

## DAFTAR PUSTAKA

- Abasalizadeh, F., Moghaddam, S. V., Alizadeh, E., Akbari, E., Kashani, E., Fazljou, S. M. B., Torbati, M., & Akbarzadeh, A. (2020). Alginate-based hydrogels as drug delivery vehicles in cancer treatment and their applications in wound dressing and 3D bioprinting. *In Journal of Biological Engineering (Vol. 14, Issue 1)*. BioMed Central Ltd.
- Abdelmaksod, A., Basha, O., Talaat, D., Ahmed, H., & Ibrahim, M. (2019). In Vitro evaluation of antimicrobial activity of *Lactobacillus acidophilus* against some pathogens. *In Damanshour Journal of Veterinary Sciences (Vol. 2, Issue 1)*.
- Abdelsamad, N. O., Esawy, M. A., Mahmoud, Z. E., El-Shazly, A. I., Elsayed, T. R., & Gamal, A. A. (2022). Evaluation of different bacterial honey isolates as probiotics and their efficient roles in cholesterol reduction. *World Journal of Microbiology and Biotechnology, 38(6)*, 106.
- Abdul Rahman, A. S., Fizal, A. N. S., Khalil, N. A., Ahmad Yahaya, A. N., Hossain, M. S., & Zulkifli, M. (2023). Fabrication and characterization of magnetic cellulose–chitosan–alginate composite hydrogel bead bio-sorbent. *Polymers, 15(11)*.
- Abedfar, A., Abbaszadeh, S., Hosseini-zhad, M., & Taghdir, M. (2020). Retraction: Physicochemical and biological characterization of the EPS produced by *L. acidophilus* isolated from rice bran sourdough. *In LWT (Vol. 127)*. Academic Press.
- Adilah, R. N., Chiu, S. T., Hu, S. Y., Ballantyne, R., Happy, N., Cheng, A. C., & Liu, C. H. (2022). Improvement in the probiotic efficacy of *Bacillus subtilis* E20-stimulates growth and health status of white shrimp, *Litopenaeus vannamei* via encapsulation in alginate and coated with chitosan. *Fish and Shellfish Immunology, 125*, 74–83.
- Afzaal, M., Saeed, F., Ateeq, H., Shah, Y. A., Hussain, M., Javed, A., Ikram, A., Raza, M. A., Nayik, G. A., Alfarraj, S., Ansari, M. J., & Karabagias, I. K. (2022). Effect of cellulose–chitosan hybrid-based encapsulation on the viability and stability of probiotics under simulated gastric transit and in kefir. *Biomimetics, 7(3)*.
- Ahmadi, F., Samani, S. M., Oveisi, Z., & Amoozgar, Z. (2015). Chitosan based hydrogels: characteristics and pharmaceutical applications. *In Research in Pharmaceutical Sciences (Vol. 10, Issue 1)*.
- Ahn, Y.T., Lim, K.L., Ryu, J., Kang, D., Ham, J., Jang, Y.H., & Kim, H.U. (2002). Characterization of *Lactobacillus acidophilus* isolated from piglets and chicken. *Asian-australasian Journal of Animal Sciences, 15*, 1790-1797.
- Ahtesh, F. B., Stojanovska, L., & Apostolopoulos, V. (2018). Anti-hypertensive peptides released from milk proteins by probiotics. *In Maturitas (Vol. 115, pp. 103–109)*. Elsevier Ireland Ltd.
- Alaqil, A. A., Abbas, A. O., El-Beltagi, H. S., Abd El-Atty, H. K., Mehaisen, G. M. K., & Moustafa, E. S. (2020). Dietary supplementation of probiotic *Lactobacillus*

*acidophilus* modulates cholesterol levels, immune response, and productive performance of laying hens. *Animals*, 10(9), 1–12.

