BAB V
KESIMPULAN DAN SARAN

5.1 Kesimpulan

1. Pigmen kuning merupakan pigmen dominan dalam angkak biji durian.
2. Pelarut yang paling efektif untuk melarutkan pigmen angkak biji durian yaitu etanol 40% (v/v).
3 Aktivitas antioksidan angkak biji durian dengan metode DPPH yang paling tinggi yaitu 0,5876 mg AAE/g sampel (wb) pada pelarut etanol 40% (v/v).
4 Aktivitas antioksidan angkak biji durian dengan metode *phosphomolybdenum* yang paling tinggi yaitu pada etanol 0% (v/v) dengan nilai 6,7899 mg AAE/g sampel (wb) dan 6,4247 mg GAE/g sampel (wb).

5.2. Saran

Diperlukan penelitian lebih lanjut mengenai jenis senyawa antioksidan yang ada pada angkak biji durian dan penelitian mengenai kadar citrinin angkak biji durian.

DAFTAR PUSTAKA

Ajdari, Z., A.Ebrahimpour, M.A. Manan, M. Hamid, R. Mohamad, and A.B. Ariff. 2011. Assessment of Monacolin in the Fermented Products Using *Monascus purpureus* FTC5391. *Journal of Biomedicine and Biotechnology*, 1-9.

Aniya, Y., I. I. Ohtani, T. Higa, C. Miyaggi, H. Gibo, M. Shimabukuro, H. Nakanishi, and J. Taira. 2000. Dimuremic Acid as an Antioxidant of The Mold, Monascus Anka. *Free Radical Biology & Medicine* 28(6):999-1004.

Armala, M. M. 2009. Daya Antioksidan Fraksi Air Ekstrak Herba Kenikir (*Cosmos caudatus* H. B. K.) dan Profil KLT, *Skripsi-S1*, Fakultas Farmasi Universitas Islam Indonesia, Yogyakarta.

Avila, P.A., F. Toledo, Y.S. Park, S.T. Jung, S.G. Kang, B.G. Heo, S.H. Lee, M. Sajewicz, T. Kowalska, and S. Gorinstein. 2008. Antioxidant Properties of Durian Fruit as Influenced by Ripening. *Food Science and Technology* 41:2118-2125.

Azizah, R.N., A. Triono, dan L. Arqan. 2012. *Identifikasi Senyawa Bahan Alam serta Uji Antioksidan Ekstrak Lempuyang Gajah (Zingiber Zerumbet).* http://chittaputri.blogspot.com/2012/01/identifikasi-senyawa-bahan-alam-serta.html (5 Desember 2012).

Babitha, S., C.R. Soccol, and A. Pandey. 2006. Jackfruit Seed-A Novel Substrate for The Production of Monascus Pigments Trough Solid-state Fermentation. *Food Technology Biotechnol*ogy 44(4):465-471.

Badan Pusat Statistik. 2012. *Produksi buah-buahan di Indonesia*. http://www.bps.go.id/tab_sub/view.php?kat=3&tabel=1&daftar=1&id_subyek=55&notab=4 (16 September 2012).

Bailon, M.T.E and C.S.Buelga. 2012. *Polyphenol Extraction from Foods*. http://kurdchemists.org/files/Polyphenols.pdf (8 November 2012)

Benzie, I.F.F. and J.J. Strain. 1996. The Reducing Ability of Plasma (FRAP) as a Measure of "Antioxidant Power": The FRAP Assay. *Analytical Biochemistry* 239:70-76.

Bondet, V., W.B. Williams, and C. Berset. 1997. Kinetics dan Mechanisms of Antioxidant Activity Using the DPPH Free Radical Method. *Lebensmittel-Wissenschaft und-Technologie* 30:609-615.

Carvalho, J.C., B.O. Oishi, A. Pandey, and C.R. Soccol. 2005. Biopigments from *Monascus*: Strains Selection, Citrinin Production, and Color Stability. *Brazilian Archives of Biology dan Technology* 48(6):885-894.

Chairote, E., G. Chairote, and S. Lumyong. 2009. Red Yeast Rice Prepared form Thai Glutinous Rice and Antioxidant Activities. *Chiang Mai Journal Science* 36(1): 42-49.

Chairote, E., S. Lumyong, and G. Chairote. 2010. Study on Cholesterol Lowering Compounds in Red Yeast Rice Prepared from Thai Glutinous Rice. *Asian Journal of Food and Agro-Industry* 3(2):217-228.

Chang, H.Y., Y.L. HO, M.J. Sheu, Y.H. Lin, M.C. Tseng, S.H. Wu, G.J. Huang, and Y.S. Chang. 2007. Antioxidant and Free Radical Scavenging Activities of *Phellinus merrillii* Extracts. *Botanical Studies* 48: 407-417.

