

## DAFTAR PUSTAKA

- Aalaei, K., Rayner, M., & Sj Oholm, I. (2016). Storage stability of freeze-dried, spray-dried and drum-dried skim milk powders evaluated by available lysine. *LWT Food Science and Technology*, 73, 675–682. DOI: <https://doi.org/10.1016/j.lwt.2016.07.011>.
- Abdulgawad, I. (2016). Fermentation of Nile tilapia (*Oreochromis niloticus*) wastes using *Lactobacillus plantarum* for the production of lactic acid and fertilizer. *International Journal of Waste Resources*.
- Abubakar, Y., Muzaifa, M., Widayat, H., Martunis, & Safitri, R. (2022). Peningkatan mutu kakao melalui fermentasi menggunakan starter kering bakteri asam laktat dan bakteri asam asetat indigenous kakao aceh. *Agrointek : Jurnal Teknologi Industri Pertanian*, 84-95,16(1).
- Adesulu-Dahunsi, A.T., Samuel, Olatunde, Dahunsi, Adeniyi, & Olayanju. (2020). Synergistic microbial interactions between lactic acid bacteria and yeasts during production of Nigerian indigenous fermented foods and beverages. *Food Control*, 110:106963. DOI: 10.1016/J.FOODCONT.2019.106963
- Adiko, C. E., Ginette, D., Lessoy, T., Zoue., & Sébastien, N. (2018). Emphasis on functional properties of cocoa-specific acidifying lactic acid bacteria for cocoa beans fermentation improvement. *African Journal of Microbiology Research*, 12(19):456-463. DOI: 10.5897/AJMR2018.8842
- Afoakwa, E. O., A. Paterson, M. Fowler & A. Ryan. (2008). Flavor formation and character in cocoa and chocolate. *Critical Reviews in Food Science and Nutrition*, Vol. 48, No. 9, pp. 840–857.
- Ahimou, F., Frédéric, A., Ahmed, T., Yves, F., & Dufrière. (2002). Probing microbial cell surface charges by atomic force microscopy. *Langmuir*, DOI: 10.1021/LA026273K
- Aliya, H., Maslakah, N., Numrapi, T., Buana, A. P., & Hasri, Y. N. (2016). Pemanfaatan asam laktat hasil fermentasi limbah kubis sebagai pengawet anggur dan stroberi. *Bioedukasi: Jurnal Pendidikan Biologi*, 8(2), 23. DOI: <https://doi.org/10.20961/bioedukasi-uns.v9i1.3878>
- Amalia, L. (2022). Profiling of volatile compounds in beef, rat, and wild boar meat using SPME-GC/MS. *Jurnal Sains Malaysiana*, 51 (9). pp. 2897-2911. ISSN 01266039.

- Anggrahini., D. N., D. Mubarik., & N. R. Desniar. (2016). *Produksi, pemekatan, dan karakterisasi enzim protease dari Lactobacillus plantarum Sk(5)*. Bogor: IPB Press.
- Anna, V., Lutsenko., & O., B., Soprunova. (2022). Yeast autolysates as components of nutrient media for cultivation of microorganisms. *Vestnik Permskogo Universiteta*, DOI: 10.17072/1994-9952-2022-3-226-234
- Anushka, M., Wickramasuriya & Jim M. Dunwell. (2017). Cacao biotechnology: current status and future prospects. *Plant Biotechnology Journal*, 16, pp. 4-17. DOI: 10.1111pbi.12848.
- Apriyanto, M. (2016). *Fermentasi biji kakao kering terkendali menggunakan inokulum mikrobia*. Disertasi, Universitas Gadjah Mada.
- Aprotosoae, A. C., Luca, S. V., & Miron, A. (2015). Flavor chemistry of cocoa and cocoa products. *Comprehensive Reviews in Food Science and Food Safety*, 15 (1): 73-91.
- Ardilla, Y. A., Anggreini, K. W., & Rahmani, T. P. D. (2022). Peran bakteri asam laktat indigen genus *Lactobacillus* pada fermentasi buah durian (*Durio zibethinus*) sebagai bahan pembuatan tempoyak. *Berkala Ilmiah Biologi*, 13 (2): 42 - 52. DOI: 10.22146/bib.v13i1.4619
- Aritonang S. N., Roza, E., Rossi, E., Purwati, E., & Husmaini, H., (2017). Isolation and identification of lactic acid bacteria from okara and evaluation of their potential as candidate probiotics. *Pakistan Journal of Nutrition*, 16(8): 618-628.
- Ariyanti, M. (2017). Karakteristik mutu biji kakao (*Theobroma cacao* L.) dengan perlakuan waktu fermentasi berdasar SNI 2323-2008. *Jurnal Industri Hasil Perkebunan*, 12(1), 34-42.
- Aryani. N. L. P. N. A., Yulianti, N. L., & Arda, G. (2018). Characteristics of cocoa beans on small capacity fermentation results based on different types of containers and different fermentation lengths. *Jurnal BETA (Biosistem dan Teknik Pertanian)*, 6(1), 17-24.
- Aulia, A. (2017). *Isolasi dan karakterisasi bakteri penghasil enzim protease netral dari dadih*. Thesis, Padang: Universitas Andalas.
- Azelee, N. I. W., Ramli, A. N. M., Manas, N. H. A., Nurrulhidayah, S., Rohaida, C, M., Hesham, A., & El, Enshasy. (2019). Glycerol in food, cosmetics and pharmaceutical industries: basics and new applications. *International Journal of Scientific & Technology Research*, 8(12):553-558.

