

BAB VI

KESIMPULAN DAN SARAN

6.1. Kesimpulan

1. Variasi konsentrasi Monosodium Glutamat (MSG) sebagai sumber nitrogen pada media biji durian petruk berpengaruh nyata terhadap pertumbuhan dan produksi pigmen oleh *Monascus* sp. KJR2.
2. Penambahan Monosodium Glutamat (MSG) sebesar 1,5% ke dalam media biji durian Petruk menghasilkan total kapang *Monascus* sp. KJR 2 paling tinggi (6,1139 Log (CFU/g)).
3. Penambahan Monosodium Glutamat (MSG) sebesar 1,5% ke dalam media biji durian Petruk menghasilkan kadar pigmen larut air yang paling tinggi, baik pigmen kuning (13,8150 AU/g), oranye (8,5000 AU/g) maupun merah (8,1000 AU/g).
4. Penambahan Monosodium Glutamat (MSG) sebesar 1,5% ke dalam media biji durian Petruk menghasilkan kadar pigmen larut etanol yang paling tinggi, baik pigmen kuning (5,7000 AU/g), oranye (3,0450 AU/g) maupun merah (2,8650 AU/g).

6.1. Saran

1. Diperlukan penelitian lebih lanjut mengenai aplikasi angkak dengan media biji durian varietas Petruk dalam penggunaannya dalam bahan pangan.

DAFTAR PUSTAKA

- Agung, T. 2010. *Glukosa*.
<http://www.agungtry10.co.cc/2010/06/glukosa.html>. (20 Maret 2011).
- Alternative Medicine Review. 2004. Volume 9, Number 2, Halaman 208-210.
- Ashari, S. 1995. *Hortikultura Aspek Budaya*. Jakarta: Universitas Indonesia Press.
- Babitha, S., C. R. Soccol, and A. Pandey. 2006. Jackfruit Seed - A Novel Substrate for the Production of *Monascus* Pigments through Solid-State Fermentation, *Food Technol. Biotechnol.*, 44 (4), 465-471.
- Badan Pusat Statistik Indonesia. 2010. *Produksi Buah-buahan Menurut Provinsi tahun 2010*.
www.bps.go.id/tab_sub/view.php?tabel=1&daftar=1&id_subyek=55¬ab=2 (15 September 2011).
- Bakošová, A., D. Máté, A. Laciaková, dan M. Pipová. 2001. Utilization of *Monascus purpureus* in the Production of Foods of Animal Origin, *Bull. Vet. Inst. Pulawy*, 45, 111-116.
- Bau, Y. S. and H. C. Wong (1979) Zinc effects on growth pigmentation and antibacterial activity of *Monascus purpureus*. *Physiol. Plant.* 46: 63-67.
- Behr, W. 2002. *Dietetic and Pharmaceutical Raw Materials: Monascus purpureus*. <http://www.bhrbonn.com/literat/monasub.htm> (10 Oktober 2011).
- Blanc, P.J., J.P. Laussac, J. Le Bars, P. Le Bars, M.O. Loret, A. Pareilleux, D. Prome, J.C. Prome, A.L. Santerre, G. Goma. 1995. Characterization of monascidin A from *Monascus* as citrinin. *International Journal of Food Microbiology* 27 (1995), 2001-213.
- Blanc, P.J., M.O. Loret, dan G. Goma. 1997. Pigments and Citrinin Production During Cultures of *Monascus* in Liquid and Solid Media, *Advance in Solid State Fermentation*, Kluwer Acad. Publ., Dordrecht, 393-406.