Cheng, M.J., M.D. Wu, P.S. Yang, J.J. Chen, I.S. Chen, Y.L. Chen, and G.F. Yuan. 2010. Secondary Metabolites Isolated from The Fungus *Monascus kaoliang*-Fermented Rice. *Journal Chilean Chemistry Society* 55(1):107-110.

Dehpour, A.A., M.A. Ebrahimzadeh, N.S. Fazel, and N.S. Mohammad. 2009. Antioxidant Activity of Methanol Extract of Ferula Assafoetida and Its Essential Oil Composition. *Grasas Aceites* 60(4):405-412.

Dhale, M.A., S. Divakar, and U. Kumar. 2007. Isolation and Characterization of Dihydromonacolin-MV from *Monascus purpureus* for Antioxidant Properties. *Applied Microbiology Biotechnology* 73:1197-1202.

Edhisambada. 2011. *Metode Uji Aktivitas Antioksidan Radikal 1,1-difenil-2-pikrilhidrazil (DPPH).* http://www.medallionlabs.com (14 September 2010).

Erdogrul, O. and S. Azirak. 2005. A Review on The Red Yeast Rice (*Monascus purpureus*). *KSU Journal of Science and Engineering* 8(1):10-15.

Fardiaz, S., D.B. Fauzi, 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* 7(2):63-68.

Fauzana, S. 2011. Isolasi dan Potensi Bakteri Endofitik Penghasil Antibiotik dari Tanaman Sirih Merah (*Piper Crocatum* Ruiz & Pav.), *Skripsi S-1*, Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Andalas, Padang.

Harborne, J.B. 1987. *Metode Fitokimia Edisi Kedua*. Bandung: ITB.

Ho, B.Y., Y.M. Wu, K.J. Chang, and T.M. Pan. 2011. Dimerumic Acid Inhibits SW620 Cell Invasion by Attenuating H_2O_2-Mediated MMP-7 Expression via JNK/C-Jun and ERK/C-Fos Activation in an AP-1-Dependent Manner. *International Journal Biology Science* 7(6):869-880.

Hong, S.H., I. Lee, S.J. Kim, and J.Y. Imm. 2012. Improved Functionality of Soft Soybean Curd Containing *Monascus* Fermented Soybean Ethanol Extract. *Food Science and Biotechnology* 21(3):701-707.

Irawati, I. 2008. Perbandingan Metode Penentuan Aktivitas Antioksidan Rimpang Temulawak, *Skripsi S-1*, Fakultas Matematika dan Ilmu Pengetahuan IPB, Bogor.

Jenie, B.S.L., K.D. Mitrajanty, dan S. Fardiaz. 1997. Produksi Konsentrat dan Bubuk Pigmen Angkak dari Monascus purpureus serta Stabilitasnya selama Penyimpanan. *Buletin Teknologi dan Industri Pangan* 8(2):39-46.

Jenie, B.S.L., Ridawati, dan W.P. Rahayu. 1994. Produksi Angkak oleh Monascus puspureus dalam Medium Limbah Cair Tapioka, Ampas Tapioka, dan Ampas Tahu. *Buletin Teknologi dan Industri Pangan* 5(3):60-64.

Karadag, A., B. Ozcelik, and S. Saner. 2009. Review of Methods to Determine Antioxidant Capacities. *Food Analysis Methods* 2:41-60.

Kasim, E., S. Astuti, dan N. Nurhidayat. 2006. Kandungan Pigmen dan Lovastatin pada Angkak Beras Merah Kultivar Bah Butong dan BP 1804 IF 9 yang Difermentasi dengan *Monascus purpureus Jmba*. *Biodiversitas* 7(1):7-9.

Katja, D.G., E. Suryanto, dan F. Wehantouw. 2009. Potensi Daun Alpukat (*Peresa Americana Mill*) sebagai Sumber Antioksidan Alami. *Chemistry Program* 2(1):58-64.

Khalaf, N.A., A.K. Shakya, A.A. Othman, Z.E. Agbar, and H. Farah. 2008. Antioxidant Activity of Some Common Plants. *Turki Journal Biology* 32:51-55.

Kim, D.O., K.W. Lee, H.J. Lee, and C.Y. Lee. 2002., Vitamin C Equivalent Antioxidant Capacity (VCEAC) of Phenolic Phytochemicals. *Journal of Agricultural and Food Chemistry* 50: -3717.

Kohen, R. and A. Nyska. 2002. Invited Review: Oxidation of Biological Systems: Oxidative Stress Phenomena, Antioxidants, Redox Reactions, and Methods for Their Quantification. *Toxicology Pathology* 30:620-650.

Koleva, I.I., T.A.V Beek, J.P.H. Linssen, A. de Groot, and L.N. Evstatieva. 2002. Screening of Plant Extracts For Antioxidant Activity: A Comparative Study on Three Testing Methods, *Phytochemical Analysis* 13:8-17.

