

DAFTAR PUSTAKA

- Adamczyk, B., J. Simon, V. Kitunen, S. Adamczyk, and A. Smolander. 2017. Tannins and their complex interaction with different organic nitrogen compounds and enzymes: Old paradigms versus recent advances. *Chem. Pub. Soc.* 6:610-614.
- Anonim. 2017. Cellulase. Worthington Biochemical Corporation. Tersedia pada www.worthington-biochem.com/cel/default.html. Diakses pada 13 Februari 2018.
- Anonim. 2017. Invasive Species Compendium. CAB International. Wallingford. Tersedia pada www.cabi.org/isc/datasheet/45141. Diakses pada 10 Februari 2018.
- AOAC. 2005. Official Method of Analysis of the Association of Official Analytical Chemist. William Harwitz (ed). 18th ed. Maryland: AOAC International. USA.
- Astuti, M. 1981. Rancangan Percobaan dan Analisis Statistika. Bagian Ilmu Pemuliaan Ternak. Fakultas Peternakan UGM. Yogyakarta.
- Bach, A., S. Calsamiglia, and M.D. Stern. 2005. Nitrogen metabolism in the rumen. *J. Dairy Sci.* 88:(E. Suppl.):E9–E21.
- Batta, R., U. Uyeno, K. Tajima, Y. Yabumoto, I. Nonaka, O. Enishi, and M. Kurihara. 2009. Differences in the nature of tannins on *in vitro* ruminal methane and volatile fatty acid production and on methanogenic archae and protozoa populations. *J. Dairy Sci.* 92: 5512-5522.
- Beauchemin, K.A., D. Colombatto, D.P. Morgavi, and W.Z. Yang. 2003. Use of exogenous fibrolytic enzymes to improve feed utilization by ruminants. *J. Anim. Sci.* 81:E37-E47.
- Bedford, M.R., and G.G. Partridge. 2010. *Enzymes in Farm Animal Nutrition*. 2nd ed. CAB International. London, UK.
- Bennick, A. 2002. Interaction of plant polyphenols with salivary protein. *Crit. Rev. Oral. Biol. Med.* 13(2):184-196.
- Berg, J.M., J.L. Tymoczko, and L. Stryer. 2012. *Biochemistry*. 7th ed. W.H. Freeman and Company. USA.
- Bergmeyer, H.U. and M. Grassl. 1983. *Methods of enzymes analysis*. 2. Verlag Chemie, Weinheim.
- Boufennara, S., L. Bouazza, S. Lopez, H. Bousseboua, and R. Bodas. 2013. Effect of polyethylene glycol addition on methane production from some *Algerian* browse plant species in an *in vitro* gas system. *Serie A. Seminaires Mediterraneens*. pp. 283-287.

