

DAFTAR PUSTAKA

- Abdillah, M. (2022). Characterization and modification of corn starch (*Zea mays* [L.]) and HPMC with sodium tripolyphosphate as crosslinking agent. *Flurecol Journal. Part C: Health Sciences*, 2(2), 35-46.
- Al-Tabakha, M. M., Arida, A. I., Faelelbom, K. M., Sadek, B., Saeed, D. A., Abu Jarad, R. A., & Jawadi, J. (2015). Influence of capsule shell composition on the performance indicators of hypromellose capsule in comparison to hard gelatin capsules. *Drug development and industrial pharmacy*, 41(10), 1726–1737.
- Aliyu, R. S., Lawal, A. M., Chasta, P., & Sharma, G. K. (2020). Capsules: Types, Manufacturing, Formulation, Quality Control Tests and, Packaging and Storage-a Comprehensive Review. *World J Pharm Life Sci*, 6(8), 93-104.
- Ambarsari, L., & Purwoto, H. (2016). Optimization of Formula Film based on Amylopectin Cassava Starch and Carrageenan as a Raw Materials of Capsule Shell. *Current Biochemistry*, 3(1), 20-32.
- Aprillanda, D. R., Andrie, M., & Taurina, W. (2019). Uji stabilitas kadar protein dalam sediaan kapsul freeze dry fase air ekstrak ikan gabus (*channa striata*) menggunakan metode kjeldahl. *Jurnal Mahasiswa Farmasi Fakultas Kedokteran UNTAN*, 4(1).
- Association of Official Analytical Chemists. (2005). *Official methods of analysis of the Association of Official Analytical Chemists*. Virginia, USA: Association of Official Analytical Chemists, Inc.
- Badan Pusat Statistik. (2025). *Luas Panen, Produksi, dan Produktivitas Jagung Menurut Provinsi, 2024*. <https://www.bps.go.id/id/statistics-table/2/MjIwNCMy/luas-panen--produksi--dan-produktivitas-jagung-menurut-provinsi.html>
- Batu, M. S., Kolo, M. M., Saka, A. R., & Funan, S. E. (2024). Sintesis dan karakterisasi cangkang kapsul obat dari gelatin tulang ikan tembang (*Sardinella fimbriata*). *Indonesia Journal of Halal*, 7(1), 1-11.
- Brindle, L. P., & Krochta, J. M. (2008). Physical properties of whey protein–hydroxypropylmethylcellulose blend edible films. *Journal of food science*, 73(9), E446-E454.
- Chavarría-Rojas, M., Acuña-Amador, D., & Madrigal-Redondo, G. L. (2021). Gelatin and non-gelatin soft gel capsules: A review. *International Journal of Pharmaceutical Excipients*, 12(2), 19-29.
- Departemen Kesehatan RI. (2014). *Farmakope Indonesia Edisi V*. Jakarta: Departemen Kesehatan RI.
- Eslami, Z., Elkoun, S., Robert, M., & Adjallé, K. (2023). A Review of the Effect of Plasticizers on the Physical and Mechanical Properties of Alginate-Based Films. *Molecules (Basel, Switzerland)*, 28(18), 6637.
- Fadjria, N., Arfiandi, A., & Auliyah, N. D. (2024). Analisis kadar amilosa pada pati jagung manis (*Zea Mays* L. Var. Saccharata) secara spektrofotometri UV-Vis. *Journal of Pharmaceutical and Sciences*, 7(2), 152-158.
- Fauzi, M. A. R. D., Pudjiastuti, P., Wibowo, A. C., & Hendradi, E. (2021). Preparation, properties and potential of carrageenan-based hard capsules for

- replacing gelatine: A review. *Polymers*, 13(16), 2666. Gullapalli, R. P., & Mazzitelli, C. L. (2017). Gelatin and non-gelatin capsule dosage forms. *Journal of pharmaceutical sciences*, 106(6), 1453-1465.
- Firdaus, F. E., & Kinanti, A. (2025). Structural and Functional Enhancement of Halal Gelatin Capsules Reinforced with Corn Husk Cellulose. *Polymers*, 17(20), 2803.
