, J., Liu, F., Majeed, H., & Zhong, F. (2015). Characterization of tara gum edible films incorporated with bulk chitosan and chitosan nanoparticles: A comparative study. *Food Hydrocolloids*, 44, 309–319. <https://doi.org/10.1016/j.foodhyd.2014.09.023>
- Apriyanto, A., Compart, J., & Fettke, J. (2022). A review of starch, a unique biopolymer – Structure, metabolism and in planta modifications. *Plant Science*, 318(February), 111223. <https://doi.org/10.1016/j.plantsci.2022.111223>
- Ashori, A., & Bahrami, R. (2014). Modification of Physico-Mechanical Properties of Chitosan-Tapioca Starch Blend Films Using Nano Graphene. *Polymer - Plastics Technology and Engineering*, 53(3), 312–318. <https://doi.org/10.1080/03602559.2013.866246>
- Babae, M., Garavand, F., Rehman, A., Jafarazadeh, S., Amini, E., & Cacciotti, I. (2022). Biodegradability, physical, mechanical and antimicrobial attributes of starch nanocomposites containing chitosan nanoparticles. *International Journal of Biological Macromolecules*, 195(September 2021), 49–58. <https://doi.org/10.1016/j.ijbiomac.2021.11.162>
- Bashir, S. M., Ahmed Rather, G., Patricio, A., Haq, Z., Sheikh, A. A., Shah, M. Z., ul H., Singh, H., Khan, A. A., Imtiyaz, S., Ahmad, S. B., Nabi, S., Rakhshan, R., Hassan, S., & Fonte, P. (2022). 3 Pdf. *Materials*, 15(19), 1–28.
- Bourtoom, T., & Chinnan, M. S. (2008). Preparation and properties of rice starch-chitosan blend biodegradable film. *Lwt*, 41(9), 1633–1641. <https://doi.org/10.1016/j.lwt.2007.10.014>
- Brown, W., & Poon, T. (2011). *Introduction to Organic Chemistry*. Wiley.
- Chang, P. R., Jian, R., Yu, J., & Ma, X. (2010). Fabrication and characterisation of chitosan nanoparticles/plasticised-starch composites. *Food Chemistry*, 120(3), 736–740. <https://doi.org/10.1016/j.foodchem.2009.11.002>
- Chang, Y. P., Cheah, P. B., & Seow, C. C. (2000). Plasticizing – Antiplasticizing

- Effects of Water on Physical Properties of Tapioca. *Journal of Food Science*, 65(3), 445–447.
- Chaudhary, P., Fatima, F., & Kumar, A. (2020). Relevance of Nanomaterials in Food Packaging and its Advanced Future Prospects. *Journal of Inorganic and Organometallic Polymers and Materials*, 30(12), 5180–5192. <https://doi.org/10.1007/s10904-020-01674-8>
- Cheetham, N. W. H., & Tao, L. (1998). Solid state NMR studies on the structural and conformational properties of natural maize starches. *Carbohydrate Polymers*, 36, 285–292.