- Blanc, P.J., H. Hajjaj, M.O. Loret, dan G. Goma. 1998. Control of the Production of Citrinin by *Monascus*, *Symposium on Monascus Culture and Applications*, Center Pour L'Unesco, Toulouse, France, 8-10 Juli 1998, organized by Laboratoire Biotechnologies-Bioprecedes, UMR-CNRS 5504, Institut National des Sciences Appliquees de Toulouse, France.
- Carvalho, J. C., B. O. Oishi, A. Pandey, and C. R. Soccol. 2005. Biopigments from *Monascus*: Strains Selection, Citrinin Production and Color Stability, *Braz. Arch. Biol. Technol.*, 48 (6), 885-894.
- Carvalho, J. C., B. O. Oishi, A. L. Woiciechowski, A. Pandey, S. Babitha, and C. R. Soccol. 2007. Effects of Substrates on the Production of *Monascus* Biopigments by Solid-State Fermentation and Pigment Extraction Using Different Solvents, *Indian J. Biotechnol.*, 6, 194-199.
- Carvalho, J. C. D., A. Pandey, S. Babitha, and C. R. Soccol. 2003. Production of *Monascus* Biopigments: An Overview, *Agro. Food Ind. Hi-Tech*, 14, 37-42.
- Chan, S.W., C.Y. Lee, C.F. Yap, W.M. Wan Aida, and C.W. Ho. 2009. Optimisation of Extraction Conditions for Phenolic Compounds
- Chen, M. H. and M. R. Johns. 1993. Effects of pH and Nitrogen Source on Pigment Production by *Monascus purpureus*, *Appl. Microb. Biotechnol.*, 40, 132-138.
- Dikshit, R. dan P. Tallapragada. 2011. *Monascus purpureus*: A Potential Source for Natural Pigment Production, *J. Microbiol. Biotech. Res.*, 1 (4), 164-174.
- Direktorat Perbenihan. 2001. *Buku Deskripsi Varietas Tanaman Hortikultura, Seri Tanaman Buah-Buahan*. <http://www.worldagroforestrycentre.org/sea/Publications/Files/book/BK0094-06/BK0094-06-2.PDF> (3 Desember 2011).
- Dufossé, L., P. Galaup, A. Yaron, S. M. Arad, P. J. Blanc, K. N. C. Murthy, and G. A. Ravishankar. 2005. Microorganisms and microalgae as sources of pigments for food use: a scientific oddity or an industrial reality?, *Trends Food Sci. Technol.*, 16, 389-406.

- Dufossé, L. 2006. Microbial Production of Food Grade Pigments, *Food Technol. Biotechnol.*, 44 (3), 313-321.
- Dwiana, K. P., B. Soedarini, I. Sulistyawati. 1998. *Antimicrobial Effectiveness in Several Angkak Concentrations and Its Application in Guava Fruit Juice*. Proceeding of the 5th National Student Conference : 231-237.
- Erdoğan, O. dan S. Azirak. 2005. A Review on the Red Yeast Rice (*Monascus purpureus*), *KSU Journal of Science and Engineering*, 8 (1), 10-15.
- Fermentek Biotechnology. 2012. Citrinin. <http://www.fermentek.co.il/citrinin.htm>. (1 Januari 2013).
- Ganrong, X., W. Yanping, C. Yun, and T. Jiyang. 1998. Production of Healthcare Red Rice with High Colour Value and Monacolin K, *Symposium on Monascus Culture and Applications*, Toulouse, July 8-10.
- Hajjaj, H., A. Kläbe, G. Goma, P. J. Blanc, E. Barbier, and J. Francois. 2000. Medium-Chain Fatty Acids Affect Citrinin Production in the Filamentous Fungus *Monascus ruber*, *Appl. Environmental Microbiol.*, 66 (3), 1120-1125.
- Hajjaj, H., A. Kläbe, M. O. Loret, T. Tzedakis, G. Goma, and P. J. Blanc. 1997. Production and Identification of N-Glucosylrubropunctamine and N-Glucosylmonascorubramine from *Monascus ruber* and Occurrence of Electron Donor-Acceptor Complexes in These Red Pigments, *Appl. Environmental Microbiol.*, 63 (7), 2671-2678.
- Han, O. and R. E. Mudgett. 1992. Effects of Oxygen and Carbon Dioxide Partial Pressures on *Monascus* Growth and Pigment Production in Solid-State Fermentations, *Biotechnol. Prog.*, 8, 5-10.
- Hartanto, E. A. 2011. Pengaruh Penambahan Jenis Sumber Nitrogen dalam Media Biji Durian Varietas Manalagi terhadap Produksi Pigmen *Monascus* oleh *Monascus sp.* KJR2. *Skripsi S-1*, Fakultas Teknologi Pertanian UKWMS, Surabaya.
- Hermawan, S. 2012. Pengaruh Variasi Konsentrasi Tepung Kedelai sebagai Sumber Nitrogen Organik pada Media Biji Durian Varietas Petruk terhadap Pertumbuhan dan Produksi Pigmen *Monascus sp.* KJR2. *Skripsi S-1*, Fakultas Teknologi Pertanian UKWMS, Surabaya.