- Bozic, N., R. Jordi, J. Lopez-Santin, and Z. Vujeie. 2010. Production and Properties of the Highly Efficient Raw Starch Digesting α -amylase from a *Bacillus licheniformis* ATCC 9945a. *Biochem. Eng. J.* 53(2):203-209.
- Bulut, A., and O. Mahmut. 2009. Rapid, facile synthesis of silver non-structure using hydrolyzable tannin. *J. Chem. Res.* 48: 5686-5690.
- Canbolat O., A. Kamalak, E. Ozkose, C.O. Ozkan, M. Sahin, and P. Karabay. 2005. Effect of polyethylene glycol on *in vitro* gas production, metabolizable energy and organic matter digestibility of *Quercus cerris* leaves. *Lives. Res. Rural Dev.* 17:42.
- Cantarel, B.L., P.M. Courinho, C. Rancuel, T. Bernard, V. Lombard, and B. Henrissat. 2008. The Carbohydrate-Active EnZYme database (CAZy): an expert resource for glycogenomics. *Nucl. Ac. Res.* 37:D233–D238.
- Carulla, J.E., M. Kreuzer, A. Machmueller, and H.D. Hess. 2005. Supplementation of *Acacia mearnsii* tannins decreases methanogenesis and urinary nitrogen in forage-fed sheep. *J. Agric. Res.* 56: 961–970.
- Devlin, T.M. 1997. *Textbook of Biochemistry with Clinical Correlations*. 4th ed. Willey-Liss Inc. USA.
- El-Wazyri, A.M., M.E.A. Nasser, and S.M.A. Sallam. 2005. Processing methods of soybean meal : 1-effect of roasting and tannic acid treated-soybean meal on gas production and rumen fermentation *in vitro*. *J. Appl. Sci. Res.* 1(3):313-320.
- Forsberg, C. W. and K.J. Cheng. 1992. Molecular strategies to optimize forage and cereal digestion by ruminants. In: *Biotechnology and Nutrition* (Ed. D. D. Bills and S.D. Kung). Butterworth Heinmann, Stoneham, UK. pp. 107-147.
- Forsberg C.W., K.J. Cheng, P.J. Krell, and J.P. Phillips. 1993. Establishment of rumen microbial gene pools and their manipulation to benefit fibre digestion by domestic animals. *Proceedings VII World Conference on Animal Production*. World Association for Animal Production, Edmonton. pp. 281–316.
- Fujiwara, N., A. Masui, and T. Imanaka. 1993. Purification and properties of the highly thermostable alkaline protease from an alkaliphilic and thermophilic *Bacillus sp.* *J. Biotech.* 30(2):245-256.
- Gebrehiwot, L., P.R. Beuselinck, and C.A. Roberts. 2002. Seasonal variation in condensed tannin concentration of three Lotus species. *Agron. J.* 94:1059-1065.
- Gibbs, M.J. and R.A. Leng. 1993. Methane emission from livestock in Van Amsel. *Proceedings of the International Workshop on Methane and*

- Nitrous Oxide. RIVM report 481507003. National Institute of Public Health dan Environmental Protection. Netherlands. pp. 73-79.
- Hagerman, A.E., and D.M. Carlson. 1998. Biological responses to dietary tannins and other polyphenols. *Rec. Res. Dev. Agric. Food Chem.* 2:689–704.
- Halliwel, G. and J. Lovelady. 1981. Utilization of carboxymethyl cellulose and enzyme synthesis by *Trichoderma koningii*. *J. Gen. Microbiol.* 126:211-217.
- Hartadi, H., S. Reksohadiprojo, dan A.D. Tillman. 1997. *Tabel Komposisi Pakan Ternak untuk Indonesia*. Cetakan ke-4. Gadjah Mada University Press. P. 76.
- Jayanegara, A., dan A. Sofyan. 2008. Penentuan aktivitas biologis tanin secara *in vitro* menggunakan Hohenheim gas test dengan polietilen glikol sebagai determinan. *Media Peternakan.* 31:44–52.
- Jayanegara, A., E. Wina, C.R. Soliva, S. Marquardt, M. Kreuzer, and F. Leiber. 2011. Dependence of forage quality and methanogenic potential of tropical plants on their phenolic fractions as determined by principal component analysis. *Anim. Feed. Sci. Technol.* 163: 231–243.
- Kahkonen, M.P., A.I. Hopia, and M. Heinonen. 2001. Berry phenolics and their antioxidant activity. *J. Agr. Food. Chem.* 49: 4076-4082.
- Kamra, D.N. , N. Agarwal, and L.C. Chaudhary. 2006. Inhibition of ruminal methanogenesis by tropical plants containing secondary compounds. *Int. Congr. Ser.* 1293:156–163.
- Khanbabaee, K., and T. Van Ree. 2001. Tannins: Classification and definition. *Nat. Prod. Rep.* 18(6):641–649.
- Khiaosa-Ard, R., S.F. Bryner, M.R.L. Scheeder, H.R. Wettstein, F. Leiber, M. Kreuzer, and C.R. Soliva. 2009. Evidence for the inhibition of the terminal step of ruminal alpha-linolenic acid biohydrogenation by condensed tannins. *J. Dairy Sci.* 92:177–188.
- Kumar, R. and M. Singh. 1984. Tannins: their adverse role in ruminant nutrition. *J. Agric. Food Chem.* 32:447-453.
- Liang, H., Y. Pei, J. Li, W. Xiong, Y. He, S. Liu, Y. Li, and B. Li. 2016. pH-degradable antioxidant nanoparticles based on hydrogen-bonded tannic acid assembly. *RSC Adv.* 6:31374-31385.
- Makkar, H.P.S. 2003. Effects and fate of tannins in ruminant animals, adaptation to tannins, and strategies to overcome detrimental effects of feeding tannin-rich feeds. *Small Rum. Res.* 49:241–256.
- Makkar, H.P.S., M. Blummel, and K. Becker. 1995. Formation of complexes between polyvinyl pyrrolidones or polyethylene glycols

