Study on the Antioxidativity and Chemical Components of Bidens pilosa and Liquidambar formosana

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ABSTRACT

In this study, to examine the effect of drying temperature on antioxidant activities, Bidens pilosa was first dried under various temperatures (40, 60, 80 and 100°C) and was then extracted using a hot reflux of ethanol-water (50-50) solution. In addition, various solvents (n-hexane, dichloromethane, methanol-water, and methanol- chloroform) were used to extract Bidens pilosa and Liquidambar formosana to examine the in vitro antioxidant activities. These antioxidative activities assays included α , α -diphenyl- β -picrylhydrazyl (DPPH) radical scavenging ability, Fe2+ chelating ability, relative reducing power, superoxide anion scavenging ability, the inhibition of Fe/ascorbate-induced lipid peroxidation in a liposome model system, and ABTS cation scavenging ability. These antioxidative activities of Bidens pilosa and Liquidambar formosana were measured and compared with those of butylated hydroxyanisole (BHA), ethylene diamine tetracetic acid (EDTA), α – tocopherol and gallic acid. The experimental results show that the recovery rate of extraction for leaf is higher than that for stem when Bidens pilosa was dried under various temperatures and then extracted using the hot reflux of 50% ethanol. The extracts from the leaf of Bidens pilosa (dried under 40°C) had the highest contents of total flavonoids and total phenols (10.89 and 63.96 mg/g, respectively) and better antioxidant activities than those of the stem. These antioxidant activities of the leaf of Bidens pilosa were obtained to be the DPPH radical scavenging ability, IC50 = 0.03 ± 0.00 mg/g; the Fe2+ chelating ability, IC50 = 0.08 ± 0.01 mg/g; the relative reducing power, k =1.13 ± 0.01 mL/mg; the superoxide anion scavenging ability, 60.7%; the inhibition of lipid peroxidation, 71.0%: and the ABTS cation scavenging ability, IC50 = 0.03 ± 0.01 mg/g. In addition, Bidens pilosa and Liquidambar formosana were extracted using various solvents. The extracts of Bidens pilosa and Liquidambar formosana from the methanol-water fraction had the highest contents of total phenol (63.60 and 49.41 mg/g, respectively). However, the extracts of Bidens pilosa and Liquidambar formosana from methanol-chloroform fraction had the highest contents of total flavonoids (49.91 and 26.81 mg/g, respectively). For antioxidant activities, the extracts of Bidens pilosa and Liquidambar formosana from the methanol-water fraction performed the best. These antioxidant activities for the extracts of Bidens pilosa and Liquidambar formosana were obtained as: the DPPH radical scavenging ability, IC50 = 0.03 ± 0.00 and 0.06 ± 0.00 mg/g, respectively; the Fe2+ chelating ability, IC50 = 0.06 ± 0.01 and 0.23 ± 0.00 mg/g; the relative reducing power, k = 0.88 ± 0.05 and 0.40 ± 0.01 mL/mg; the superoxide anion scavenging ability, 64.1 and 72.6%; the inhibition of lipid peroxidation, 57.8 and 69.7%; and the ABTS cation scavenging ability, IC50 = 0.05 ± 0.01 and 0.02 ± 0.00 mg/g. In summary, both Bidens pilosa and Liquidambar formosana showed some antioxidant activities. Bidens pilos had better antioxidant activities when it was dried under 40°C, and the leaf was better than the stem. When various solvents were used to extract Bidens pilosa and Liquidambar formosana, the extract from the methanol-water fraction had the highest antioxidant activities and the content of total phenol. The result also shows that the antioxidant activity is related to the content of total phenol. The findings in this study can help understand the antioxidant activities and processing methods of Bidens pilosa and Liquidambar formosana.

Keywords : Bidens pilosa ; Liquidambar formosana ; antioxidant ; total phenol ; total flavonoid