- Hamdan, M. A., Najwa, M. A. K., Jose, R., Martin, D., & Adam, F. (2021). Tuning mechanical properties of seaweeds for hard capsules: a step forward for a sustainable drug delivery medium. *Food Hydrocolloids for Health*, 1, 100023.
- Hans, A., & Kartawiria, I. S. (2009). Production of Pharmaceutical Hard Capsule Shell from Corn Starch. *Thesis*. Swiss German University, Banten.
- Hikmah, A. M., & Wafiroh, S. (2023). Uji Ketahanan Air (Swelling) pada Cangkang Kapsul Alginat-Kitosan Menggunakan Polyethylene Glycol (PEG). *Dalton: Jurnal Pendidikan Kimia dan Ilmu Kimia*, 6(3), 196-201.
- Huang, J., Chen, M., Zhou, Y., Li, Y., & Hu, Y. (2020). Functional characteristics improvement by structural modification of hydroxypropyl methylcellulose modified polyvinyl alcohol films incorporating roselle anthocyanins for shrimp freshness monitoring. *International journal of biological macromolecules*, 162, 1250-1261.
- Kalmer, R. R., Karimi, A., Golizadeh, M., Haddadan, M. M., Azizi, M., Ramezanalizadeh, H., & Ghanbari, M. (2022). Effect of different molecular weights of polyethylene glycol as a plasticizer on the formulation of dry powder inhaler capsules: Investigation of puncturing size, morphologies, and surface properties. *Arabian Journal of Chemistry*, 15(11), 104239.
- Khairunnisa, A., Viogenta, P., Kartinah, N., & Azzahra, D. A. (2025). The Characterization of Capsule Shell from Acid-Hydrolyzed Palm Oil Starch. *ALCHEMY Jurnal Penelitian Kimia*, 21(1), 72-81.
- Latifah, F., & Zannah, A. (2024). Optimasi sediaan masker peel-off ekstrak daun mangga gedong (*Mangifera indica* L.) menggunakan simplex lattice design (SLD). *Jurnal Penelitian Farmasi Indonesia*, 13(2), 80-86.
- Legowo, W. P., Ferdiansyah, R., & Tristiyanti, D. (2024, January). Aplikasi dan evaluasi karagenan dari rumput laut asli Indonesia sebagai bahan baku cangkang kapsul keras. *Perjuangan Nature Pharmaceutical Conference*, 1(1), 118-35).
- Lestari, I. T., Putri, A. A. A., Fajriah, F. N., Awaluddin, R., & Rahma, A. (2021). Formulasi dan karakterisasi cangkang kapsul dari pati kulit kentang (*Solanum tuberosum* L.) dan madu sebagai plasticizer. *Journal of Food and Pharmaceutical Sciences*, 9(3), 503-512.
- Liew, K. B., Tan, Y. T. F., & Peh, K. K. (2014). Effect of polymer, plasticizer and filler on orally disintegrating film. *Drug development and industrial pharmacy*, 40(1), 110-119.
- Lismeri, L., Darni, Y., Abrar, A., & Darmansyah, D. (2024). Pengaruh Suhu dan Lama Waktu Pengeringan Terhadap Karakteristik Cangkang Kapsul Berbasis Hydroxypropyl Methylcellulose (HPMC). *Jurnal Teknologi dan Inovasi Industri (JTII)*, 5(2), 46-52.

- Mahardika, G. B., Salsabila, R., Kurniawansyah, F., Ni'mah, H., Nurtono, T., & Mahfud, M. (2023, August). Synthesis of alternative hard capsule from carrageenan and starch using glycerol as plasticizer. In *AIP Conference Proceedings* (Vol. 2818, No. 1, p. 090001). AIP Publishing LLC.
- Maulana, D. S., Mubarak, A. S., & Pujiastuti, D. Y. (2021). The concentration of polyethylene glycol (PEG) 400 on cellulose-based bioplastic from carrageenan waste: Effects on biodegradability and mechanical properties. *IOP Conference Series: Earth and Environmental Science*, 679(1), 012008.