- and their implication in gas production and true digestibility *in vitro* techniques. *British Journ. Nut.* 73: 897-913.
- Makkar, H.P.S., M. Blummel, and K. Becker. 1995. *In vitro* affects of quebracho powder and interactions between tannins and saponins and fate of tannins in the rumen. *J. Food Sci. Agric.* 69: 481-493.
- McDonald, P., R.A. Edwards, J.F.D. Greenhalgh, C.A. Morgan, L.A. Sinclair, and R.G. Wilkinson. 2010. *Animal Nutrition*. 7th ed. Pearson. Harlow, England.
- Menke, K.H. and H. Steinngas. 1988. Estimation of energetic feed value obtained from chemical analysis and *in vitro* gas production using rumen fluid. *Anim. Res. Develop.* 28:7-55.
- Monteny, G. J., A. Bannink, and D. Chadwick. 2006. Greenhouse gas abatement strategies for animal husbandry. *Agric. Eco. Environ.* 112:163-170.
- Mueller-Harvey, I. 2006. Unravelling the conundrum of tannins in animal nutrition and health. *J. Sci. Food Agric.* 86:2010–2037.
- Mustopo, R.F. 2017. Kajian aktivitas biologis tanin tanaman pakan pada pencernaan rumen secara *in vitro*. *Unpublished*.
- Nath, K.G., D. Vijayalakshmi, G.M. Yankanchi, and R.B. Patil. 2008. Proximate composition of underutilized green leafy vegetables in Southern Karnataka. *Asian J. Home Sci.* 3(2):118-120.
- Nelson, D.L., and M.M. Cox. 2008. *Lehninger Principles of Biochemistry*. 5th Edition. W.H. Freeman and Company. New York, USA.
- Patra, A.K., D.N. Kamra, and N. Agarwal. 2006. Effect of plant extracts on *in vitro* methanogenesis, enzyme activities and fermentation of feed in rumen liquor of buffalo. *Anim. Feed Sci. Tech.* 128:276–291.
- Patra, A.K. and J. Saxena. 2010. A new perspective on the use of plant secondary metabolites to inhibit methanogenesis in the rumen. *Phytochemistry*. 71:1198-1222.
- Plummer, D.T. 1987. *An Introduction to Practical Biochemistry*. 3rd ed. Mc Graw-Hill Book Company. Publ. New Delhi.
- Puastuti, W., D. Yulistiani, I.W. Mathius, F. Giyai, dan E. Dihansih. 2010. Ransum berbasis kulit buah kakao yang disuplementasi Zn organik: Respon pertumbuhan pada domba. *JITV*. 15(14):269-277.
- Puchala, R., B.R. Min, A.L. Goetsch, and T. Sahl. 2005. The effect of a condensed tannin-containing forage on methane emission by goats. *J. Anim. Sci.* 83:182–186.
- Rindyastuti, R., dan A.S. Darmayanti. 2010. Komposisi kimia dan estimasi proses dekomposisi serasah 3 spesies *familia fabaceae* di Kebun Raya Purwodadi. *Sem. Nas. Biol.* pp. 993-998.

