# BAB VI
# KESIMPULAN DAN SARAN

## 6.1 Kesimpulan

1. Penambahan glukosa pada media biji lupin memberikan pengaruh nyata terhadap total kapang *Monascus sp.* KJR 2.
2. Penambahan glukosa sebanyak 5% menghasilkan total kapang *Monascus sp.* KJR 2 paling tinggi, yaitu 6,3925 log cfu/g, dibandingkan dengan semua perlakuan.
3. Penambahan glukosa pada media biji lupin memberikan pengaruh nyata terhadap produksi pigmen kuning dan pigmen merah oleh *Monascus sp.* KJR 2.
4. Penambahan glukosa sebanyak 5% menghasilkan produksi pigmen kuning dan merah paling tinggi, yaitu 9,982 AU/g dan 10,268 AU/g, dibandingkan dengan semua perlakuan.
5. Penambahan glukosa pada media biji lupin tidak memberikan pengaruh nyata terhadap produksi pigmen oranye oleh *Monascus sp.* KJR 2 dengan kisaran 7,813-8,884 AU/g.

## 6.2 Saran

1. Perlu dilakukan penelitian terhadap senyawa aromatik pada angkak lupin.
2. Perlu dilakukan penelitian terhadap senyawa toksik, seperti citrinin pada angkak lupin.
3. Perlu dilakukan penelitian terhadap aplikasi angkak dengan media biji lupin pada bahan pangan.

## DAFTAR PUSTAKA


Astawan, M. 2004. Sehat Bersama Aneka Serat Pangan Alami. Solo: Penerbit Tiga Serangkai.

Babitha, S., C.R. Soccol, dan 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.

Berg, J.M., J. Tymoczko, dan L. Stryer. 2012. *Biochemistry seventh edition*. London: W.H. Freeman and Company.

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, UMRCNRS 5504, Institut National des Sciences Appliquees de Toulouse, France.

Broder, C.U. dan P.E. Koehler. 1980. Pigmen Produced by *Monascus purpureus* with Regard to Quality and Quantity, *J. Food Sci.*, 45: 567-569.

Cahyadi, W. 2007. *Kedelai, Kasiat, dan Teknologi*. Jakarta: Bumi Aksara.

Carvalho, J.C., B.O. Oishi, A.L. Woiciechowski, A. Pandey, S. Babitha, dan C.R. Soccol. 2007. Effect of Substrates on the Production of *Monascus* Biopigments by Solid-State Fermentation and Pigment Extraction Using Different Solvents, *Indian J. Biotechnol.* 6: 194-199.

Chen, M. H. dan M. R. Johns.1983. Effect of Carbon Source on Ethanol and Pigment Production by *Monascus purpureus*. 16(7): 584–590.

Dikshit, R. dan P. Tallapragada. 2011. *Monascus purpureus* : A potential source for natural pigment production. *J. Microbiol. Biotech. Res*. 1(4): 164-174.

Dube, H.C. 1990. *An Introduction to Fungi*. New Delhi: Vikas Publishing House Pvt Ltd.

Dufossé L., P. Galaup, A. Yaron, S.M. Arad, P. Blanc, K.N.C. Murthy, dan G.A. Ravishankar. 2005. Microorganisms and Microalgae as Sources of Pigments for Food Use: A Scientific Oddity or An Industrial Reality?, *Trends in Food Science and Technology* 16: 389-406.

El-Shazly, A., A. M. Ateya, dan M. Wink. 2001. Quinolizidine Alkaoid Profile of *Lupinus Varius Orientalis L. albus albus, L. hartwegii* and *L. densiflorus*. *J. Biological Activity*. 56: 21-30.

Erbas, M., M. Certel, dan M.K. Uslu. 2005. Some Chemical Properties of White Lupin Seeds (*Lupinus albus* L.). *Food Chem.* 89: 341–345

Erbas, M. 2010. The Effects of Different Debittering Methods on the Production of Lupin Bean Snack from Bitter *Lupinus albus* L. Seeds. *Journal of Food Quality* 33: 742–757

Erdoğrul, O. dan S. Azirak. 2005. A Review on the Red Yeast Rice (*Monascus purpureus*), *KSU Journal of Science and Engineering* 8:10-15.

Fardiaz, S. 1992. *Mikrobiologi Pangan*. Jakarta: PT. Gramedia Pustaka Utama.