- Meliala, D. I. P., Rahmi, S., Simorangkir, D., & Harefa, B. P. (2021). Formulasi dan uji aktivitas antikejang sediaan kapsul ekstrak etanol daun titanus (*Leea aequanta* L.) terhadap otot polos trakea marmut (*Cavia cobaya*) secara in vitro. *Jurnal Biosains*, 7(3), 133–141.
- Mujizari. (2018). Formulasi dan Karakterisasi Amilopektin Pati Jagung Pulut (*Zea Mays* Ceritina Kulesh) Sebagai Bahan Baku Pembuatan Cangkang Kapsul yang Dikombinasikan dengan Karagenan. *Skripsi*. UIN Alauddin Makassar, Makassar.
- Murachanian, D. (2017). An introduction to two-piece hard capsules and their marketing benefits. In *Pharmaceutical Dosage Forms* (pp. 15-30). CRC Press.
- Nandi, I., Bateson, M., Bari, M., & Joshi, H. N. (2003). Synergistic effect of PEG-400 and cyclodextrin to enhance solubility of progesterone. *AAPS PharmSciTech*, 4(1), E1.
- National Center for Biotechnology Information (2025). PubChem Compound Summary for Polyethylene Glycol 400. Retrieved September 28, 2025 from <https://pubchem.ncbi.nlm.nih.gov/compound/Polyethylene-Glycol-400>.
- Nazira, A. N., & Utami, Y. D. (2025). Kajian komparatif performansi hidroksipropil metilselulosa (HPMC) dan karagenan sebagai matriks pengganti gelatin pada formulasi kapsul halal. *Konferensi Integrasi Interkoneksi Islam dan Sains*, 6(1), 239-246.
- Notonegoro, H., Syaputra, D., & Djamaludin, H. (2024). Pengaruh Karagenan pada Sifat Mekanik dan Gugus Fungsi Formulasi Edible Film Pati Jagung: Effect of Carrageenan on Mechanical Properties and Functional Groups of Corn Starch Edible Film Formulation. *Media Teknologi Hasil Perikanan*, 12(3), 163-171.
- Nurfitri, A. R. (2020). Pengaruh PEG 400 sebagai Plasticizer terhadap Sifat Fisik dan Waktu Hancur Formula Fast Dissolving Film Minyak Jintan Hitam (*Nigella sativa*). *Skripsi*. Universitas Brawijaya, Malang.
- Rachmadhani, F. (2022). Studi Literatur Tanaman Yang Berpotensi Sebagai Bahan Baku Pembuatan Cangkang Kapsul. *Skripsi*. Universitas Islam Negeri Alauddin Makassar, Makassar.
- Rahmi, A., Olvia, B. V., & Saufani, I. A. (2025). Synthesis and Characterization of Sodium Carboxymethylcellulose from *Sansevieria trifasciata* as an Alternative Raw Material for Capsule Shell. *Turkish Journal of Pharmaceutical Sciences*, 22(2), 77–82.
- Ramadita, A., & Ariyanto, H. D. (2024). Effect of Corn Starch and Glycerol Additions on the Characteristics of Capsule Shells from Seaweed

- Carrageenan. *Journal of Food and Pharmaceutical Sciences*, 12(2), 141-148.
- Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (2009). *Handbook of pharmaceutical excipients* (6th ed.). Pharmaceutical Press.
- Sigma-Aldrich. (2025). *Poly(ethylene glycol) (PEG) — Product detail* [Web page]. Retrieved October 1, 2025, from <https://www.sigmaaldrich.com/ID/id/substance/polyethyleneglycol1234525322683>
- Soraya, M., Laksono, H., Putri, R. P. G., Royanti, I., Perwatasari, D. D., Dewi, R. A. P., & Purwoto, H. (2025). Exploring disintegration and swelling dynamics in Kappa-Carrageenan-based seaweed capsule shells. *South African Journal of Chemical Engineering*, 53, 96-102.
- Stegemann, S., Tian, W., Morgen, M., & Brown, S. (2018). Hard capsules in modern drug delivery.
- Sumiati, T., Ratnasari, D., Setiadji, A., & Hanapiah, S. R. (2020). Sintesis dan Karakterisasi Cangkang Kapsul Keras dari Gelatin Tulang Ikan Lele Dumbo (*Clarias Gariepinus*). *Jurnal Farmamedika (Pharmamedika Journal)*, 5(2), 45-51.