- [BPS] Badan Pusat Statistika. (2021). *Produksi tanaman buah-buahan 2020* [online]. Diakses pada <https://www.bps.go.id/indicator/55/62/1/produksi-tanaman-buah-buahan.html> [14 Maret 2024]
- Balasubramanian, S & Panigrahi, S. (2011). Solid-phase microextraction (SPME) techniques for quality characterization of food product. *Food and Bioprocess Technology*, 4. 1-26. DOI: 10.1007/s11947-009-0299-3.
- Bardi, E. P., V. Bakoyianis, A. A. Koutinas & M. Kanellaki. (1996). Room temperature and low temperature wine making using yeast immobilized on gluten pellets. *Process Biochemistry*, Vol. 31, No. 5, pp. 425-430.
- Bekatorou, A., A.A. Koutinas, A. Kaliafas, & M. Kanellaki. (2001). Freeze-dried *Saccharomyces cerevisiae* cells immobilized on gluten pellets for glucose fermentation. *Process Biochemistry*, 549–557.
- Bergey, D. H., & Boone, D. R. (2009). *Bergey's Manual of Systematic Bacteriology*, Vol. 3, Ed. 2. New York: Springer Science.
- Bonvehi, J. S. (2005). Investigation of aromatic compounds in roasted cocoa powder. *European Food Research and Technology Journal*. DOI: 10.1007/S00217-005-1147-Y
- Bosnea, L. A., Yiannis, K., Natalia, A., Constantina, T., Athanasios., A. K., & Kanellaki, M. (2009). Functionality of freeze-dried *L. casei* cells immobilized on wheat grains. *LWT Food Science and Technology* 42, 1696–1702.
- Bulandari, S. (2016). *Pengaruh produksi kakao terhadap pertumbuhan ekonomi di kabupaten Kolaka Utara*. Makassar: Universitas Islam Negeri Alauddin.
- Burgin, A. J., Yang, W. H., Hamilton, S. K., & Silver, W. L. (2011). Beyond carbon and nitrogen: how the microbial energy economy couples elemental cycles in diverse ecosystems. *Frontiers in Ecology and the Environment*, 9(1), 44-52.
- Cahyadi, W. (2008). *Analisis dan Aspek Kesehatan Bahan Tambahan Pangan*. Jakarta: PT Bumi Aksara.
- Caligiani, A., Acquotti, D., Cirlini, M., & Palla, G. (2010). 1H NMR study of fermented cocoa (*Theobroma cacao* L.) beans. *Journal of Agricultural and Food Chemistry*, 58, 12105–12111.
- Caligiani, A., A. Marseglia, B. Prandi, G. Palla, & S. Sforza. (2016). Influence of fermentation level and geographical origin on cocoa bean oligopeptide pattern, *Food Chemistry*, Vol. 211, pp. 431–439.

- Cambrai, A., Marcic, C., Morville, S., Sae Houer, P., Bindler, F., & Marchioni, E. (2010). Differentiation of chocolates according to the cocoa's geographical origin using chemometrics. *Journal of Agricultural and Food Chemistry*, 58(3), 1478–1483. DOI: <https://doi.org/10.1021/jf903471e>
- Campos-vega, R., Nieto-figueroa, K. H. & Oomah, B. D. (2018). Cocoa (*Theobroma cacao* L.) pod husk: renewable source of bioactive compounds, trends in Food Science & Technology. *Elsevier*, 81, 172–184.
- Cao, L., Xu, Q. L., Xing, Y. G., Guo, X. L., Li, W. X., & Cai, Y. M. (2020). Effect of skimmed milk powder concentrations on the biological characteristics of microencapsulated *Saccharomyces cerevisiae* by vacuum spray freeze drying. *Drying Technology*, 38(4), 476–494. DOI: <https://doi.org/10.1080/07373937.2019.1581797>.
- Carvalho, A. S., J. Silva, P. Ho, P. Teixeira, F. X. Malcata, & P. Gibbs. (2004). Relevant factors for the preparation of freeze-dried lactic acid bacteria, *International Dairy Journal*, vol. 14, no. 10, pp. 835-847.
- Cevallos-Cevallos, J. M., Gysel, L., Maridueña-Zavala, M.G., & Molina-Miranda, M. J. (2018). Time-related changes in volatile compounds during fermentation of bulk and fine-flavor cocoa (*Theobroma cacao*) beans. *Journal Food Quality*, 1-14.
- Chen, B., Xiaoying, W., Pengzhen, L., Xiaoxuan, F., Zhihao, M., Junjie, W., Xian, L., Xiaowen, L., & Li Wang. (2022). Exploring the protective effects of freeze-dried *Lactobacillus rhamnosus* under optimized cryoprotectants formulation. *LWT Food Science and Technology*, 173-114295. DOI: <https://doi.org/10.1016/j.lwt.2022.114295>.
- Chien, C. S., Lee, W. C., & Lin, T. J. (2001). Immobilization of *Aspergillus japonicus* by entrapping cells in gluten for production of fructooligosaccharides. *Enzyme and Microbial Technology* 29, 252–257.
- Christophe, J., P., Boonaert., & Paul, Rouxhet. (2000). Surface of lactic acid bacteria: relationships between chemical composition and physicochemical properties. *Applied and Environmental Microbiology*, DOI: 10.1128/AEM.66.6.2548-2554.2000
- Chu, Y., Mengmeng, Li., Jiahui, Jin., Xiameng, Dong., Ke, Xu., Libo, Jin., Yanming, Qiao., & Hao, Ji. (2023). Advances in the application of the non-conventional yeast *Pichia kudriavzevii* in food and biotechnology industries. *Journal of Fungi*, 9(2):170-170. DOI: 10.3390/jof9020170
- Crafack, M., Mikkelsen, M. B., Saerens, S., Knudsen, M., Blennow, A., Lowor, S., Takrama, J., Swiegers, J. H., Petersen, G. B., Heimdal, H., Nielsen, D. S.