Fardiaz, S.F.D.B, dan F. Zakaria. 1996. Toksisitas dan Imunogenitas Pigmen Angkak yang Diproduksi dari Kapang *Monascus purpureus* pada Substrat Limbah Cair Tapioka. *Buletin Teknologi dan Industri Pangan* 1(12): 34-38.

Food Review. 2008. *Lupin, is this Next Generation Grain Legume?*. http://www.foodreview.biz/login/preview.php?view&id=55608 (8 Februari 2013).

Fudiyansyah, N., D.S. Petterson, R.R. Bell, dan A.H. Fairbrother. 1995. A Nutritional, Chemical, and Sensory Evaluation of Lupin (*L. angustifolius*) Tempe, *International Journal of Food Science and Technology* 30: 291-305.

Gallicana, S. 2001. *Lupino*. http://www.summagallicana.it/lessico/l/lupino.htm (20 Februari 2013).

Gandjar, I., W. Sjamsuridzal, dan A. Oetari. 2006. *Mikologi Dasar dan Terapan*. http://books.google.co.id/books?id=MxEOHqhHI7sC&pg=PR3&dq=Gandjar,+Indrawati.+2006.+Mikologi+Dasar+dan+Terapan.+Jakarta:+Yayasan+Obor+Indonesia.&cd=1&redir_esc=y#v=onepage&q&f=false (28 Februari 2013).

Ganrong, X., Y. Guohua, M. Jing, dan W. Yanping. 1998. Solid State Fermentation of *Monascus anka* with Corn as the Raw Material, *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.

Garraway, M.O. dan R.C. Evans. 1984. *Fungal Nutrition and Physiology*. New York: John Wiley and Sons.

Gdala, J., A.J.M. Jansman, P. van Leeuwen, J. Huisman, dan M.W.A. Verstegen. 1996. Lupins *( L. luteus, L. albus, L. angustifolius)* as a Protein Source for Young Pigs. *Animal Feed Science Technology* 62: 239-249

Grive, M. 2001. *Lupins*. http://botanical.com/botanical/mgmh/l/lupins50.html (28 Februari 2013).

Guinadi, C. 2011. *Roasted pork / Cha Shao*. http://gourmetjourney.blogspot.com/2011/06/roasted-pork-cha-shao.html (4 Maret 2013).

Hajjaj, H., Blanc P.J., Groussac,E., Goma, G., Uribelarrea, J.L., dan Loubiere, P, 1999. Improvement of Red Pigment/Citronin Production Ratio as Function of Environmental Conditions by *Monascus rubber*, *Biotech. Bioengineer* 64(4): 497-501.

Hajjaj, H., A. Klaébé, G. Goma, P. J. Blanc, E. Barbier, dan J. François. 2000. Medium-Chain Fatty Acids Affect Citrinin Production in the Filamentous Fungus *Monascus ruber*, *Appl. Environ. Microbiol.* 66(3): 1120-1125.

Hamdi, M., Ph. Blanc, dan G. Goma. 1998. Production of Red Pigments by *Monascus purpureus* Growth on Prickly Pear Juice, *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.

Henares, J.A.R. dan F.J. Morales. 2007. Antimicrobial Activity of Melanoidins. *Journal of Food Quality* 30: 160–168.

Jenie, B.S.L., Helianti, dan S. Fardiaz. 1994. Pemanfaatan Ampas Tahu, Onggok, dan Dedak untuk Produksi Pigmen Merah oleh *Monascus purpureus*, *Bul. Teknol. dan Industri Pangan* 5(2): 22-29.

Juzlova, P., Martinkova, L., dan Kien, V. 1996. Secondary Metabolites of the Fungus *Monascus*: A review. *J. Ind. Microbiol*. 16: 163–170.

Kamrani, M., B.B. Kohnehrouz, dan A. Gholizadeh. 2011. Cisgenic Inhibition of Potato Cold Induced Phosphorylase L Gene Expression and Decrease in Sugar Contents, *African Journal of Biotechnology* 10(50): 10.076-10.082.

Kumalaningsih, S. dan N. Hidayat. 1995. *Mikrobiologi Hasil Pertanian*. Malang: IKIP.

Kumara, H.P.M. 2009. *Monascus purpureus* in Relation to Statin and Sterol Production and Mutational Analysis. *Ph.D thesis*, Central Food Technological Research Institute at Mysore.

Lee, Y.K. dan D. Chen. 1998[a]. *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, UMR42 CNRS 5504, Institut National des Sciences Appliquees de Toulouse, France.

Lee, Y.K. dan D. Chen. 1998[b]. 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.