- Hutapea, P. 2010. Pembuatan Tepung Biji Durian (*Durio zibethinus* Murr) Dengan Variasi Perendaman Dalam Air Kapur Dan Uji Mutunya, *Skripsi S-1*, Fakultas Kesehatan Masyarakat USU, Medan.
- Jenie, B.S.L., Helianti, S. Fardias. 1994. Pemanfaatan Ampas Tahu, Onggok, dan Dedak untuk Produksi Pigmen Merah oleh *Monascus purpureus*, *Bul. Teknol. dan Industri Pangan*, 5 (2), 22-29.
- Juszlová, P., L. Martínková, and V. Kren. 1996. Secondary Metabolites of the Fungus *Monascus*: A Review, *J. Ind. Microbiol.*, 16, 163-170.
- Kauffman, G.B., 2004. *The Monosodium Glutamate Story : The Commercial Production of MSG and Other Amino Acids*. Journal of Chemical Education Vol. 81 No. 3.
- Kumalaningsih, S. dan N. Hidayat. 1995. *Mikrobiologi Hasil Pertanian*. Malang: IKIP.
- Kyu Lee, B., No-Hwan Park, Haiyon Piao, dan Wook-Jin Chung. 2001. *Production of Red Pigments by Monascus purpureus in Submerged Culture*. *Biotechnol. Bioprocess Eng.* 2001, 6:341-346.
- Lee, Y. K. and D. C. Chen. 1995. Production of *Monascus* Pigments by A Solid-Liquid State Culture Method, *J. Ferment. Bioeng.*, 79, 516-518.
- Lee, Y.K. dan D. Chen. 1998a. *Monascus* Pigment Production in Submerged Fermentation, *Symposium on Monascus Culture and Applications*, Center Pour L'Unesco, Toulouse, France, 8-10 Juli 1998, organized by Laboratoire Biotechnologies-Bioprecedes, UMR-CNRS 5504, Institut National des Sciences Appliquees de Toulouse, France.
- Lee, Y.K. dan D. Chen. 1998b. Application of *Monascus* Pigments as Food Colorant, *Symposium on Monascus Culture and Applications*, Center Pour L'Unesco, Toulouse, France, 8-10 Juli 1998, organized by Laboratoire Biotechnologies-Bioprecedes, UMR-CNRS 5504, Institut National des Sciences Appliquees de Toulouse, France.
- Lee, Y. K. and Khng, H. P. 2001. Natural Color Additives, (dalam *Food Additives*, A. L. Branen, P. M. Davidson, S. Salminen, and J. H. Thorngate, Eds.), Marcel Dekker, New York, 2nd ed, 501-522.