- Sun, G., Liang, T., Tan, W., & Wang, L. (2018). Rheological behaviors and physical properties of plasticized hydrogel films developed from κ -carrageenan incorporating hydroxypropyl methylcellulose. *Food Hydrocolloids*, 85, 61-68.
- Suparman, A. (2019). Karakterisasi dan formulasi cangkang kapsul dari tepung pektin kulit buah cokelat (*Theobroma cacao* L). *Jurnal Ilmiah Farmasi Farmasyifa*, 2(2), 77-83.
- Susianti, N., Juliantoni, Y., & Hanifa, N. I. (2021). Optimasi Sediaan Gel Ekstrak Buah Belimbing Wuluh (*Averrhoa bilimbi* L.) Dengan Variasi Basis Karbopol 940 Dan CMC-Na. *Acta Pharmaciae Indonesia : Acta Pharm Indo*, 9(1), 44. <https://doi.org/10.20884/1.api.2021.9.1.3669>
- Tinrat, S., & Sila-Asna, M. (2017). Optimization of gelatin extraction and physico-chemical properties of fish skin and bone gelatin: Its application to Panna Cotta formulas. *Current Research in Nutrition and Food Science Journal*, 5(3), 263-273.
- Uboldi, M., Gelain, A., Buratti, G., Chiappa, A., Gazzaniga, A., Melocchi, A., & Zema, L. (2024). Polyvinyl alcohol-based capsule shells manufactured by injection molding as ready-to-use moisture barriers for the development of delivery systems. *International Journal of Pharmaceutics*, 661, 124373.
- United States Pharmacopeial Convention. (2007). *The United States Pharmacopeia 30 – The National Formulary 25 (USP 30–NF 25)*. Rockville, MD: United States Pharmacopeial Convention.
- United States Pharmacopeia. (2016). (2040) *Disintegration and dissolution of dietary supplements*. In *United States Pharmacopeia–National Formulary (USP 39–NF 34)*, pp. 8423–8431. United States Pharmacopeial Convention.
- Wang, J., Xu, X., Cui, B., Wang, B., & Abd El-Aty, A. M. (2024). Changes in the properties of the corn starch glycerol film in a time-dependent manner during gelatinization. *Food Chemistry*, 458, 140183

- Wu, J., Meng, Q., Zhao, R., Zhu, Y., Huang, J., Zhang, Y., Wang, J., & Gong, J. (2025). Study on the properties of capsule shell prepared by multi-type HPMC mixed system. *Medical engineering & physics*, *141*, 104362. <https://doi.org/10.1016/j.medengphy.2025.104362>
- Zani'ah, C. (2020). Sintesis dan Karakterisasi Sodium Carboxymethyl Cellulose (CMC-Na) dari Ampas Tebu sebagai Alternatif Bahan Baku Cangkang Kapsul. *Skripsi*. Universitas Islam Negeri Maulana Malik Ibrahim, Malang.
- Zhang, N., Liu, H., Yu, L., Liu, X., Zhang, L., Chen, L., & Shanks, R. (2013a). Developing gelatin–starch blends for use as capsule materials. *Carbohydrate polymers*, *92*(1), 455-461.
- Zhang, L., Wang, Y., Liu, H., Yu, L., Liu, X., Chen, L., & Zhang, N. (2013b). Developing hydroxypropyl methylcellulose/hydroxypropyl starch blends for use as capsule materials. *Carbohydrate polymers*, *98*(1), 73-79.
- Zhang, Y., Rempel, C., & Liu, Q. (2014). Thermoplastic starch processing and characteristics—a review. *Critical reviews in food science and nutrition*, *54*(10), 1353-1370.
- Zhang, Y., Zhao, Q., Wang, H., Jiang, X., & Cha, R. (2017). Preparation of green and gelatin-free nanocrystalline cellulose capsules. *Carbohydrate polymers*, *164*, 358-363.
- Zilhada, Z., Harahap, Y., Jaswir, I., & Anwar, E. (2022). Evaluation and characterization of hard-shell capsules formulated by using goatskin gelatin. *Polymers*, *14*(20), 4416.