- (2014). Influencing cocoa flavour using *Pichia kluyveri* and *Kluyveromyces marxianus* in a defined mixed starter culture for cocoa fermentation. *International Journal Food Microbiology*. 167:103–116. DOI: 10.1016/j.ijfoodmicro.2013.06.024.
- Dalcanton, F., Elena, C., Fernando, Pérez-Rodríguez., Guiomar, Denisse, Posada-Izquierdo., Gláucia, Maria, Falcão, de, Aragão., & R. M. García-Gimeno. (2018). Modeling the combined effects of temperature, pH, and sodium chloride and sodium lactate concentrations on the growth rate of *Lactobacillus plantarum* ATCC 8014. *Journal of Food Quality*, 1-10. DOI: 10.1155/2018/1726761
- Dand, R. (2011). *The International Cocoa Trade*. Third edition. Woodhead Publishing.
- Darwin, M., A. de Wolf, & C. de Wolf. (2007). “Cryonics” *The Science of Cryonics*, Arizona.
- De Andrade, A. B., da, Cruz, M. L., de Souza, Oliveira., Sérgio, E, S., Janice, I, D., de, Santana, L. R. R., de, Souza, C. O., & da, Silva, B. (2021). Influence of under-fermented cocoa mass in chocolate production: Sensory acceptance and volatile profile characterization during the processing. *LWT Food Science and Technology*, 149:112048. DOI: 10.1016/J.LWT.2021.112048
- De Souza, P. A., Moreira, L. F., Sarmiento, D. H. A., & da Costa, F. B. (2018). Cacao-*Theobroma cacao*. In: Exotic Fruits. Elsevier. pp. 69–76
- De Vuyst, L., Lefeber, T., Papalexandratou, Z., & Camu, N. (2010). *The functional role of lactic acid bacteria in cocoa bean fermentation*. In: Mozzi, F., Raya, R.R., Vignolo, G. M.(Eds.), *Biotechnology of Lactic Acid Bacteria-Novel Applications* (USA: Wiley-Blackwell).
- Delgado-Ospina, J., Samantha, T., Valentina, A., Annalisa, S., Manuel, S., Antonello, P., Kalliopi, R., & Clemencia, Chaves-López. (2020). *Functional biodiversity of yeasts isolated from colombian fermented and dry cocoa beans*. DOI: 10.3390/MICROORGANISMS8071086
- Delgado-Ospina, J., M. Martuscelli, C. D. Grande-Tovar, R. Lucas-González, J. B. Molina-Hernandez, M. Viuda-Martos, J. Fernández-López, J. Á. Pérez-álvarez, & C. Chaves-López. (2021). Cacao pod husk flour as an ingredient for reformulating frankfurters: Effects on quality properties. *Foods* 10(6).
- Diaz-Muñoz, C., Van de Voorde, D., Comasio, A., Verce, M., Hernandez, C. E., Weckx, S., & De Vuyst, L. (2021). Curing of cocoa beans: fine-scale monitoring of the starter cultures applied and metabolomics of the

- fermentation and drying steps. *Frontiers in Microbiology*, 11, 616875. DOI: <https://doi.org/10.3389/fmicb.2020.616875>
- Dinh, Y. N., Quang, D., Nguyen., & Hong, Phu, Le. (2022). Investigation of changes of antioxidant properties of coffee through fermentation by using *Saccharomyces cerevisiae* and *Bacillus subtilis*. *Tạp chí Giáo dục Kỹ thuật*, 72-79. DOI: 10.54644/jte.70b.2022.1174
- Dussap, C. G., & Laurent, P. (2017). Microbiology of alcoholic fermentation. DOI: 10.1016/B978-0-444-63666-9.00010-8
- Elkhairy, B. M., Salama, N. M., A. M., Desouki., A. B. Abdelrazek., K. A. Soliman., S. A. Ibrahim., & H. B. Khalil. (2023). Towards unlocking the biocontrol potential of *Pichia kudriavzevii* for plant fungal diseases: in vitro and in vivo assessments with candidate secreted protein prediction. *Journal BMC Microbiology*, DOI: 10.1186/s12866-023-03047-w
- Emmanuel, O. A., Jeniffer, Q., Agnes, S. B., Jemmy, S. T., & Firibu, K. S. (2012). Influence of pulp-preconditioning and fermentation fermentative quality and appearance of ghanaiian cocoa (*Theobroma cacao*) beans. *International Food Research Journal*, 19 (1): 127-133
- Fan, Li., Tingting, Li., Jiajia, Zhao., Mingcong, Fan., Haifeng, Qian., Yan, Li., & Li, Kang, Wang. (2023). Entanglement between water un-extractable arabinoxylan and gliadin or glutenins induced a more fragile and soft gluten network structure. *Foods*, DOI: 10.3390/foods12091800
- Feng, X., H. Dong, P. Yang, R. Yang, J. Lu, J. Lv, & J. Sheng. (2016). Culture dependent and independent methods to investigate the predominant microorganisms associated with wet processed coffee, *Current Microbiology*, Vol. 73, no. 2, pp. 190–195
- Gaidhani, K. A., M. Harwalkar, D. Bhambere, & P. S. Nirgude. (2015). Lyophilization or freeze drying—a review. *World Journal of Pharmaceutical Research*, Vol. 4, No. 8, pp. 516-543.
- Ganeswari, I., Khairul Bariah, S., Amizi, M. A., & Sim, K. Y. (2015). Effects of different fermentation approaches on the microbiological and physicochemical changes during cocoa bean fermentation. *International Food Research Journal*, 22(1), 70-76. DOI: 10.3923/jas.2010.1.7
- Garrity, G. M., Bell, J. A. & Lilburn, T. G. (2004). *Taxonomic Outline of the Prokaryotes. Bergey's Manual of Systematic Bacteriology, 2nd Edition. Release 5.0.* Springer-Verlag, New York., 1-399. DOI: 10.1007/bergeysoutline200405