Lin TF dan Demain AL. 1991. Effect of Nutrition of *Monascus sp*. on Formation of Red Pigments. *Appl Microbiol and Biotechnol* 36: 70-75.

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.

Lotong, N. and Suwanarit,P. 1990. Fermentation of Angkak in Plastic Bags and Regulation of Pigmentation by Initial Moisture Content, *J. Appl. Bacteriol.* 68: 65-70.

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.

Maknickiene, Z., R. Asakaviciute, E. Baksiene dan A. Razukaś. 2013. Alkaloid Content Variations in *Lupinus Luteus L*. and *Lupinus Angustifolius L. Arch. Biol. Sci*. 65(1): 107-112.

Marshall. 2004. *Alpha Amylase*. http://science.marshall.edu/murraye/alpha_amylase.htm (5 Maret 2013).

Martinez, H.J., N.R. Quintos, R.M. Escabedo, dan G.D. Ortiz. 2001. Alkaloids Composition of *Lupinus campestris* from Mexico, *J. Food Biochem.* 25:117-125

Meadows, B. 2012. *Definition of pH and pH Testing Tools*. http://www.google.com/url?sa=t&rct=j&q=ph%20definition%20pdf&source=web&cd=8&cad=rja&sqi=2&ved=0CFYQFjAH&url=http%3A%2F%2Fwww.benmeadows.com%2Frefinfo%2Ftechfacts%2Ftechpdf%2FDefinitionofpHandpHTestingTools-149.pdf&ei=qYTdUb-RFoXwrQee4oGwCg&usg=AFQjCNGe4fetu0QruFE3rej151tTWztjIQ&bvm=bv.48705608,d.bmk (10 Juli 2013)

Merck. 2013. D(+)-Glucose Monohydrate. http://www.merckmillipore.com/indonesia/chemicals/d-plus-glucose-monohydrate/MDA_CHEM-108342/english/p_Qxub.s1Oha4AAAEnWk0l5OKW (30 April 2013)

Mohamed, A.A. dan P.R. Duarte. 1995. Composition of *Lupinus albus*, *Cereal Chem.* 72(6): 643-647.

Nimnoi, P. dan S. Lumyong. 2011. Improving Solid-State Fermentation of Monascus purpureus on Agricultural Products for Pigment Production. *Food Bioprocess Technol.* 4: 1384–1390.

Nuriati, R. 2008. Penggunaan *Saccharomyces cerevisiae* H. sebagai Elisitor dalam Upaya Meningkatkan Ssenyawa Oksazol (Alkaloid) pada Kultur Kalus Mengkudu (*Morinda citrifolia* L.), *Skripsi*, Jurusan Biologi, FMIPA, Universitas Pendidikan Indonesia Bandung http://repository.upi.edu/operator/upload/s_d525_033584_chapter2.pdf (27 Februari 2013).

Pattanagul, P., R. Pinthong, A. Phianmongkhol, dan N. Leksawasdi. 2007. Review of Angkak Production (*Monascus purpureus*), *Chiang Mai J.Sci.* 34(3): 319-328.

Permana, D.R., S. Marzuki, dan D. Tisnadjaja. 2004. Analisis Kualitas Produk Fermentasi Beras (*Red Fermented Rice*) dengan *Monascus purpureus* 3090, *Biodiversitas* 5(1): 7-12.

Pirt, S. J. 1985. *Principles of Microbe and Cell Cultivation*. London: Blackwell Scientific Publications.

Purnomo, J. 1993. *Ekologi Tanaman Lupin (Lupinus sp.) dan Potensi Pengembangannya di Indonesia*. Jakarta: Balai Penelitian Tanaman Kacang-kacangan dan Umbi-Umbian.

Puspitadewi, S.R.D. 2012. Pola Produksi Pigmen *Monascus* Oleh *Monascus sp.* KJR2 Pada Media Biji Durian Varietas Petruk Melalui Fermentasi Padat, *Skripsi S-1*, Fakultas Teknologi Pertanian Universitas Katolik Widya Mandala Surabaya, Surabaya.

Pyo, Y.H. dan T.C. Lee. 2007. The Potential Antioxidant Capacity and Angiotensin I-Converting Enzyme Inhibitory Activity of *Monascus*-Fermented Soybean Extracts : Evaluation of *Monascus*-Fermented Soybean Extracts as Multifunctional Food Additives, *J. Food Sci.* 72(3): 218-223.

Rasheva, T., J.N. Hallet, dan A. Kujumdzieva. 1998. Taxonomic Investigation of *Monascus purpureus* Strain, *Journal of Culture Collection* 2: 51-59.