- Anjum, N., Maqsood, S., Masud, T., Ahmad, A., Sohail, A., & Momin, A. (2014). *Lactobacillus acidophilus*: Characterization of the species and application in food production. *Critical Reviews in Food Science and Nutrition*, 54(9), 1241–1251.
- Aprilia, V., Murdiati, A., Hastuti, P., & Harmayani, E. (2017). Encapsulation of *Lactobacillus acidophilus* FNCC 0051 in hydrogel using a complex coacervation of glucomannan and chitosan. *Research Journal of Microbiology*, 12(4), 236–242.
- Aprilia, V., Murdiati, A., Hastuti, P., & Harmayani, E. (2021). The effect of carboxymethyl glucomannan concentration on the properties of glucomannan-chitosan hydrogel for *Lactobacillus acidophilus* fncc 0051 encapsulation. *Walailak Journal of Science and Technology*, 18(16).
- Aprilia, V., Murdiati, A., Hastuti, P., & Harmayani, E. (2022). Hydrogel derived from glucomannan-chitosan to improve the survival of *Lactobacillus acidophilus* FNCC 0051 in simulated gastrointestinal fluid. *Scientific World Journal*, 2022.
- Athipornchai, A., Pabunrueang, P., & Trakulsujaritchook, T. (2024). Mangiferin loaded carrageenan/chitosan core-shell hydrogel beads: Preparation, characterization and proposed application. *Food Hydrocolloids*, 147.
- Baghbani-Arani, F., Asgary, V., & Hashemi, A. (2020). Cell-free extracts of *Lactobacillus acidophilus* and *Lactobacillus delbrueckii* display antiproliferative and antioxidant activities against HT-29 cell line. *Nutrition and Cancer*, 72(8), 1390–1399.
- Bajpai, S. K., & Sharma, S. (2004). Investigation of swelling/degradation behaviour of alginate beads crosslinked with Ca<sup>2+</sup> and Ba<sup>2+</sup> ions. *Reactive and Functional Polymers*, 59(2), 129–140.
- Barleany, D.R., Jayanudin, J., Nasihin, N., Widiawati, M., Yulvianti, M., Sari, D.K., & Gunawan, A. (2023). Hydrogel preparation from shrimp shell-based chitosan: the degree of crosslinking and swelling study. *ASEAN Journal of Chemical Engineering*.
- Bosnea, L. A., Moschakis, T., & Biliaderis, C. G. (2014). Complex coacervation as a novel microencapsulation technique to improve viability of probiotics under different stresses. *Food and Bioprocess Technology*, 7(10), 2767-2781.
- Brickman, C. E., Agnello, M., Imam, N., Camejo, P., Pino, R., Carroll, L. N., Chein, A., & Palefsky, J. M. (2024). Distinct anal microbiome is correlated with anal cancer precursors in MSM with HIV. *AIDS*, 38(10), 1476–1484.
- Chaiyawan, N., Taveeteptaikul, P., Wannissorn, B., Ruengsomwong, S., Klungsunya, P., Buaban, W., & Itsaranuwat, P. (2010). Characterization and probiotic properties of *Bacillus* strains isolated from broiler. In *Vet. Med* (Vol. 40, Issue 2).

- Chean, S. X., Hoh, P. Y., How, Y. H., Nyam, K. L., & Pui, L. P. (2021). Microencapsulation of *Lactiplantibacillus plantarum* with inulin and evaluation of survival in simulated gastrointestinal conditions and roselle juice. *Brazilian Journal of Food Technology*, 24.
- Cheng, H., Ma, Y., Liu, X., Tian, C., Zhong, X., & Zhao, L. (2022). A systematic review and meta-analysis: *Lactobacillus acidophilus* for treating acute gastroenteritis in children. *Nutrients*, 14(3), 682.
- Deepak, V., Ram Kumar Pandian, S., Sivasubramaniam, S. D., Nellaiah, H., & Sundar, K. (2016). Optimization of anticancer exopolysaccharide production from probiotic *Lactobacillus acidophilus* by response surface methodology. *Preparative Biochemistry and Biotechnology*, 46(3), 288–297.
- Dianawati, D., & Shah, N. P. (2011). Enzyme Stability of Microencapsulated *Bifidobacterium animalis* ssp. lactis Bb12 after Freeze Drying and during Storage in Low Water Activity at Room Temperature. *Journal of Food Science*, 76(6).
- Dinev, T., Beev, G., Denev, S., Dermendzhieva, D., Tzanova, M., & Valkova, E. (2017). Antimicrobial activity of *Lactobacillus acidophilus* against pathogenic and food spoilage microorganisms: A review. *Agricultural Science and Technology*, 8(1), 3–9.
- Ding, X., Li, D., Xu, Y., Wang, Y., Liang, S., Xie, L., Yu, W., Zhan, X., & Fu, A. (2023). Carboxymethyl konjac glucomannan-chitosan complex nanogels stabilized emulsions incorporated into alginate as microcapsule matrix for intestinal-targeted delivery of probiotics: In vivo and in vitro studies. *International Journal of Biological Macromolecules*, 253.
- Ding, X., Xu, Y., Wang, Y., Xie, L., Liang, S., Li, D., Wang, Y., Wang, J., & Zhan, X. (2022). Carboxymethyl konjac glucomannan-chitosan complex nanogels stabilized double emulsions incorporated into alginate hydrogel beads for the encapsulation, protection and delivery of probiotics. *Carbohydrate Polymers*, 289.
- Du, J., Dai, J., Liu, J. L., & Dankovich, T. (2006). Novel pH-sensitive polyelectrolyte carboxymethyl konjac glucomannan-chitosan beads as drug carriers. *Reactive and Functional Polymers*, 66(10), 1055–1061.
- Ekarosadi, A. B. is, Cahyanto, M. N., & Fibri, D. L. N. (2025). Microbiological, physicochemical, and sensory changes during masin--shrimp fermentation. *International Journal of Gastronomy and Food Science*, 42.
- Ergin, F., Atamer, Z., Comak Göcer, E. M., Demir, M., Hinrichs, J., & Kucukcetin, A. (2021). Optimization of *salmonella* bacteriophage microencapsulation in alginate-caseinate formulation using vibrational nozzle technique. *Food Hydrocolloids*, 113.
- Fajardo-Cavazos, P., & Nicholson, W. L. (2021). Shelf life and simulated gastrointestinal tract survival of selected commercial probiotics during a simulated round-trip journey to Mars. *Frontiers in Microbiology*, 12, 748950.