- Gazali, F. & Yuliani, F. (2020). Pemanfaatan kulit buah kakao sebagai sumber antioksidan alami. *Journal of Multidisciplinary Research and Development*. Vol. 2, Issue 4.
- Gialleli, A. I., Bekatorou, A., Kanellaki, M., Nigam, P., & Koutinas, A. A. (2016). Apple juice preservation through microbial adsorption by nano/micro-tubular cellulose. *Innov. Food Science Emerging Technologies*. 33, 416–421, DOI: <http://dx.doi.org/10.1016/j.ifset.2015.11.006>.
- Gunadi, S. A. (2023). *Pengaruh penambahan Saccharomyces cerevisiae UNJCC Y-87 dan Pichia kudriavzevii UNJCC Y-103 pada fermentasi biakan terhadap produksi maggot Hermentia illucens*. Sarjana thesis, Universitas Negeri Jakarta.
- Halim, M., N. A. M. Mustafa, M. Othman, H. Wasoh, M. R. Kapri, & A. B. Ariff. (2017). Effect of encapsulant and cryoprotectant on the viability of probiotic *Pediococcus acidilactici* ATCC 8042 during freeze-drying and exposure to high acidity, bile salts and heat. *LWT Food Science Technology*, Vol. 81, pp. 210-216, DOI: [doi.org/10.1016/j.lwt.2017.04.009](https://doi.org/10.1016/j.lwt.2017.04.009).
- Hanna, C. (2023). Gluten proteins. DOI: 10.1016/b978-0-323-95295-8.00041-1
- Hasanuddin. (2010). Mikroflora pada tempoyak. *Agritech*, Vol. 30 (4):218-222.
- Hassanzadeh, A. M., Khiabani, M. S., Sadrina, M., Divband, B., Rahmanpour, O., Jabbari, V., Ghlizadeh, P., & Kafil, H. S. (2017). Immobilization and microencapsulation of *Lactobacillus caseii* and *Lactobacillus plantarum* using zeolite base and evaluating their viability in gastroesophageal-intestine simulated condition. *Ars Pharmaceutica*, 58(4): 163-170.
- He, W., Fang, Ren., Yingqian, Wang., Xing, Gao., Xiaoxia, Wang., Xia, Dai., & Jibing, Song. (2020). Application of GC-MS in detection of food flavor substances. DOI: 10.1088/1755-1315/545/1/012030
- Hernani & Haliza, W. (2013). Optimasi komposisi nutrisi untuk pembentukan komponen citarasa pada fermentasi biji kakao asalan. *Jurnal Pascapanen* 10(2), 74-82.
- Hidayatulloh, J. G., & Harlia, E. (2019). Potensi senyawa metabolit yang dihasilkan. *Jurnal Ilmu dan Teknologi Peternakan*, 7(2), 1–6.
- Ho, V. T. T., J. Zhao, & G. Fleet. (2014). Yeasts are essential for cocoa bean fermentation. *International Journal of Food Microbiology*, Vol. 174, pp. 72–87.

- Huang, H., Huang, M., Wang, Q., Sun, Z., Yang, W., & Jiang, T. (2016). Culture medium and culturing method for culture medium.
- Hunaefi, D., Divine, N., Akumo., & Iryna, S. (2013). Effect of fermentation on antioxidant properties of red cabbages. *Food Biotechnology*, 27(1):66-85. DOI: 10.1080/08905436.2012.755694
- Hustiany, R. (2016). *Reaksi Maillard*. Banjarmasin: Lambung Mangkurat University Press.
- Jarque, S., Michal, B., & Klara, H. (2016). Freeze-drying as suitable method to achieve ready to use yeast biosensors for androgenic and estrogenic compounds. *Chemosphere* 148, 204-210.
- Jéssica, A., Viesser., Gilberto, V, D, M, Pereira., Carvalho, N., Hervé, R., Aristóteles, Góes-Neto., Vasco, A., Bertram, B., Flávia, F, A., & Carlos, Ricardo, Soccol. (2021). Co-culturing fructophilic lactic acid bacteria and yeast enhanced sugar metabolism and aroma formation during cocoa beans fermentation. *International Journal of Food Microbiology*, DOI: 10.1016/J.IJFOODMICRO.2020.109015
- Kallis, M., Sideris, K., Kopsahelis, N., Bosnea, L., Kourkoutas, Y., Terpou, A., & Kanellaki, M. (2019). *Pistacia terebinthus* resin as yeast Immobilization support for alcoholic fermentation. *Foods* 8 (4), 127, DOI: <http://dx.doi.org/10.3390/foods8040127>.
- Kandil, S. & M. El Soda. (2015). Influence of freezing and freeze drying on intracellular enzymatic activity and autolytic properties of some lactic acid bacterial strains. *Advanced Microbiology*, Vol. 5, No. 6.
- Karmawati, E. Z., Mahmud, M., Syakir, S. J., Munarso, I Ketut A, & Rubiyo. (2010). *Budidaya dan Pasca Panen Kakao*. Bogor: Pusat Penelitian dan Pengembangan Perkebunan.
- Komisi Kakao Indonesia. (2006). Direktori dan revitalisasi agribisnis kakao Indonesia. *Departemen Pertanian*, 248.
- Kostinek, M., Ban-Koffi, L., Ottah-Atikpo, M., Teniola, D., Schillinger, U., Holzappel, W. H., & Franz, C. M. (2008). Diversity of predominant lactic acid bacteria associated with cocoa fermentation in Nigeria. *Current Microbiology*, 56, 306-314. DOI: <https://doi.org/10.1007/00284-008-9097-9>
- Kresnowati, M., T., A., Penia., Lenny, S., & Mirra, A. (2013). Improvement of cocoa beans fermentation by LAB starter addition. *Journal of Medical and Bioengineering*, DOI: 10.12720/JOMB.2.4.274-278