Kumari, H.P.M., M.A. Dhale, K.A. Naidu, and G. Vijayalakshmi. 2011. Antioxidant Effect of Red Mouls Rice in Hypercholesterolemic Wistar Male Rats. *Cell Biochemistry Function* 29:597-602.

Kurnia,R. 2010. *Ekstraksi dengan Pelarut*. http://lordbroken.wordpress.com/2010/02/17/ekstraksi-pelarut/ (8 November 2012)

Lee, Y.K. 1995. Production of *Monascus* Pigments by a Solid-liquidstate Culture Method. *Journal Fermentation Bioengineering* 79:516–518.

Lee, Y.L., J.H. Yang, and J.L. Mau. 2007. Antioxidant Properties of Water Extracts from *Monascus* Fermented Soybeans. *Food Chemistry* 106:1128-1137.

Lestario, L.N., S. Sugiarto, dan K.H. Timotius. 2008. Aktivitas Antioksidan dan Kadar Fenolik Total dari Ganggang Merah (*Gracilaria verrucosa L.). Jurnal Teknologi dan Industri Pangan (19:2), 131-138.*

Lin, C.F., and H. Iizuka. 1982. Production of Extracellular Pigment by A Mutant of *M. Kaoling sp*. *Applied Environment Microbiology 43*:671–676.

Lin, Y.L., T.H. Wang, M.H. Lee, and N.W. Su. 2008. Biologically Active Components and Nutraceutocals in the *Monascus*-Fermented Rice:A Review. *Applied Mocrobiology Biotechnology* 77:965-973.

Matkowski, A. 2008. Antioxidant Activity of Extracts and Different Solvent Fractions of *Glechoma hederacea L*. and *Orthosiphon stamineus* (Benth.) *Kudo. Advance Clinical Experimental Medicine.* 17(6):615-624.

Mukaromah, U., S.H. Susetyorini, dan S. Aminah. 2010. Kadar Vitamin C, pH, dan Mutu Organoleptik Sirup Rosella (*Hibiscus Sabdariffa, L*) Berdasarkan Cara Ekstraksi. *Jurnal Pangan dan Gizi* 01(01):43-51.

Mursalin. 2010. *Pemanfaatan Dedak dan Pati Jagung Termodifikasi sebagai Media Pertumbuhan Kapang* (*Monascus Purpureus*) *PenghasilPigmenMerah.*.http://jurnal.pdii.lipi.go.id/admin/jurnal/112mei103843.pdf (18 maret 2012).

Nauli, S.K. 2006. Upaya Memperpanjang Umur Simpan Tempe dengan Metode Pengeringan dan Sterilisasi, *Skripsi S-1*, Fakultas Teknologi Pertanian IPB, Bogor.

Olsen, R.W. 2012. *GABA*. California: Department of Molecular and Medical Pharmacology

Ou, H.P., C.C.R. Wang, and L.S. Lai. 2008. Thermal degradtion kinetics analysis of monacolin K in *Monascus*-fermented products. *Food Science and Technolgy* 42:292-296.

Panda, B.P., S. Javed, and M. Ali. 2008. Optimization of Fermented Parameters for Higher Lovastatin Production in Red Mold Rice trough Co-culture of *Monascus purpureus* and *Monascus ruber*. *Food Bioprocess Technology*, 1-6.

Pattanagul, P., R. Pinthong, A.Phianmongkhol, and S. Tharatha. 2008. Mevinolin, Citrinin, and Pigments of Adlay Angkak Fermented by *Monascus sp.*. *International Journal of Food Microbiology* 126:20-23.

Pattanagul, P., R. Pinthong, and A. Phianmongkhol. 2007. Review of Angkak Production (*Monascus purpureus*). *Chiang Mai Journal Science* 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.

Prieto, P., M. Pineda, and M. Aguilar. 1999. Spectrophotometric Quantitation of Antioxidant Capacity Through the Formation of A Phosphomolybdenum Complex: Specific Application to the Determination of Vitamin E (*Abstract*). *Analysis Biochemistry* 262(2):337-341.

Puspitadewi, S.R.D. 2012. Pola Produksi Pigmen *Monascus sp*. KJR 2 pada Media Biji Durian Varietas Petruk melalui Fermentasi Padat, *Skripsi S-1*, Fakultas Teknologi Pertanian UKWMS, Surabaya.

Raghu, K.L., C.K..Ramesh, T.R. Srinivasa, and K.S. Jamuna. 2011. Total Antioxidant Capacity in aqueous Extracts of Some Common Vegetables. *Asian Journal of Experimental Biology Sciences* 2(1):58-62.