- Lin, Y. L., T. H. Wang, M. H. Lee, and N. W. Su. 2008. Biologically Active Components and Nutraceuticals in the *Monascus*-Fermented Rice: A Review, *Appl. Microb. Biotechnol.*, 77, 965-973.
- Listyani, P. 2003. Pola Produksi Pigmen *Monascus* secara Fermentasi Cair pada Media Tunggal dan Campurannya: Germ, Bran, dan Pollard Gandum, *Skripsi*, Fakultas Teknologi Pertanian, Universitas Katolik Widya Mandala Surabaya.
- Ma, J., Y. Li, Q. Ye, J. Li, Y. Hua, D. Ju, dan D. Zhang. 2000. Constituents of Red Yeast Rice, A Traditional Chinese Food and Medicine, *J. Agric. Food Chem.*, 48 (11), 5220-5225.
- Mak, N. K., W. F. Fong, and Y. L. Wong-Leung. 1990. Improved Fermentative Production of *Monascus* Pigments in Roller Bottle Culture, *Enzyme Microb. Technol.*, 12, 965-968.
- Martinkova, L. and P. Patakova. 1999. *Monascus*, (dalam *Encyclopedia of Food Microbiology*, R. K. Robinson, C. Batt, and P. Patel, Eds.), Academic Press, London, 1481-1487.
- Merck. 2006. *Merck Safety Data Sheet: Sabouraud-2% Dextrose Broth for Microbiology*.
- Merck. 2010. *Merck Safety Data Sheet: Sabouraud-4% Dextrose Agar for Microbiology*.
- New Zealand Food Safety Authority. 2012. *Monosodium Glutamate (MSG) – Information Sheet*.
- Novita, Y. 2011. Produksi Pigmen dari *Monascus* sp. KJR 2 pada Media Biji Durian Manalagi : Kajian Pengaruh Jenis Sumber Karbon, *Skripsi S-1*, Fakultas Teknologi Pertanian Universitas Katolik Widya Mandala Surabaya.
- Oetari, A. 2006. Metabolisme pada Fungi, (dalam *Mikologi: Dasar dan Terapan*, I. Gandjar dan W. Sjamsuridzal, Eds.), Yayasan Obor Indonesia, Jakarta, 23-35.
- Orozco, S.F.B. dan B.V. Kilikian. 2008. *Effect of pH on Citrinin and Red Pigments Production by Monascus purpureus CCT3802*. *World J Microbiol Biotechnol* 24:263-268.
- Panda, B.P., Saleem J., Mohd A. 2010. Production of Angkak Though Co-culture of *Monascus Purpureus* and *Monascus ruber*. *Brazilian Journal of Microbiology*, 41:757-764, ISSN 1517-8382.

- Pattanagul, P., R. Pinthong, A. Phianmongkhol, N. Leksawasdi. 2007. Review of Angkak Production (*Monascus purpureus*), *Chiang Mai J. Sci.*, 34 (3), 319-328.
- Phoolphundh, S., A. Wongwicharn, and A. Terasawat. 2007. Effect of C:N ratio on *Monascus* pigment production in fermentor using cassava decanter wastewater as substrate.
- Pirt, S. J. 1985. *Principles of Microbe and Cell Cultivation*. London: Blackwell Scientific Publications.
- Pitt, J. I. and A. D. Hocking. 2009. *Fungi and Food Spoilage*, 2nd ed. London: Chapman and Hall.
- Rasheva, T., J.N. Hallet, dan A. Kujumdzieva. 1998. Taxonomic Investigation of *Monascus purpureus* 94-25 Strain, *Journal of Culture Collection*, 2, 51-59.
- Ristiarini, S., N. Kusumawati, I. Srianta. 2010. Isolasi *Monascus* sp. dari Angkak yang Beredar di Surabaya dan Studi Potensinya untuk Produksi Pigmen *Monascus*, *Laporan*, Pusat Penelitian Pangan dan Gizi UKWMS, Surabaya.
- Robinson, J. A. 1991. Polyketide Synthase Complexes: Their Structure and Function in Antibiotic Biosynthesis, *Biol. Sci.*, 332, 107-114.
- Rukmana, R. 1996. *Durian Budidaya dan Pasca Panen*. Yogyakarta: Kanisius.
- Said, F. M. S. 2010. *Monascus ruber* ICMP 15220 Fermentation for the Production of Pigments, *Ph.D thesis*, Massey University.
- Shaanxi Meihe Biochemics. 2011. *Red Yeast Rice Extract*. <http://www.meihebio.com/info.asp?id=62> (14 Desember 2012).
- Sheu, F., Wang, C.L., and Shyu, Y.T. 2000. Fermentation of *Monascus purpureus* on bacterial cellulose-nata and the color stability of *Monascus*-nata complex. *J. Food Science*. 65 (2) : 342-345.
- Steinkraus, K.H. 1983. *Handbook of Indigenous Fermented Foods*. New York: Institute of Science Cornell University.
- Subianto, Christine. 2013. Aktivitas Antioksidan Angkak Biji Durian : Pengaruh Propors Air dan Etanol Terhadap Aktivitas Antioksi dan Ekstrak Angkak Biji Durian dengan Metode DPPH dan Phosphomolybdenum. *Skripsi S-1*, Fakultas Teknologi Pertanian UKWMS, Surabaya.