- Kumar, L., A. Baheti, & A. K. Bansal. (2016). Excipients used in lyophilization of small molecules. *Journal Excipients Food Chemistry*, Vol. 1, No. 1.
- Kumar, P. (2019). Lyophilization: an important formulation technique. *International Journal Research*, Vol. 7, No. 9, pp. 11-15.
- Ladaywa, A. (2019). *Optimasi kualitas kimia dan sensori produk minuman herbal berbasis daun sirih*. Thesis, Unika Soegijapranata Semarang.
- Lin, Y. B., Hong, C., & Li, Ran, Yue. (2011). 2. Effects of  $K_2HPO_4$  on fermentative biohydrogen production of biohydrogen bacterium R3 Sp.nov. *Advanced Materials Research*, DOI: 10.4028/WWW.SCIENTIFIC.NET/AMR.280.1
- Liu, C., Yang, P., Wang, H., & Song, H. (2022). Identification of odor compounds and odor active compounds of yogurt using DHS, SPME, SAFE, and SBSE/GC-O-MS. *LWT Food Science and Technology*, 112689.
- Liu, H., Yang, Ni., Yun-Yan, Yu., & Liuping, Fan. (2023). Evaluation of co-fermentation of *L. plantarum* and *P. kluyveri* of a plant-based fermented beverage: physicochemical, functional, and sensory properties. *Food Research International*, 172. DOI:10.1016/j.foodres.2023.113060
- Lukito, A. M., Mulyono., Yullia, T., & Iswanto, H. (2010). *Budidaya Kakao*. Pusat penelitian kopi dan kakao Indonesia. Jakarta.
- Mahfuzh, S. F. (2023). *Pengaruh khamir Pichia kudriavzevii UNJCC Y-77 dan Pichia manshurica UNJCC Y-123 terhadap karakteristik fisik dan kimia biji kakao (Theobroma cacao L.) selama proses fermentasi*. Sarjana thesis, Universitas Negeri Jakarta.
- Manalu, R. (2018). Pengolahan biji kakao produksi perkebunan rakyat untuk meningkatkan pendapatan petani. *Jurnal Ekonomi & Kebijakan Publik*, Vol. 9 No. 2.
- Marham, D., Y. Rustam, & D. Sukmawati. (2016). Uji kemampuan antagonisme khamir asal daun jati (*Tectona grandis*) terhadap kapang pengkontaminan pada pakan ternak ayam, *Bioma*, Vol. 12, No. 2, pp. 49–56.
- Markgren, J., Mikael, S., Hedenqvist., Faiza, Rasheed., Marie, Skepö., & Eva, Johansson. (2020). Glutenin and gliadin, a piece in the puzzle of their structural properties in the cell described through monte carlo simulations. 10(8):1095. DOI: 10.3390/BIOM10081095
- Martono, B. (2014). *Karakteristik Morfologi dan Kegiatan Plasma Nutfah Tanaman Kakao*. Sukabumi: Balai Penelitian Tanaman Industri dan Penyegar.

- Masood, M. I., Qadir, M. I., Shirazi, J. H., Khan, I. U. (2011). Beneficial effects of lactic acid bacteria on human beings. *Critical Reviews in Microbiology*, 37(1): 1–98.
- Matra, N., Puspitasari, E., & Siswoyo, T. (2018). Hidrolisis protein isolat biji melinjo (*Gnetum gnemon* L.) menggunakan alkalase terimobilisasi dan aktivitasnya sebagai antihipertensi. *Pustaka Kesehatan*, 6(1), 18-24. DOI:10.19184/pk.v6i1.6612
- Maya, F. N., & Alami, N. H. (2019). Uji potensi isolat khamir dari rhizosfer mangrove wonorejo dan gunung anyar sebagai agen penghasil IAA (Indole Acetic Acid). *Jurnal Sains dan Seni ITS*, 8(1), 4-8.
- Meryandini, A., Anwar, I., & Sunarti, T. C. (2023). Effect of cocoa bean fermentation using lactic acid bacteria and yeast starters on flavonoid formation and antioxidant activity. *Microbiology Indonesia*, 17(1), 7-14.
- Misnawi, S. Jinap, B. Jamilah, & S. Nazamid. (2003). Effects of incubation and polyphenol oxidase enrichment on colour, fermentation index, procyanidins and astringency of unfermented and partly fermented cocoa beans. *International Journal of Food Science and Technology*, 38:285–295.
- Molyneux. (2013). The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity. *Songklanakarın Journal Science Technology*. 26(2): 211-219.
- Moreira, I. M. D. V., Miguel, M. G., Ramos, C. L., Duarte, W. F., Priscilla, E., Rosane, F, S. (2016). Influence of cocoa hybrids on volatile compounds of fermented beans, microbial diversity during fermentation and sensory characteristics and acceptance of chocolates. *Journal of Food Quality*, 39(6):839-849. DOI: 10.1111/JFQ.12238.
- Mubarokah, I. (2018). *Pengaruh konsentrasi alginat terhadap karakteristik sel Pseudomonas fluorescens terimobilisasi untuk produksi biodiesel*. Skripsi. Fakultas Teknologi Pertanian. Universitas Brawijaya. Malang. 87 hlm.
- Mulato, Widyotomo, Misnawi, & Suharyanto. (2005). *Petunjuk Teknis Pengolahan Produk Primer dan Sekunder Kakao*. Jember: Pusat Penelitian Kopi dan Kakao Indonesia.
- Mulyono, D. (2017). Harmonisasi kebijakan hulu-hilir dalam pengembangan budidaya dan industri pengolahan kakao nasional. *Jurnal Ekonomi dan Kebijakan Publik*, 7(2), 185–200.