- 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>
- Cornejo-Ramírez, Y. I., Martínez-Cruz, O., Del Toro-Sánchez, C. L., Wong-Corral, F. J., Borboa-Flores, J., & Cinco-Moroyoqui, F. J. (2018). The structural characteristics of starches and their functional properties. *CYTA - Journal of Food*, 16(1), 1003–1017. <https://doi.org/10.1080/19476337.2018.1518343>
- Dang, K. M., & Yoksan, R. (2016). Morphological characteristics and barrier properties of thermoplastic starch/chitosan blown film. *Carbohydrate Polymers*, 150, 40–47. <https://doi.org/10.1016/j.carbpol.2016.04.113>
- de Moura, M. R., Aouada, F. A., Avena-Bustillos, R. J., McHugh, T. H., Krochta, J. M., & Mattoso, L. H. C. (2009). Improved barrier and mechanical properties of novel hydroxypropyl methylcellulose edible films with chitosan/tripolyphosphate nanoparticles. *Journal of Food Engineering*, 92(4), 448–453. <https://doi.org/10.1016/j.jfoodeng.2008.12.015>
- Duan, B., Sun, P., Wang, X., & Yang, C. (2011). Preparation and properties of starch nanocrystals/carboxymethyl chitosan nanocomposite films. *Starch/Staerke*, 63(9), 528–535. <https://doi.org/10.1002/star.201000136>
- Garavand, F., Rouhi, M., Jafarzadeh, S., Khodaei, D., Cacciotti, I., Zargar, M., & Razavi, S. H. (2022). Tuning the Physicochemical, Structural, and Antimicrobial Attributes of Whey-Based Poly (L-Lactic Acid) (PLLA) Films by Chitosan Nanoparticles. *Frontiers in Nutrition*, 9(April), 1–16. <https://doi.org/10.3389/fnut.2022.880520>
- 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>
- Greener, & Fennema. (1989). No Barrier Properties and Surface Characteristics of Edible, Bilayer Films. *Journal of Food Science*, 54(06), 0022–1147.
- Guan, Y., Liu, X., Zhang, Y., & Kangde, Y. (1998). Study of phase behavior on chitosan/viscose rayon blend film. *Journal of Applied Polymer Science*, 67(12), 1965–1972.
- Haghighi, H., Leugoue, S. K., Pfeifer, F., Siesler, H. W., Licciardello, F., Fava, P., & Pulvirenti, A. (2020). Development of antimicrobial films based on chitosan-polyvinyl alcohol blend enriched with ethyl lauroyl arginate (LAE)

- for food packaging applications. *Food Hydrocolloids*, 100(July 2019). <https://doi.org/10.1016/j.foodhyd.2019.105419>
- Hii, S. L., Tan, J. S., Ling, T. C., & Ariff, A. Bin. (2012). Pullulanase: Role in starch hydrolysis and potential industrial applications. *Enzyme Research*, 2012. <https://doi.org/10.1155/2012/921362>
- Hoang, N. H., Thanh, T. Le, Sangpueak, R., Treekoon, J., Saengchan, C., Thepbandit, W., Papatoti, N. K., Kamkaew, A., & Buensanteai, N. (2022). Chitosan Nanoparticles-Based Ionic Gelation Method: A Promising Candidate for Plant Disease Management. *Polymers*, 14(4), 1–28. <https://doi.org/10.3390/polym14040662>
- Lei, Q., Pan, J., Bao, J., Huang, Z., & Zhang, Y. (2014). Analysis and modeling of moisture sorption behavior for antimicrobial composite protein films. *Bio-Medical Materials and Engineering*, 24(6), 1969–1978. <https://doi.org/10.3233/BME-141006>
- Li, H., & Huneault, M. A. (2010). Comparison of Sorbitol and Glycerol as Plasticizers for Thermoplastic Starch in TPS/PLA Blends. *Journal of Applied Polymer Science*, 119(4), 2439–2448. <https://doi.org/10.1002/app>