- Farid, W., Masud, T., Sohail, A., Ahmad, N., Naqvi, S. M. S., Khan, S., Ali, A., Khalifa, S. A., Hussain, A., Ali, S., Saghir, M., Siddeeg, A., & Manzoor, M. F. (2021). Gastrointestinal transit tolerance, cell surface hydrophobicity, and functional attributes of *Lactobacillus acidophilus* strains isolated from Indigenous Dahi. *Food Science and Nutrition*, 9(9), 5092–5102.
- Frakolaki, G., Giannou, V., Topakas, E., & Tzia, C. (2021). Effect of various encapsulating agents on the beads' morphology and the viability of cells during BB-12 encapsulation through extrusion. *Journal of Food Engineering*, 294.
- Gao, H., Li, X., Chen, X., Hai, D., Wei, C., Zhang, L., & Li, P. (2022). The functional roles of *Lactobacillus acidophilus* in different physiological and pathological processes. *Journal of Microbiology and Biotechnology*, 32, 1226 - 1233.
- Gbassi, G. K., & Vandamme, T. (2012). Probiotic encapsulation technology: From microencapsulation to release into the gut. In *Pharmaceutics* (Vol. 4, Issue 1, pp. 149–163).
- Gharajalar, N. S., Mirzai, P., Nofouzi, K., & Madadi, M. S. (2020). Immune enhancing effects of *Lactobacillus acidophilus* on newcastle disease vaccination in chickens. *Comparative Immunology, Microbiology and Infectious Diseases*, 72.
- Govaert, M., Rotsaert, C., Vannieuwenhuysse, C., Duysburgh, C., Medlin, S., Marzorati, M., & Jarrett, H. (2024). Survival of probiotic bacterial cells in the upper gastrointestinal tract and the effect of the surviving population on the colonic microbial community activity and composition. *Nutrients*, 16.
- Guo, Y., Zhang, T., Gao, J., Jiang, X., Tao, M., Zeng, X., Wu, Z., & Pan, D. (2020). *Lactobacillus acidophilus* CICC 6074 inhibits growth and induces apoptosis in colorectal cancer cells in vitro and in HT-29 cells induced-mouse model. *Journal of Functional Foods*, 75.
- Han, S., Lu, Y., Xie, J., Fei, Y., Zheng, G., Wang, Z., Liu, J., Lv, L., Ling, Z., Berglund, B., Yao, M., & Li, L. (2021). Probiotic gastrointestinal transit and colonization after oral administration: a long journey. In *Frontiers in Cellular and Infection Microbiology* (Vol. 11). Frontiers Media S.A.
- Hardiningsih, R., Napitupulu, R. N. R., & Yulinery, T. (2006). Isolation and resistance test of several isolates of *Lactobacillus* in low pH. *Biodiversitas Journal of Biological Diversity*, 7(1).
- Hidayah, T. N., Djaenudin, D., & Lubis, N. (2021). Encapsulasi Probiotik *Lactobacillus* sp. Menggunakan Biopolimer Alginat dan Kitosan dengan Metode Satu Tahap. *Jurnal Serambi Engineering*, 6(2).
- Hong, F., Qiu, P., Wang, Y., Ren, P., Liu, J., Zhao, J., & Gou, D. (2024). Chitosan-based hydrogels: From preparation to applications, a review. In *Food Chemistry: X* (Vol. 21). Elsevier Ltd.
- Jiménez-Martín, E., Gharsallaoui, A., Pérez-Palacios, T., Carrascal, J. R., & Rojas, T. A. (2015). Suitability of using monolayered and multilayered emulsions for

microencapsulation of  $\omega$ -3 fatty acids by spray drying: effect of storage at different temperatures. *Food and bioprocess technology*, 8(1), 100-111.