- National Center for Biotechnology Information (2024). PubChem Compound Summary for CID 674, *Dimethylamine*. Retrieved December 26, 2024 from <https://pubchem.ncbi.nlm.nih.gov/compound/Dimethylamine>.
- Nizori, A., Tanjung O. Y., Ulyarti U., Arzita, A., Lavlinesia, L., & Ichwan, B. (2021). Pengaruh lama fermentasi biji kakao (*Theobroma cacao* L.) terhadap sifat fisik, kimia dan organoleptik bubuk kakao. *Jurnal Pangan dan Agroindustri*, 9(2): 129-138.
- Nofrianti, R. (2013). Metode freeze drying bikin keripik makin crunchy. *Jurnal Aplikasi Teknologi Pangan*, 2(1).
- Nudyanto A., & Zubaidah, E. (2015). Isolasi bakteri asam laktat penghasil eksopolisakarida dari kimchi. *Jurnal Pangan dan Agroindustri* 3(2): 743-748.
- Nurhayati, N., Setyabudi, F. M., Marseno, D. W., & Supriyanto, S. (2019). The effects of roasting time of unfermented cocoa liquor using the oil bath methods on physicochemical properties and volatile compound profiles. *Agritech*, 39(1) 36-47.
- Ouattara, H. G., Ryan, J., Elias., Edward, & G., Dudley. (2020). Microbial synergy between *Pichia kudriazevii* YS201 and *Bacillus subtilis* BS38 improves pulp degradation and aroma production in cocoa pulp simulation medium. *Heliyon*, 6(1). DOI: 10.1016/J.HELİYON.2020.E03269
- Pemerintah Badan Standardisasi Nasional. Standar Nasional Indonesia (SNI) Biji Kakao Nomor 2323:2008.
- Pereira, G. V. M., Alvarez, J. P., Neto, D. P., de, C., Soccol, V. T., Tanobe, V. O. A., Rogez, H., Góes-Neto, A., Soccol, C. R. (2017). Great intraspecies diversity of *Pichia kudriavzevii* in cocoa fermentation highlights the importance of yeast strain selection for flavor modulation of cocoa beans. *LWT Food Science and Technology*, 84:290-297.
- Pereira, G. V. D. M., Dão, Pedro, de, Carvalho, Neto., Ana, C., de, Oliveira, Junqueira., Susan, Grace, Karp., L. A. J. Letti., Az I. M. Júnior., & C. R. Soccol. (2020). A review of selection criteria for starter culture development in the food fermentation industry. *Food Reviews International*, DOI: 10.1080/87559129.2019.1630636
- Pratiwi, N., Inayatul, F., Wilya, Y, P., dan Irdawati. (2021). Tinjauan Literatur: Industri alkohol menggunakan immobilisasi sel. *Prosiding SEMNAS BIO*. Universitas Negeri Padang. Padang. 12 hlm.
- Prawoto, A. A. (2008). *Kakao Manajemen Agribisnis dari Hulu hingga Hilir*. Penebar Swadaya. Jakarta.

- Prins, A., & Ondrej, K. (2023). Genetic approaches to increase arabinoxylan and  $\beta$ -glucan content in wheat. *Plants*, DOI: 10.3390/plants12183216
- Priscilla, E., Nelson, Horacio, & Pezoa, Garcia. (2004). Study to minimize flavonoid losses during the fermentation of cocoa seeds for chocolate production.
- Pokharel, B. (2023). Cocoa bean fermentation: impact on chocolate flavor and quality. *International Journal of Science and Research*, DOI: 10.21275/sr23614230652
- Puspawati, N., Nuraida, L., & Adawiyah, D. (2010). Penggunaan berbagai jenis bahan pelindung untuk mempertahankan viabilitas bakteri asam laktat yang diisolasi dari air susu ibu pada proses pengeringan beku. *Jurnal Teknologi dan Industri Pangan*, 21 (1).
- Puspita, D., Nadia, E., Immanuela, E., Titania, M. C. (2020). Isolasi, identifikasi dan uji produksi yeast yang diisolasi dari nira kelapa. *Biosfer, Jurnal Biologi & Pendidikan Biologi*, 5(1): 1-5.
- Putri, T. (2020). Mengenal lebih dalam proses fermentasi biji kakao. *Pusat Penelitian Kopi dan Kakao Indonesia*. F(4), 240621.
- Qin, X. W., Lai, J. X., Tan, L.H., Hao, C. Y., Li, F. P., He, S. Z., & Song, Y. H. (2017). Characterization of volatile compounds in Criollo, Forastero, and Trinitario cocoa seeds (*Theobroma cacao* L.) in China. *International Journal of Food Properties*, Vol. 20, No. 10, 2261–2275.
- Quelal, O. M., Hurtado, D. P., Benavides, A. A., Alanes, P. V., & Alanes, N. V. (2023). Key aromatic volatile compounds from roasted cocoa beans, cocoa liquor, and chocolate. *Fermentation*. 9(2):166.
- Rachmat, S. S. & Shovitri, M. (2021). Studi literatur tentang teknik liofilisasi untuk preservasi bakteri. *Jurnal Teknik ITS*, Vol. 10, No. 2.
- Rahmadewi, Y. M. & Darmadji, P. (2018). Pengaruh penjemuran dan pengering mekanis terhadap pH dan total polifenol dan kandungan gula biji kakao dan coklat batang dari biji kakao rakyat. *Jurnal Rekayasa Pangan dan Pertanian*, No. 2.
- Rahmiati, R., & Mumpuni, M. (2017). Eksplorasi bakteri asam laktat kandidat probiotik dan potensinya dalam menghambat bakteri patogen. *Elkawnie*, 3(2), 141–150. DOI: <https://doi.org/10.22373/ekw.v3i2.1870>
- Rannes, Setiawan, A. W., & Handoko, Y. A. (2021). Perbandingan kualitas fermentasi biji kakao dengan penambahan kultur campur dan kultur

tunggal *Lactobacillus brevis*. *Jurnal Teknik Pertanian Lampung*, 10(4),537-547.