- THX Biotechnology. 2012. Monascus Red Color from Tian Hong Xiang Biotechnology Co.,Ltd. <http://www.natural-extract.com/natural-pigments/107-monascus-red-color.html>. (15 Desember 2012).
- Timotius, K. H. 2004. Produksi Pigmen Angkak oleh *Monascus*, *Jurnal Teknologi dan Industri Pangan*, 15 (1), 79-86.
- Turner, W. B. 1971. *Fungal Metabolites*. London: Academic Press.
- TTG Budidaya Pertanian. 2000. Durian (*Bombaceae sp.*). Kantor Deputi Menegristek Bidang Pendayagunaan dan Pemasyarakatan Ilmu Pengetahuan dan Teknologi. Halaman 1-18.
- Jenie, U.A., 2012. Penjelasan Pembuatan Monosodium Glutamat (MSG). Pustaka Online. <http://media.isnet.org/islam/Etc/MSG.html>. (3 Januari 2013).
- Untung, O. 2002. *Durian Untuk Kebun Komersial dan Nabati*. Jakarta: Penebar Swadaya.
- Wahyono. 2009. Karakteristik *Edible Film* Berbahan Dasar Kulit dan Pati Biji Durian (*Durio sp.*) untuk Pengemasan Buah Strawberry, *Skripsi*, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Muhammadiyah Surakarta. <http://etd.eprints.ums.ac.id/3831/1/A420050124.PDF> (2 Desember 2011).
- Wibisono, M., 2013. Aktivitas Antioksidan Angkak Biji Durian : Pengaruh Proporsi Dan Suhu Air Terhadap Aktivitas Antioksi dan Ekstrak Angkak Biji Durian dengan Metode DPPH dan Phosphomolybdenum. *Skripsi S-1*, Fakultas Teknologi Pertanian UKWMS, Surabaya.
- Winarno, F.G., 1997. Kimia Pangan dan Gizi. Gramedia Pustaka Utama, Jakarta
- Wong, H. C., Y. C. Lin, and P. E. Koehler. 1981. Regulation of Growth and Pigmentation of *Monascus purpureus* by Carbon and Nitrogen Concentrations, *Mycologia*, 73, 649-654.
- Wongjewboot, I. dan S. Kongruang. 2011. pH Stability of Ultrasonic Thai Isolated *Monascus purpureus* Pigments, *International Journal of Bioscience, Biochemistry and Bioinformatics*, 1 (1), 79-83.
- Yongsmith, B., W. Tabloka, W. Yongmanitchai, and R. Bavavoda. 1993. Culture Conditions for Yellow Pigment Formation by *Monascus sp.* KB 10 Grown on Cassava Medium, *World J. Microbiol. Biotechnol.*, 9, 85-90.

- Yongsmith, B., C. Chaisrisook, P. Chimange, dan S. Krairak. 1998. Production of Yellow Pigments by *Monascus* Molds Growing on Cassava Substrates, *Symposium on Monascus Culture and Applications*, Center Pour L'Unesco, Toulouse, France, 8-10 Juli 1998, organized by Laboratoire Biotechnologies-Bioprecedes, UMR-CNRS 5504, Institut National des Sciences Appliquees de Toulouse, France.
- Yoshimura, M., S. Yamanaka, K. Mitsugi, and Y. Hirose. 1975. Production of *Monascus* Pigment in a Submerged Culture, *Agric. Biol. Chem.*, 39, 1789-1795.