- Liu, G., Shi, K., & Sun, H. (2023). Research Progress in Hemicellulose-Based Nanocomposite Film as Food Packaging. *Polymers*, 15(4). <https://doi.org/10.3390/polym15040979>
- Liu, H., Yu, L., Xie, F., & Chen, L. (2006). Gelatinization of cornstarch with different amylose/amylopectin content. *Carbohydrate Polymers*, 65(3), 357–363. <https://doi.org/10.1016/j.carbpol.2006.01.026>
- Liu, Z., & Han, J. H. (2005). Film-forming characteristics of starches. *Journal of Food Science*, 70(1). <https://doi.org/10.1111/j.1365-2621.2005.tb09034.x>
- Mali, S., Sakanaka, L. S., Yamashita, F., & Grossmann, M. V. E. (2005). Water sorption and mechanical properties of cassava starch films and their relation to plasticizing effect. *Carbohydrate Polymers*, 60(3), 283–289. <https://doi.org/10.1016/j.carbpol.2005.01.003>
- Molavi, H., Behfar, S., Ali Shariati, M., Kaviani, M., & Atarod, S. (2015). a Review on Biodegradable Starch Based Film. *Journal of Microbiology, Biotechnology and Food Sciences*, 4(5), 456–461. <https://doi.org/10.15414/jmbfs.2015.4.5.456-461>
- Naskar, S., Sharma, S., & Kuotsu, K. (2019). Chitosan-based nanoparticles: An overview of biomedical applications and its preparation. *Journal of Drug Delivery Science and Technology*, 49(September 2020), 66–81. <https://doi.org/10.1016/j.jddst.2018.10.022>
- Othman, S. H., Kechik, N. R. A., Shapi'i, R. A., Talib, R. A., & Tawakkal, I. S. M. A. (2019). Water sorption and mechanical properties of starch/chitosan nanoparticle films. *Journal of Nanomaterials*, 2019. <https://doi.org/10.1155/2019/3843949>
- Oyekunle, D. T., Nia, M. H., & Wilson, L. D. (2024). Recent Progress on the Application of Chitosan, Starch and Chitosan–Starch Composites for Meat Preservation—A Mini Review. *Journal of Composites Science*, 8(8), 1–30. <https://doi.org/10.3390/jcs8080302>
- Piyada, K., Waranyou, S., & Thawien, W. (2013). Mechanical, thermal and

- structural properties of rice starch films reinforced with rice starch nanocrystals. *International Food Research Journal*, 20(1), 439–449.
- Polnaya, F. J., Haryadi, & Marseno, D. W. (2008). Characteristics of Hydroxypropylated and Acetylated Sago Starches. *Sago Palm*, December 2008.
- Quiñones, J. P., Peniche, H., & Peniche, C. (2018). Chitosan based self-assembled nanoparticles in drug delivery. *Polymers*, 10(3), 1–32. <https://doi.org/10.3390/polym10030235>
- Ribeiro, E. F., de Barros-Alexandrino, T. T., Assis, O. B. G., Junior, A. C., Quiles, A., Hernando, I., & Nicoletti, V. R. (2020). Chitosan and crosslinked chitosan nanoparticles: Synthesis, characterization and their role as Pickering emulsifiers. *Carbohydrate Polymers*, 250(August), 116878. <https://doi.org/10.1016/j.carbpol.2020.116878>
- Rindlav-Westling, A., B, A.-M. H., & Gatenholm, P. (1998). Structure, mechanical and barrier properties of amylose and amylopectin films. *Carbohydrate Polymers*, 36(2–3), 217–224. [https://doi.org/10.1016/S0144-8617\(98\)00025-3](https://doi.org/10.1016/S0144-8617(98)00025-3)
- Robert, M. S., Francis, X. W., David, J. K., & David, L. B. (2005). *Spectrometric identification of organic compounds*. John Wiley & Sons, Inc.
- Robertson, G. L. (2005). *Food packaging: Principles and practice (2nd ed)*. CRC Press.