- Ratnam, K. R., & Samir, S. (2016). Synthesis and application of an antimicrobial active.
- Rodriguez-Campos, J., Héctor, B., Escalona-Buendía., I., Orozco-Avila., E., Lugo-Cervantes., María, Eugenia, Jaramillo-Flores. (2011). Dynamics of volatile and non-volatile compounds in cocoa (*Theobroma cacao* L.) during fermentation and drying processes using principal components analysis. *Food Research International*, 44(1):250-258. DOI: 10.1016/J.FOODRES.2010.10.028
- Romel, E., Guzmán-Alvarez., José, G., & Márquez-Ramos. (2021). Fermentation of cocoa beans. DOI: 10.5772/INTECHOPEN.98756
- Sabahannur, Netty, S., & Ervina. (2023). Mutu fisik dan kimia biji kakao (*Theobroma cacao* L.) pada beberapa jenis klon. *Jurnal Agroteknologi*, Vol. 7 No. 2.
- Sari, P., Utari, E., Praptiningsih, Y., & Maryanto. (2015). Karakteristik kimia-sensoris dan stabilitas polifenol minuman coklat rempah. *Jurnal Agroteknologi*, Vol. 09 No. 01.
- Sartini., Djide, M. N., & Alam, G. (2012). Ekstraksi komponen bioaktif dari limbah kulit buah kakao dan pengaruhnya terhadap aktivitas antioksidan dan antimikroba.
- Schwab, W., Rikanati, R. D., & Lewinhson, E. (2008). Biosynthesis of plant derived flavor compounds. *The Plant Journal* 54, pp 712-732.
- Schwan, R. F. & A. E. Wheals. (2004). The microbiology of cocoa fermentation and its role in chocolate quality. *Critical Reviews in Food Science and Nutrition*, 44:205–221.
- Scollo, E., Neville, D. C., Oruna-Concha, M. J., Trotin, M., & Cramer, R. (2020). UHPLC–MS/MS analysis of cocoa bean proteomes from four different genotypes. *Food Chemistry*, 303, 125244.
- Septianti, E., Salengke, S., Langkong., Jumriah., Sukendar, Nandi, K., & Hanifa, A. (2020). Characteristic quality of pinrang's cocoa beans during fermentation used styrofoam containers. *Canrea Journal: Food Technology, Nutritions, and Culinary Journal*.

- Setiarto, R. H. B., Widhyastuti, N., & Saskiawan, I. (2016). Pengaruh fermentasi fungi, bakteri asam laktat dan khamir terhadap kualitas nutrisi tepung sorgum. *Agritechology*, 36(4), 440-449. DOI: <https://doi.org/10.22146/agritech.16769>.
- Shahbandeh, M. (2022). Global cocoa bean production from 2019/20 to 2021/22, by country.
- Shekhar, T. C. & Anju, G. (2014). Antioxidant activity by DPPH radical scavenging method of *Ageratum conyzoides* Linn leaves. *American Journal of Ethnomedicine*, 1(4), 244-249.
- Sigalingging, H. A., Putri, S. H., & Iflah, T. (2020). Perubahan fisik dan kimia biji kakao selama fermentasi. *Jurnal Industri Pertanian*, 2(2), 158–165.
- Sihombing, M., Puspita, D., & Sirenden, M. T. (2018). Fragrance formation in the of cocoa roasted process (*Theobroma cacao*) with roaster temperature variation using a vacuum drying oven. *Jurnal Kimia Sains dan Aplikasi* 21(3):155-160.
- Sinangil, Z., Özge, Taştan., & T, Baysal. (2022). Beta-glucan as a novel functional fiber: functional properties, health benefits and food applications. *Turkish Journal of Agriculture: Food Science and Technology*, DOI: 10.24925/turjaf.v10i10.1957-1965.5430
- Smetana, K., Vytásek, R., & Stol, M. (1992). Electrostatic interaction influences cell adhesion. *International Journal of Hematology*.
- Spietelun, A., Pilarczyk, M., Kloskowski, A & Namieśnik, J. (2010). ChemInform Abstract: Current trends in solid-phase microextraction (SPME) fibre coatings. *Chemical Society reviews*. 39. 4524-37. DOI: 10.1039/c003335a.
- Sri, Melia., S. N., Aritonang., Indri, Juliyarsi., Rizki, Dwi, Setiawan., & Doni, Supadil. (2024). The effect of *L. plantarum* SN13T addition on pH, titratable acidity and total lactic acid bacteria in skim milk starters. *IOP Conference Series*, DOI: 10.1088/1755-1315/1341/1/012029z
- Sukmawati, D., G. A. Sondana, N. N. Fikriyyah, Z. N. Afifah, A. Firhandini, U. Khumaiya, D. A. Komsiatun, Y. T. Asmara. (2021). Cellulase-producing yeast isolated from fermented cocoa beans as biocontrol for pathogenic mold chocolate fruit collected from Sentul, Jawa Barat, Indonesia. *Journal of Physics: Conference Series*.
- Sukmawati, D., Z. Arman, R. Hasanah, M. Balqis, A. Setiawan, F. Tafrijiyyah, R. Sari, A. Supiyani, N. B. Prihantini, S. N. A. Husna, H. A. El Enshasy & D. J. Dailin. (2021). Application of yeasts isolated from fermented cocoa beans

for biocontrol of pathogenic mold in chocolate fruit. *Journal of Physics: Conference Series*.