- Jumazhanova, M., Kakimova, Z., Zharykbasov, Y., Kassymov, S., Zhumadilova, G., Muratbayev, A., Tashybayeva, M., & Suychinov, A. (2023). Effect of the encapsulation process on the viability of probiotics in a simulated gastrointestinal tract model medium. *Processes*, 11(9).
- Kageyama, T. (2002). Review pepsinogens, progastricsins, and prochymosins: structure, function, evolution, and development. In *CMLS, Cell. Mol. Life Sci* (Vol. 59).
- Kaushik, P., Dowling, K., Barrow, C. J., & Adhikari, B. (2015). Microencapsulation of omega-3 fatty acids: A review of microencapsulation and characterization methods. In *Journal of Functional Foods* (Vol. 19, pp. 868–881). Elsevier Ltd.
- Khedr, O. M. S., El-Sonbaty, S. M., Moawed, F. S. M., Kandil, E. I., & Abdel-Maksoud, B. E. (2022). *Lactobacillus acidophilus* ATCC 4356 Exopolysaccharides Suppresses Mediators of Inflammation through the Inhibition of TLR2/STAT-3/P38-MAPK Pathway in DEN-Induced Hepatocarcinogenesis in Rats. *Nutrition and Cancer*, 74(3), 1037–1047.
- Krunić, T., & Rakin, M. B. (2022). Enriching alginate matrix used for probiotic encapsulation with whey protein concentrate or its trypsin-derived hydrolysate: Impact on antioxidant capacity and stability of fermented whey-based beverages. *Food Chemistry*, 370.
- Kumar, P., & Dhanda, S. (2024). Chitosan encapsulation of *Pediococcus acidilactici* NCDC 252 improved its survival in simulated gastro-intestinal conditions. *Process Biochemistry*, 138, 130–138.
- Kvakova, M., Bertkova, I., Stofilova, J., & Savidge, T. C. (2021). Co-encapsulated synbiotics and immobilized probiotics in human health and gut microbiota modulation. *Foods*, 10(6).
- Lee, S. I., Kim, H. S., Koo, J. M., & Kim, I. H. (2016). *Lactobacillus acidophilus* modulates inflammatory activity by regulating the TLR4 and NF- $\kappa$ B expression in porcine peripheral blood mononuclear cells after lipopolysaccharide challenge. *British Journal of Nutrition*, 115(4), 567–575.
- Lee, Y. eun, Kang, Y. R., & Chang, Y. H. (2023). Effect of pectic oligosaccharide on probiotic survival and physicochemical properties of hydrogel beads for synbiotic encapsulation of *Lactobacillus bulgaricus*. *Food Bioscience*, 51.
- Li, H., Wang, J., Luo, Y., Bai, B., & Cao, F. (2022). pH-responsive eco-friendly chitosan–chlorella hydrogel beads for water retention and controlled release of humic acid. *Water (Switzerland)*, 14(8).
- Li, J., Jia, X., & Yin, L. (2021). Hydrogel: diversity of structures and applications in food science. In *Food Reviews International* (Vol. 37, Issue 3, pp. 313–372). Bellwether Publishing, Ltd.