- Rosita. 2010. Pemanfaatan Daun Jambu Biji (*Psidium guajava* L.) sebagai Sumber Tanin untuk Menurunkan Produksi Metan. Tesis. Sekolah Pascasarjana, Universitas Gadjah Mada, Yogyakarta.
- Santos-Buelga, C., and V. De Freitas. 2008. Influence of phenolics on wine organoleptic properties. *Wine Chemistry and Biochemistry*. New York, Springer Science.
- Santoso, B., B.Tj. Hariadi, H. Manik, dan H. Abubakar. 2010. Nilai nutritif dan pencernaan nutrisi *in vitro* silase rumput raja yang ditambahkan bakteri asam laktat indigenous rumput dan tanin daun akasia. *Sem. Nas. Tek. Pet. Vet.* pp. 144-150.
- Sasongko, W.T., L. M. Yusiati, Z. Bachrudin, dan Mugiono. 2010. Optimalisasi pengikatan tanin daun nangka dengan protein bovine serum albumin. *Buletin Peternakan*. 34(3):154-158.
- Smith, T., and H. Thiollet. 2017. Feedpedia, a programme by INRA, CIRAD, AFZ, and FAO. Tersedia pada <http://www.feedipedia.org/node/111>. Diakses pada 13 Januari 2018.
- Smith, A.H., E. Zoetendal, and R.I. Mackie. 2005. Bacterial mechanisms to overcome inhibitory effects of dietary tannins. *Microb. Ecol.* 50:197-205.
- Soedarya, A.P. 2010. Agribisnis Guava (Jambu Batu). CV Pustaka Grafika. Bandung.
- Soltan, Y.A., A.S. Morsy, S.M.A. Sallam, H. Louvandini, and A.L. Abdalla. 2012. Comparative *in vitro* evaluation of forage legumes (*Prosopis*, *Acacia*, *Atriplex*, and *Leucaena*) on ruminal fermentation and methanogenesis. *J. Anim. Feed Sci.* 21:759–772.
- Tanner, G.J., A.E. Moore, and P.J. Larkin. 1994. Proanthocyanidins inhibit hydrolysis of leaf proteins by rumen microflora *in vitro*. *Br. J. Nutr.* 74: 947-958.
- Tester, R.F., J. Karkalas, and X. Qi. 2004. Starch structure and digestibility enzyme–substrate relationship. *W. Poult. Sci. J.* 60:186–195.
- Trisnadewi, A.A.A.S., I.G.L.O Cakra, I.W. Wirawan, I.M. Mudita, dan N.L.G. Sumardani. 2014. Substitusi gamal (*Gliricidia sepium*) dengan kaliandra (*Caliandra calothyrsus*) pada ransum terhadap pencernaan *in vitro*. *Pastur*. 3(2):106-109.
- Valera, L.S., J.A. Jorge, and L.H.S. Guimaraes. 2015. Characterization of a multi-tolerant tannin acyl hydrolase ii from *Aspergillus carbonarius* produced under solid-state fermentation. *Elect. J. Biotech.* 18(6):1–7.
- Waghorn, G.C., and W.C. McNabb. 2003. Consequences of plant phenolic compounds for productivity and health of ruminants. *Proc. Nutr. Soc.* 62(2):383-392.

- Walton J.P., G.C. Waghorn, G.C. Plaizier, M. Birtles, and B.W. McBride. 2001. Influence of condensed tannins on gut morphology in sheep fed *Lotus pedunculatus*. *Can. J. Anim. Sci.* 81:605–607.
- Wang, Y. and T. A. McAllister. 2002. Rumen microbes, enzymes and feed digestion. *Asian-Aust. J. Anim. Sci.* 15(11):1659-1676.
- Watanabe, H. and G. Tokuda. 2011. Cellulolytic systems in insect. *Annual Rev. Entomol.* 55:602-632.
- Westendarp, H. 2006. Effects of tannins in animal nutrition. *Dtsch Tierarztl Wochenschr.* 113(7):264-268.
- Yao, J., G.S. Guo, G.H. Ren, and Y.H. Liu. 2014. Production, characterization, and applications of tannase. *J. Mol. Cat. B:Enzymatic.* 101:137–147.