Rashmi, D. dan T. Padmavathi. 2013. Exploring *Monascus sanguineus* as a Potential Natural Source for Pigment Production. *International Research Journal of Biological Sciences* 2(5): 59-67.

Ristiarini, S., N. Kusumawati. dan I. Srianta. 2010. Isolasi *Monascus sp*. dari Angkak yang Beredar di Surabaya dan Studi Potensinya untuk

Produksi Pigmen *Monascus*, *Laporan Penelitian*, Fakultas Teknologi Pertanian, Universitas Katolik Widya Mandala Surabaya.

Sa'adah, Z., N. Ika, dan Abdullah. 2010. Produksi Enzim Selulase oleh *Aspergillus niger* Menggunakan Substrat Jerami dengan Sistem Fermentasi Padat, *Skripsi*, Jurusan Teknik Kimia, Fakultas Teknik, Universitas Diponegoro Semarang.

Scharlau. 2010. *Potato Dextrose Broth*. http://www.scharlab.com/web_productos_detalle.php?idioma=EN&ref=02-483-500 (28 Februari 2013).

Schmitt, M., and Blanc, P. 2001. *Microbial Biotechnology Innovative Aspects in Biotechnology of Eukaryotes*. Sofia: Investpress Co.

Spencer, C. 2002. *Lupins*. United Kingdom: Springdale Crop Synergies Ltd.

Srianta, I., B. Hendrawan, N. Kusumawati, dan P.J. Blanc. 2012. Study on Durian Seed as A New Substrate for Angkak Production. *International Food Research Journal* 19(3): 941-945.

Steinkraus, K.H. 1983. *Handbook of Indigenous Fermented Foods*. New York: Institute of Science Cornell University.

Sudarmadji, S., B. Haryono dan Suhardi. 1996. *Analisa Bahan Makanan dan Pertanian*. Liberty. Yogyakarta.

Sweeny, J.G., E. Valdes., G.A. Iacobucci, H. Sato, dan S. Sakamura. 1981. Photoprotection of the Red Pigment of *Monascus anka* in Aqueous Media by 1,4,6-trihydroxynaphthalene, *J. Agric. Food Chem.* 29: 1189-1193.

Thermo Scientific. 2013. *Potato Dextrose Agar*. http://www.oxoid.com/UK/blue/prod_detail/prod_detail.asp?pr=CM0139&sec=&org=96 (28 Februari 2013).

Timotius, K.H. 2004. Produksi Pigmen Angkak oleh *Monascus*, *Jurnal. Teknol. dan Industri Pangan* XV(1): 79-86.

Timotius, K.H. dan R.S. Hartani. 1998. Pertumbuhan dan Produksi Pigmenoleh *Monascus purpureus* UKSW 40 dalam Medium Air Rendaman Kedelai: Pengaruh pH dan Cara Pemanasan Medium, *Bul. Teknol. Dan Industri Pangan* IX(1): 16-21.

USDA. 2013. *Lupinus albus*. http://plants.usda.gov/java/profile?symbol=LUAL22 (20 Februari 2013).

Velmurugan, P., H. Hur, V. Balachandar, S.K. Kannan, K.J. Lee, S.M. Lee, J.C. Chae, P.J. Shea, dan B.T. Oh. 2011. *Monascus* Pigment Production by Solid-State Fermentation with Corn Cob Substrate, *Journal of Bioscience and Bioengineering* 112(6): 590–594.

Villaluenga, C.M., G. Urbano, J.M. Porres, J. Frias, dan C.V. Valverde. 2006. Improvement in food intake and nutritive utilization of protein from *Lupinus albus* var. multolupa protein isolates supplemented with ascorbic acid. *Food Chemistry* 103: 944–95.1

Vvrs australia pty ltd. 2013. *Lupins Speckled Angustifolius.* http://www.exportersindia.com/vvrs_australia/products.htm?slno=335542 (24 Juli 2013).

Winarno, F.G. 2002. *Kimia Pangan dan Gizi*. Jakarta: Gramedia Pustaka Utama.

Wong, H. C., Y. C. Lin, dan P. E. Koehler. 1981. Regulation of Growth and Pigmentation of *Monascus Purpureus* by Carbon and Nitrogen Concentration, *Mycologia* 73(4).

Yongsmith, B., C. Chaisrisook, P. Chimanage, 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, UMRCNRS 5504, Institut National des Sciences Appliquees de Toulouse, France.