Rahayu, D.S., D. Kusrini, dan E. Fachriyah. 2012. Penentuan Aktivitas Antioksidan dari Ekstrak Etanol Daun Ketapang (*Terminalia catppa L*) dengan Mettode 1,1-Difenil-2-Pikrihidrazil (DPPH). Jurusan Kimia Fmipa Universitas Diponegoro.

Rahayu, E.S., R. Indrati, T. Utami, E. Harmayani, dan M. N. Cahyanto. 1993. *Bahan Pangan Hasil Fermentasi*. PAU-Pangan dan Gizi UGM Press. Yogyakarta.

Rispail, N., P. Morris, and K. J. Webb. 2005. Phenolic Compounds: Extraction and Analysis. *Lotus Japonicus Handbook*: 349-355.

Sayyad, S.A. and B.P. Panda. 2007. Optimization of Nutrient Parameters for Lovastatin Production by *Monascus purpureus* MTCC 369 Under Submerged Fermentaion Using Surface Methodology. *Applied Microbiology Biotechnology* 73:1054-1058.

Singleton, V.L. and J.A. Rossi. 1965. Colorimetry of Total Phenolic with Phosphomolybdic-Phosphotungstic Acid Reagent. *America Journal of Enology and Viticulture* 16:147.

Smith, J.L. and J.A. Alford. Presence of Antioxidant Materials in Bacteria. Eastern Utilization Research and Development Division, 795-799.

Srianta, I., B. Hendrawan, N. Kusumawati, and P.J. Blac. 2012. Study on durian seed as a new substrate for angkak Production. *International Food Research Journal* 19(3):941-945.

Sroykesorn, K., A. Wanleeluk, and S. Kongruang. 2011. Food Borne Pathogen Inhibition by Citrinin from *Monascus purpureus*. *International Proceedings of Chemical, Biological, and environtmental Engineering* 5:244-248.

Su, Y.C., J.J. Wang, T.T. Lin, and T.M. Pan. 2003. Production of the secondary metabolites *c*-aminobutyric acid and monacolin K by Monascus. Journal Industry Microbiology Biotechnology 30: 41–46.

Sutanto, N.F. 2011. Perbandingan Media Cair Ekstrak Kentang dan Media Padat Malt Extract Agar (MEA) sebagai Media Pengembangan Inokulum: Tinjauan Variasi pH Fermentasi (5,6, dan 7) terhadap Produksi Intensitas Pigmen, Lovastatin, dan Sitrinin oleh *Monascus purpureus*, *Skripsi S-1*, Fakultas Teknologi Pertanian Universitas Katolik Soegijapranata, Semarang.

Thaipong, K., U. Boonprakob, K. Crosby, L.C. Zevallos, and D.H. Byrne. 2006. Comparison of ABTS, DPPH, FRAP, and ORAC Assay for Estimating Antioxidant Activity from Guava Fruit Extracts. *Journal of Food Composition and Analysis* 19:669-675.

Timotius, K.H. 2004. Produksi Pigmen Angkak oleh *Monascus*. *Jurnal Teknologi dan Industri Pangan* 15(1):1-8.

Tseng, Y.H., J.H. Yang, C.H. Chen, and J.L. Mau. 2010. Quality and antioxidant Properties of Anka-Enriched Bread. *Journal of Food Processing and Preservation ISSN*, 1745-4549.

Tseng, Y.H., J.H. Yang, H.L. Chang, Y.L. Lee, and J.L Mau. 2006. Antioxidant Properties of Methanolic Extracts from Monascal Adlay. *Food Chemistry* 97:375-381.

Wahyono. 2009. Karakteristik Edible Film Berbahan Dasar Kuli dan Pati Biji Durian (*Durio Sp*) untuk Pengemasan Buah Strawberry, *Skripsi S-1*, Fakultas Keguruan dan Ilmu Pendidikan Universitas Muhammadiyah Surakarta, Surakarta.

Wibowo, C. 2011. Aktivitas Antioksidan dan Pigmen yang Dihasilkan oleh *Monascus purpureus* yang Ditumbuhkan pada Substrat Umbi-umbian (Singkong, Kentang, dan Kimpul): Tinjauan pada Variasi pH (5,6, dan 7), *Skripsi S-1*, Fakultas Teknologi Pertanian Universitas Katolik Soegijapranata, Semarang.

Wulandari, U.O. 2011. Penapisan Bakteri Penghasil Antibiotika dan Pengujian Aktivitas Antibiotikanya, *Skripsi S-1*, Fakultas Matematika Dan Ilmu Pengetahuan Alam Universitas Andalas, Padang.

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 Journal Microbiology Biotechnology* 9:85–90.

Zuhra, C.F., J.B. Tarigan, dan H. Sihotang. 2008. Aktivitas Antioksidan Senyawa Flavonoid dari Daun Katuk (*Saouropus androgunus (L) Merr*.). *Jurnal Biologi Sumatera* 3(1):7-10.