- Li, Z., Jiang, L., Wang, Y., Li, M., Liu, T., & Liu, Y. (2024). Chitosan–gellan gum polyelectrolyte hydrogel beads containing tea tree oil microcapsules: preparation, characterization and application. *Food Hydrocolloids*, 157.
- Liparoti, S., Speranza, V., & Marra, F. (2021). Alginate hydrogel: The influence of the hardening on the rheological behaviour. *Journal of the Mechanical Behavior of Biomedical Materials*, 116.
- Liu, H., Wang, C., Li, C., Qin, Y., Wang, Z., Yang, F., Li, Z., & Wang, J. (2018). A functional chitosan-based hydrogel as a wound dressing and drug delivery system in the treatment of wound healing. In *RSC Advances* (Vol. 8, Issue 14, pp. 7533–7549). Royal Society of Chemistry.
- Liu, T., Wang, Y., Zhong, W., Li, B., Mequanint, K., Luo, G., & Xing, M. (2019). Biomedical applications of layer-by-layer self-assembly for cell encapsulation: current status and future perspectives. In *Advanced Healthcare Materials* (Vol. 8, Issue 1). Wiley-VCH Verlag.
- Lopes Neto, J. H. P., Santos, M. C. G. dos, Leite, K. S., Silva, L. A. da, Campos, M. I. F., Silveira, E. S. da, Amaral, J. B. S., Madruga, M. S., Braga, A. L. M., & Cardarelli, H. R. (2021). Development and characterization of *Lactobacillus acidophilus* (LA-3) microparticles with reducing substances and its addition to Reino cheese. *LWT*, 143.
- Maftei, N. M., Raileanu, C. R., Balta, A. A., Ambrose, L., Boev, M., Marin, D. B., & Lisa, E. L. (2024). The potential impact of probiotics on human health: an update on their health-promoting properties. In *Microorganisms* (Vol. 12, Issue 2). Multidisciplinary Digital Publishing Institute (MDPI).
- María Remes Troche, J., Coss Adame, E., Ángel Valdovinos Díaz, M., Gómez Escudero, O., Eugenia Icaza Chávez, M., Antonio Chávez-Barrera, J., Zárate Mondragón, F., Antonio Ruíz Velarde Velasco, J., Rafael Aceves Tavares, G., Antonio Lira Pedrín, M., Cerda Contreras, E., Carmona Sánchez, R. I., Guerra López, H., & Solana Ortiz, R. (2020). *Lactobacillus acidophilus* LB: a useful pharmabiotic for the treatment of digestive disorders. In *Therapeutic Advances in Gastroenterology* (Vol. 13). SAGE Publications Ltd.
- Markowiak, P., & Ślizewska, K. (2017). Effects of probiotics, prebiotics, and synbiotics on human health. In *Nutrients* (Vol. 9, Issue 9). MDPI AG.
- Martins, E., Poncelet, D., Rodrigues, R. C., & Renard, D. (2017). Oil encapsulation techniques using alginate as encapsulating agent: applications and drawbacks. In *Journal of Microencapsulation* (Vol. 34, Issue 8, pp. 754–771). Taylor and Francis Ltd.
- Masoomi Dezfooli, S., Bonnot, C., Gutierrez-Maddox, N., Alfaro, A. C., & Seyfoddin, A. (2022). Chitosan coated alginate beads as probiotic delivery system for New Zealand black footed abalone (*Haliotis iris*). *Journal of Applied Polymer Science*, 139(29).
- Mazzantini, D., Celandroni, F., Calvigioni, M., Panattoni, A., Labella, R., & Ghelardi, E. (2021). Microbiological quality and resistance to an artificial gut environment of two probiotic formulations. *Foods*, 10(11), 2781.

- Menconi, A., Kallapura, G., Latorre, J.D., Morgan, M.J., Pumford, N.R., Hargis, B., & Tellez, G. (2014). Identification and characterization of lactic acid bacteria in a commercial probiotic culture. *Bioscience of Microbiota, Food and Health*, 33, 25 - 30.
- Mokarram, R., Mortazavi, S. A., Najafi, M. B., & Shahidi, F. (2009). The influence of multi stage alginate coating on survivability of potential probiotic bacteria in simulated gastric and intestinal juice. *Food Research International*, 42, 1040-1045.
- Nayak, A. K., Das, B., & Maji, R. (2012). Calcium alginate/gum arabic beads containing glibenclamide: Development and in vitro characterization. *International Journal of Biological Macromolecules*, 51(5), 1070–1078.
- Nazir, S., Afzaal, M., Saeed, F., Ahmad, A., Ateeq, H., Ikram, A., ... & Khan, M. R. (2024). Survivability and behavior of probiotic bacteria encapsulated by internal gelation in non-dairy matrix and In Vitro GIT conditions. *Plos one*, 19(6), e0303091.
- Neethu Das, P., & Govind Raj, K. (2023). Chitosan coated graphene oxide incorporated sodium alginate hydrogel beads for the controlled release of amoxicillin. *International Journal of Biological Macromolecules*, 127837.
- Nezamdoost-Sani, N., Khaledabad, M. A., Amiri, S., & Mousavi Khaneghah, A. (2023). Alginate and derivatives hydrogels in encapsulation of probiotic bacteria: An updated review. *In Food Bioscience (Vol. 52)*. Elsevier Ltd.
- Nilsen-Nygaard, J., Strand, S. P., Vårum, K. M., Draget, K. I., & Nordgård, C. T. (2015). Chitosan: Gels and interfacial properties. *In Polymers (Vol. 7, Issue 3, pp. 552–579)*. MDPI AG.
- Onur, E., Gökmen, G. G., Nalbantsoy, A., & Kışla, D. (2022). Investigation of the supportive therapy potential of propolis extract and *Lactobacillus acidophilus* LA-5 milk combination against breast cancer in mice. *Cytokine*, 149.
- Palumbo, V. D., Tutino, R., Messina, M., Santarelli, M., Nigro, C., Io Secco, G., Piceni, C., Montanari, E., Barletta, G., Venturelli, P., Geraci, G., Bonventre, S., & Io Monte, A. I. (2023). Altered gut microbial flora and haemorrhoids: could they have a possible relationship? *Journal of Clinical Medicine*, 12(6).
- Park, G. R., Gwak, M. A., Choi, Y. H., & Park, W. H. (2023). pH-sensitive gallol-rich chitosan hydrogel beads for on-off controlled drug delivery. *International Journal of Biological Macromolecules*, 240.
- Parthasarathy, G., Chen, J., Chen, X., Chia, N., O'Connor, H. M., Wolf, P. G., Gaskins, H. R., & Bharucha, A. E. (2016). Relationship between microbiota of the colonic mucosa vs feces and symptoms, colonic transit, and methane production in female patients with chronic constipation. *Gastroenterology*, 150(2), 367-379.e1.
- Phan, V. H. G., Mathiyalagan, R., Nguyen, M. T., Tran, T. T., Murugesan, M., Ho, T. N., Huong, H., Yang, D. C., Li, Y., & Thambi, T. (2022). Ionically cross-linked