- Sun, W., Vila-Santa, A., Liu, N., Prozorov, T., Xie, D., Faria, N. T., Ferreira, F. C., Mira, N. P., & Shao, Z. (2020). Metabolic engineering of an acid-tolerant yeast strain *Pichia kudriavzevii* for itaconic acid production. *Metabolic Engineering Communications*, 10.
- Suprihatin. (2010). *Teknologi Fermentasi*. Surabaya: UNESA Press.
- Supriyanto., Haryadi, B. Rahardjo, & D. W. Marseno. (2006). Aktivitas antioksidan ekstrak polifenol kasar dari kakao hasil penyangraian menggunakan energi gelombang mikro. *Jurnal Teknologi dan Industri Pangan*, Vol. 17 (3), Hal. 176-182.
- Surbakti, F. H., & Hasanah, U. (2019). Identifikasi dan karakterisasi bakteri asam laktat pada acar ketimun (*Cucumis sativus* L.) sebagai agensi probiotik. *Jurnal Teknologi Pangan dan Kesehatan*, Vol. 1 No. 1.
- Surti. (2012). *Jenis Tanaman Kakao*. Jakarta: PT. Penebar Swadaya.
- Suryaningsih, V., Ferniah, R. S., & Kusdiyantini, E. (2018). Karakteristik morfologi, biokimia, dan molekuler isolat khamir IK-2 hasil isolasi dari jus buah sirsak (*Annona muricata* L.) *Jurnal Biologi*, Vol. 7 No. 1, Hal. 18-25.
- Susanti, R. (2012). *Analisis Senyawa Fenolik (43-65)*. Semarang: Universitas Diponegoro Press.
- Tan, J., Mingyue, Ji., Jiangang, Gong., & B, Chitrakar. (2024). The formation of volatiles in fruit wine process and its impact on wine quality. *Applied Microbiology and Biotechnology*, DOI: 10.1007/s00253-024-13084-8
- Tarigan, E. B. & Iflah, T. (2017). Beberapa komponen fisikokimia kakao fermentasi dan non-fermentasi. *Jurnal Agroindustri Halal* 3(1):048-062.
- Toker, O. S., Palabiyik, I., Pirouzian, H. R., Aktar, T., & Konar, N. (2020). Chocolate aroma: factors, importance and analysis. *Trends Food Science Technology*, 99, 580-592.
- Torres-Moreno, M., Tarrega, A., & Blanch, C. (2021). Effect of cocoa roasting time on volatile composition of dark chocolates from different origins determined by HS-SPME/GC-MS.CyTA. *Journal Food*, 19, 81–95.
- Vikas, V., Patil., Pankaj, S., Patil., Amol, R., & Pawar. (2023). A brief review on gas chromatography. *Asian Journal of Pharmaceutical Analysis*, DOI: 10.52711/2231-5675.2023.00008

- Wahyudi, T., T. R., Panggabean., & Pujiyanto. (2013). *Panduan Lengkap Kakao*. Jakarta: Penebar Swadaya.
- Walter, K. (2022.) Caffeine and health. *Journal of the American Medical Association*, Vol. 327 (7): 693-693.
- Wang, S., Chang, Y., Liu, B., Chen, H., Sun, B., & Zhang, N. (2021). Characterization of the key aroma-active compounds in yongchuan douchi (fermented soybean) by application of the sensomics approach. *Molecules*, 26, 3048.
- Widiastutik, N., & Alami, N.H. (2014). Isolasi dan identifikasi yeast dari *Rhizosfer rhizophora mucronate* wonorejo. *Jurnal Sains dan Seni Pomits* Vol. 3, No.1.
- Wulan, R., Astuti, R. I., Rukayadi, Y., & Meryandini, A. (2021). Evaluation of Indigenous *Pichia kudriavzevii* from cocoa fermentation for a probiotic candidate. *Biodiversitas*. Vol. 22, No. 3.
- Xu, Y., He, L., Lv, J. L., Yu, H. X., & Wang, X. Y. (2020). Studies on stability of selenium-enriched *Lactobacillus rhamnosus* and its lyophilized protectant. *Journal of Chinese Institute of Food Science and Technology*, 20(9), 102–108. DOI: <https://doi.org/10.16429/j.1009-7848.2020.09.013>
- Xu, Y., Qi-yue, Zhao., Yida, Xu., Xiudan, Wei., Xueming, Xu., & Dan-Yao, Xu. (2024). The mechanism of low temperature enhances dough aromas during fermentation by *Pichia kudriavzevii*: sugar and amino acid metabolism, acid utilization and alcohol production. *Food Bioscience*, DOI: 10.1016/j.fbio.2024.104187
- Xue, H., Beimeng, Liang., Yu, Wang., Haiyan, Gao., Saisai, Fang., Kaifang, Xie., & J, Tan. (2024). The regulatory effect of polysaccharides on the gut microbiota and their effect on human health: A review. *International Journal of Biological Macromolecules*, DOI: 10.1016/j.ijbiomac.2024.132170
- Yang, Y., Darwish, A. G., El-Sharkawy, I., Zhu, Q., Sun, S., & Tan, J. (2022). Rapid determination of the roasting degree of cocoa beans by extreme learning machine (ELM)-based imaging analysis. *Journal of Agriculture and Food Research*, 10-100437.
- Yang, D., Wu, B., Qin, X., Zhao, X., Zhu, Z., Yan, L., Zhang, F., Wu, G., & Li, F. (2024). Quality differences and profiling of volatile components between fermented and unfermented cocoa seeds (*Theobroma cacao* L.) of Criollo, Forastero and Trinitario in China. *Beverage Plant Research*, 4:e010.



- Yoshiyama, Y., Tanaka, K., Yoshiyama, K., Hibi, M., Ogawa, J., & Shima, J. (2015). Trehalose accumulation enhances tolerance of *Saccharomyces cerevisiae* to acetic acid. *Journal of Bioscience and Bioengineering*, 119, 172-175.
- Yumas, M., Loppies, J. E., & Alfrida, L. S. (2020). Antioxidant stability and effectiveness of antosianin pigmen from unfermented cocoa flour (*Theobroma cacao* L.) by in vivo Method. *Jurnal Industri Hasil Perkebunan*, 61-73.
- Zhao, X., Susanne, P., & Thomas, B. (2015). Flavor impacts of glycerol in the processing of yeast fermented beverages: a review. *Journal of Food Science and Technology-mysore*, 52(12), DOI: 10.1007/S13197-015-1977-Y
- Ziegleder, G. (2009). *Flavour Development in Cocoa and Chocolate*. In: Beckett ST, editor. *Industrial chocolate manufacture and use*. 4th ed. Oxford: Blackwell Publishing.