- Santana, J. S., de Carvalho Costa, K., Rodrigues, P. R., Correia, P. R. C., Cruz, R. S., & Druzian, J. I. (2019). Morphological, barrier, and mechanical properties of cassava starch films reinforced with cellulose and starch nanoparticles. *Journal of Applied Polymer Science*, 136(4), 1–10. <https://doi.org/10.1002/app.47001>
- Shapii, R. A., Othman, S. H., Basha, R. K., & Naim, M. N. (2022). Mechanical, thermal, and barrier properties of starch films incorporated with chitosan nanoparticles. *Nanotechnology Reviews*, 11(1), 1464–1477. <https://doi.org/10.1515/ntrev-2022-0094>
- Silva-Pereira, M. C., Teixeira, J. A., Pereira-Júnior, V. A., & Stefani, R. (2015). Chitosan/corn starch blend films with extract from Brassica oleraceae (red cabbage) as a visual indicator of fish deterioration. *Lwt*, 61(1), 258–262. <https://doi.org/10.1016/j.lwt.2014.11.041>
- Sondari, D., Restu, W. K., Sampora, Y., Devy, Y. A., Yosta, T. D., & Muawanah, A. (2021). Effect of solvent concentration in sago starch fractionation. *IOP Conference Series: Materials Science and Engineering*, 1011(1). <https://doi.org/10.1088/1757-899X/1011/1/012038>
- Suppakul, P., Chalernsook, B., Ratisuthawat, B., Prapasitthi, S., & Munchukangwan, N. (2013). Empirical modeling of moisture sorption characteristics and mechanical and barrier properties of cassava flour film and their relation to plasticizing-antiplasticizing effects. *Lwt*, 50(1), 290–297. <https://doi.org/10.1016/j.lwt.2012.05.013>
- Teodoro, A. P., Mali, S., Romero, N., & De Carvalho, G. M. (2015). Cassava starch films containing acetylated starch nanoparticles as reinforcement: Physical and mechanical characterization. *Carbohydrate Polymers*, 126, 9–16.

- <https://doi.org/10.1016/j.carbpol.2015.03.021>
- Tsai, G. J., & Su, W. H. (1999). Antibacterial activity of shrimp chitosan against *Escherichia coli*. *Journal of Food Protection*, *62*(3), 239–243. <https://doi.org/10.4315/0362-028X-62.3.239>
- Vahedikia, N., Garavand, F., Tajeddin, B., Cacciotti, I., Jafari, S. M., Omid, T., & Zahedi, Z. (2019). Biodegradable zein film composites reinforced with chitosan nanoparticles and cinnamon essential oil: Physical, mechanical, structural and antimicrobial attributes. *Colloids and Surfaces B: Biointerfaces*, *177*(January), 25–32. <https://doi.org/10.1016/j.colsurfb.2019.01.045>
- Wattanachant, S., Syed Muhammad, S. K., Mat Hashim, D., & Abd Rahman, R. (2002). Suitability of sago starch as a base for dual-modification. *Songklanakar Journal of Science and Technology*, *24*(3), 431–438.
- Wittaya, T. (2012). Rice Starch-Based Biodegradable Films: Properties Enhancement. *Structure and Function of Food Engineering*. <https://doi.org/10.5772/47751>
- Xu, Y. X., Kim, K. M., Hanna, M. A., & Nag, D. (2005). Chitosan-starch composite film: Preparation and characterization. *Industrial Crops and Products*, *21*(2), 185–192. <https://doi.org/10.1016/j.indcrop.2004.03.002>
- Yanat, M., & Schroën, K. (2021). Preparation methods and applications of chitosan nanoparticles; with an outlook toward reinforcement of biodegradable packaging. *Reactive and Functional Polymers*, *161*(February). <https://doi.org/10.1016/j.reactfunctpolym.2021.104849>
- Yu, X., Liu, Q., Jin, Z., & Jiao, A. (2023). Preparation and characterization of hydroxypropyl methylcellulose/hydroxypropyl starch composite films reinforced by chitosan nanoparticles of different sizes. *Materials Today Communications*, *35*(December 2022), 105714. <https://doi.org/10.1016/j.mtcomm.2023.105714>
- Zhao, S., Chen, S., Ren, S., Li, G., Song, K., Guo, J., Liu, S., He, J., & Zhou, X. (2023). Preparation and Performance of Pueraria lobata Root Powder/Polylactic Acid Composite Films. *Journal of Renewable Materials*, *11*(6), 2531–2553. <https://doi.org/10.32604/jrm.2023.026066>