alginate-chitosan core-shell hydrogel beads for oral delivery of insulin. *International Journal of Biological Macromolecules*, 222, 262–271.

- Priya, A. J., Vijayalakshmi, S. P., & Raichur, A. M. (2011). Enhanced survival of probiotic *Lactobacillus acidophilus* by encapsulation with nanostructured polyelectrolyte layers through layer-by-layer approach. *Journal of Agricultural and Food Chemistry*, 59(21), 11838–11845.
- Purwanti, T., & Melani Hariyadi, D. (n.d.). *Effect of sodium alginate concentration on characteristic, viability, and antibacterial activity of probiotic-alginate microparticles*.
- Putra, B. U., Hardiningtyas, S. D., Hastuti, N., Ramadhan, W., Uju, Razi, M. A., & Agustini, L. (2024). Alginate hydrogel incorporating cellulose nanofiber from solid waste agar industry for hydrophobic antibiotic delivery: Synthesis and characterization. *Materials Today Communications*, 38.
- Rabot, S., Rafter, J., Rijkers, G. T., Watzl, B., & Antoine, J. M. (2010). Guidance for substantiating the evidence for beneficial effects of probiotics: Impact of probiotics on digestive system metabolism. *Journal of Nutrition*, 140(3).
- Racoviță, Ș., Vasiliu, S., Popa, M., & Luca, C. (2009). Polysaccharides based on micro-and nanoparticles obtained by ionic gelation and their applications as drug delivery systems. In *Revue Roumaine de Chimie* (Vol. 54, Issue 9).
- Rahimi, D., Sadeghi, A., Kashaninejad, M., & Ebrahimi, M. (2024). Postbiotic characterization of a potential probiotic yeast isolate, and its microencapsulation in alginate beads coated layer-by-layer with chitosan. *Heliyon*, 10(7).
- Razavi, S., Janfaza, S., Tasnim, N., Gibson, D. L., & Hoorfar, M. (2021). Microencapsulating polymers for probiotics delivery systems: Preparation, characterization, and applications. In *Food Hydrocolloids* (Vol. 120). Elsevier B.V.
- Rianingsih, L., & Sumardianto. (2020). Antioxidant activity in seaweed (*Sargassum* sp.) extract fermented with *Lactobacillus plantarum* and *Lactobacillus acidophilus*. *IOP Conference Series: Earth and Environmental Science*, 530(1).
- Rizwan, M., Yahya, R., Hassan, A., Yar, M., Azzahari, A. D., Selvanathan, V., Sonsudin, F., & Abouloula, C. N. (2017). pH sensitive hydrogels in drug delivery: brief history, properties, *swelling*, and release mechanism, material selection and applications. *Polymers*, 9(4), 137.
- Rodrigues, F. J., Cedran, M. F., Bicas, J. L., & Sato, H. H. (2020). Encapsulated probiotic cells: Relevant techniques, natural sources as encapsulating materials and food applications – A narrative review. In *Food Research International* (Vol. 137). Elsevier Ltd.
- Rolfe, R. D. (2000). Symposium: probiotic bacteria: implications for human health the role of probiotic cultures in the control of gastrointestinal health 1.

- Salvetti, E., Torriani, S., & Felis, G.E. (2012). The genus *Lactobacillus*: a taxonomic update. *Probiotics and antimicrobial proteins*, 4, 217-226.
- Savić Gajić, I. M., Savić, I. M., & Svirčev, Z. (2023). Preparation and characterization of alginate hydrogels with high water-retaining capacity. *Polymers*, 15(12).
- Schubert, M. L. (2017). Physiologic, pathophysiologic, and pharmacologic regulation of gastric acid secretion. In *Current Opinion in Gastroenterology* (Vol. 33, Issue 6, pp. 430–438). Lippincott Williams and Wilkins.
- Shariatnia, Z., & Jalali, A. M. (2018). Chitosan-based hydrogels: Preparation, properties and applications. *International Journal of Biological Macromolecules*, 115, 194–220.
- Shi, L. E., Li, Z. H., Li, D. T., Xu, M., Chen, H. Y., Zhang, Z. L., & Tang, Z. X. (2013). Encapsulation of probiotic *Lactobacillus bulgaricus* in alginate-milk microspheres and evaluation of the survival in simulated gastrointestinal conditions. *Journal of Food Engineering*, 117(1), 99–104.
- Silva, J. M., Silva, E., & Reis, R. L. (2021). Therapeutic deep eutectic solvents assisted the encapsulation of curcumin in alginate-chitosan hydrogel beads. *Sustainable Chemistry and Pharmacy*, 24.
- Singh, A., Kar, A. K., Singh, D., Verma, R., Shraogi, N., Zehra, A., Gautam, K., Anbumani, S., Ghosh, D., & Patnaik, S. (2021). pH-responsive eco-friendly chitosan modified cenosphere/alginate composite hydrogel beads as carrier for controlled release of Imidacloprid towards sustainable pest control. *Chemical Engineering Journal*, 131215.
- Song, H., Yu, W., Gao, M., Liu, X., & Ma, X. (2013). Microencapsulated probiotics using emulsification technique coupled with internal or external gelation process. *Carbohydrate Polymers*, 96(1), 181–189.
- Song, M., Yun, B., Moon, J.H., Park, D., Lim, K., & Oh, S. (2015). Characterization of selected *Lactobacillus* strains for use as probiotics. *Korean Journal for Food Science of Animal Resources*, 35, 551 - 556.
- Stasiak-Róžańska, L., Berthold-Pluta, A., Pluta, A. S., Dasiewicz, K., & Garbowska, M. (2021). Effect of simulated gastrointestinal tract conditions on survivability of probiotic bacteria present in commercial preparations. *International journal of environmental research and public health*, 18(3), 1108.
- Sultana, M., Chan, E. S., Pushpamalar, J., & Choo, W. S. (2022). Advances in extrusion-dripping encapsulation of probiotics and omega-3 rich oils. In *Trends in Food Science and Technology* (Vol. 123, pp. 69–86). Elsevier Ltd.
- Sun, Q., Yin, S., He, Y., Cao, Y., & Jiang, C. (2023). Biomaterials and encapsulation techniques for probiotics: current status and future prospects in biomedical applications. *Nanomaterials*, 13(15), 2185.
- Szarka, L. A., & Szarka, M. (2009). Gastric Emptying. *Clinical Gastroenterology and Hepatology*, 7(8), 823–827.

- Taha, S., El Abd, M., De Gobba, C., Abdel-Hamid, M., Khalil, E., & Hassan, D. (2017). Antioxidant and antibacterial activities of bioactive peptides in buffalo's yoghurt fermented with different starter cultures. *Food Science and Biotechnology*, 26(5), 1325-1332.
- Thinkohkaew, K., Aumphaiphensiri, N., Tangamornsiri, T., Niamsiri, N., Potiyaraj, P., & Suppavorasatit, I. (2024). Inulin extracted from burdock root (*Arctium lappa* L.) incorporated alginate/chitosan hydrogel beads for probiotics encapsulation. *Journal of Agriculture and Food Research*, 18.
- Thirupathi, K., Raorane, C. J., Ramkumar, V., Ulagesan, S., Santhamoorthy, M., Raj, V., Krishnakumar, G. S., Phan, T. T. V., & Kim, S. C. (2023). Update on chitosan-based hydrogels: preparation, characterization, and its antimicrobial and antibiofilm applications. *In Gels* (Vol. 9, Issue 1). MDPI.
- Tian, J., Wang, X., Zhang, X., Chen, X., Dong, M., Rui, X., Zhang, Q., Jiang, M., & Li, W. (2023). Artificial simulated saliva, gastric and intestinal digestion and fermentation in vitro by human gut microbiota of intrapolysaccharide from *Paecilomyces cicadae* TJJ1213. *Food Science and Human Wellness*, 12(2), 622–633.
- Tomić, S. L., Babić Radić, M. M., Vuković, J. S., Filipović, V. V., Nikodinovic-Runic, J., & Vukomanović, M. (2023). Alginate-based hydrogels and scaffolds for biomedical applications. *Marine drugs*, 21(3), 177.
- Valero-Cases, E., Reboredo-González, A., Esteban, M. Á., & Frutos, M. J. (2025). Design of multi-component beads (alginate/xanthan/glycerol): influence of polymer concentration on *Lactobacillus acidophilus* viability and release in complex food systems. *Food and Bioprocess Technology*, 18(12), 10406–10418.
- Vijayaram, S., Sinha, R., Faggio, C., Ringø, E., & Chou, C. C. (2024). Biopolymer encapsulation for improved probiotic delivery: Advancements and challenges. *AIMS microbiology*, 10(4), 986.
- Wang, J., Wu, P., Chen, X. D., Yu, A., & Dhital, S. (2025). Effect of food matrix and administration timing on the survival of *Lactobacillus rhamnosus* gg during in vitro gastrointestinal digestion. *Foods*, 14(17).
- Wathoni, N., Suhandi, C., Ghassani Purnama, M., Mutmainnah, A., Nurbaniyah, N., Syafr, D. W., & Elamin, K. M. (2024). Alginate and chitosan-based hydrogel enhance antibacterial agent activity on topical application. *Infection and Drug Resistance*, 17, 791-805.
- Wong, S. K., Lawencia, D., Supramaniam, J., Goh, B. H., Manickam, S., Wong, T. W., Pang, C. H., & Tang, S. Y. (2021). In vitro digestion and swelling kinetics of thymoquinone-loaded pickering emulsions incorporated in alginate-chitosan hydrogel beads. *Frontiers in Nutrition*, 8.
- Xu, L., Bai, E., Zhu, Y., Qin, J., Du, X., & Huang, H. (2023). pH-responsive hydrogel as a potential oral delivery system of baicalin for prolonging gastroprotective activity. *Pharmaceutics*, 15(1).

- Xu, M., Gagné-Bourque, F., Dumont, M., & Jabaji, S. (2016). Encapsulation of *Lactobacillus casei* ATCC 393 cells and evaluation of their survival after freeze-drying, storage and under gastrointestinal conditions. *Journal of Food Engineering*, 168, 52-59.
- Yang, J., Shen, M., Luo, Y., Wu, T., Chen, X., Wang, Y., & Xie, J. (2021). Advanced applications of chitosan-based hydrogels: From biosensors to intelligent food packaging system. In *Trends in Food Science and Technology* (Vol. 110, pp. 822–832). Elsevier Ltd.
- Yousefi, M., Khanniri, E., Khorshidian, N., Sohrabvandi, S., & Mortazavian, A. M. (2023). Development of probiotic apple juice using encapsulated probiotics in xanthan-chitosan based hydrogels. *Applied Food Biotechnology*, 10(3), 205–213.
- Yue, Y., Wang, S., Shi, J., Xie, Q., Li, N., Guan, J., Evvie, S. E., Liu, F., Li, B., & Huo, G. (2022). Effects of *Lactobacillus acidophilus* KLDS1.0901 on proliferation and apoptosis of colon cancer cells. *Frontiers in Microbiology*, 12.
- Zadeike, D., Gaizauskaite, Z., Basinskiene, L., Zvirdauskiene, R., & Cizeikiene, D. (2024). Exploring calcium alginate-based gels for encapsulation of *Lactobacillus paracasei* to enhance stability in functional breadmaking. *Gels*, 10(10).
- Zaeim, D., Sarabi-Jamab, M., Ghorani, B., Kadkhodae, R., & Tromp, R. H. (2017). Electro spray assisted fabrication of hydrogel microcapsules by single- and double-stage procedures for encapsulation of probiotics. *Food and Bioproducts Processing*, 102, 250–259.
- Zhang, F., Wang, R., Zhang, L., Yan, L., Jia, Y., Yang, J., Wang, X., & Lü, X. (2023). Enhanced viability of probiotics in composite hydrogel beads. *Journal of Food Engineering*, 357.
- Zhao, W., Liu, Y., Kwok, L. Y., Cai, T., & Zhang, W. (2020). The immune regulatory role of *Lactobacillus acidophilus*: An updated meta-analysis of randomized controlled trials. In *Food Bioscience* (Vol. 36). Elsevier Ltd.
- Zhou, A., Yang, K., Wu, X., Liu, G., Zhang, T. C., Wang, Q., & Luo, F. (2022). Functionally-designed chitosan-based hydrogel beads for adsorption of sulfamethoxazole with light regeneration. *Separation and Purification Technology*, 293.