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REFERENCES

1.王振瀾、許富蘭、李鴻麟。2006。細葉山茶樹種抽出物之抗氧化性質探討。台灣林業科學。21(4):559-65 2.朱亮、郭??。1991。中草藥。22(9):404-404 3.余灼?。1998。青茜琉醋治療惡性瘧疾122例。中西??合?用?床急救。5 (6):284-285 4.李春。2001。中藥路路通化學成分的研究。中國中醫研究院碩士論文。北京。 5.林佩伶、王正新、賴麗旭。2006。不同乾燥處理對小麥苗粉水萃取物抗氧化性之影響。台灣農業化學與食品科學。44(1):7-15。 6.姜淑繡。2001。省產蘿蔔之抗氧化性研究。大葉大學食品工程學系碩士論文。彰化。 7.洪熒璟。2003。不同加工處理對小麥草抗氧化性質之影響。靜宜大學食品營養學系碩士論文。台中 8.晏文潔、李家璞、杜平憨。2000。類黃酮抗氧化力與結構之關係。台灣農業化學與食品科學。38(1):80-88 9.高馥君、李敏雄。1998。食品保存與抗氧化劑。食品工業。30:（12）:17-24。 10.許曉茹、莊大永、楊文欽、賴邦嶽。2007。咸豐草的功效。科學發展。417:40-43 11.楊洋、韋小英。2002。柚皮黃酮類化合物提取方法和抗氧化性的研究。食品與發酵工業。28(6):9-12 12.盧祉彤。2003。牛樟芝菌絲體對腫瘤細胞的影響。南台科技大學生物科技研究所碩士論文。台南。 13.簡錦慈。2004。刺蔥之抗氧化性及安全性探討。靜宜大學食品營養學系碩士班。台中。 14.顏幸達。1996。楓香之草本考察及果實路路通之陣痛藥理研究。中國醫藥學院中國藥學研究所碩士論文。台中。 15.蘇正德、陳正雄。2001。新編實品化學。華格納企業。台中。 16.蘇苑菱。2007。八種藥用植物之抗氧化性研究。大葉大學生物產業科技學系碩士論文。彰化。 17.鐘耀慶。2004。功能性食品。化學工業出版社。北京。 18.Arnao, M. B., Cano, A. and Acosta, M. 2001. The hydrophilic and lipophilic contribution to total antioxidant activity. Food Chem. 73:239-244. 19.Arouma, O. I. 1994. Nutrition and health aspects of free radicals and antioxidants. Food Chem. Toxic. 32(7): 671-683. 20.Benzie, I. F. and Strain, J. J. 1996. The ferric reducing ability of plasma (FRAP) as a measure of ‘ ‘ antioxidant power ’ ’ : The FRAP Assay. Anal. Chem..239: 70 – 76. 21.Bonoli, M., Verardo, V., Marconi, E. and Caboni, M. F. 2004. Antioxidant phenols in barley (Hordeum vulgare L.) flour: comparative spectrophotometric study among extraction methods of free and bound phenolic compounds. J. Agric. Food Chem..52: 5195 – 5200. 22.Cai, Y. And Ruan, J. 2005. Studies on the chemical constituents from the leaf of Liquidambar formosana Hance. J. Chin. Med. Mater .28:294-295. 23.Chang, J. S., Chiang, L. C., Chen, C. C., Liu, L. T., Wang, K. C. and Lin, C. C. 2001a. Antileukemic activity of Bidens pilosa L. var. minor (Blume) Sherff and Houttuynia cordata Thunb. Am. J. Chin. Med 29 : 303 – 312. 24.Chiang, Y. M., Chuang, D. Y., Wang, S. Y., Kuo, Y. H., Tsai, P. W. and Shyur, L. F. 2004. Metabolite profiling and chemopreventive bioactivity of plant extracts from Bidens pilosa. J. Ethnopharmacol. 95: 409 – 419. 25.Choundhary, D. and Kale, R. K. 2002. Antioxidant and non-toxic properties of piper betle leaf extract: in vitro and in vivo studies. Phytother Res. 16(5): 461-466. 26.Christel, Q. D., Bernard, G., Jacques, V., Thierry, D., Claude, B., Michel, L., Micheline, C., Jean-Cluade, C., Francois, B. and Francis, T. 2000. Phenolic compounds and antioxidant activities of buckwheat (Fagopyrim esculentum Moench) hulls and four. J. Ethnopharmacol. 72:35-42. 27.Cohen, L. A. 2002. A review of animal model studies of tomato carotenoids, lycopene, and cancer chemoprevention. Exp. Biol. Med. 227(10):864-868. 28.Deba, F., Tran, D. X., Masaaki, Y. and Shinkichi, T. 2008. Chemical composition and antioxidant, antibacterial and antifungal activites of the essential oils from Bidens pilosa Linn. Var. Radiata. Food Control. 19: 346-352. 29.Dziezak, J. D. 1986. Preservatives:antioxidant. Food Technol 40: 94-102. 30.Fang, Y. Z., Yang, S. and Wu, G. 2002. Free radical, antixodiant, and nutrition. Nutri. 18: 872-879. 31.Dastmalchi, K., Damiem, H. J., Oinonen, D. P., Darwis, Y., Laakso, I.and Hiltunen, R. 2008. Chemical composition and in vitro antioxidative activity of a lemon balm (Melissa officinalis L.) extract. LWT 41 : 391 – 400. 32.Dreosti, I. E. 2000. Antioxidant polyphenols in tea,cocoa and wine. Nutri. 16: 692-694. 33.Ferda, C., Unlu, M., Tepe, B., Daferera, D., Polissiou, M., Sokmen, A. and Akpulat, H. A. 2003. Antioxidant and antimicrobia; activity of the essential oil and methanol extracts of Achillea millefolium subsp. Millefolium Afan. (Asteraceae). J. Ethnopharmacology, 87:215-220 34.Ferreira, E. C., Nogueira, A. R. A., Souza, G. B. and Batista, L. A. R. 2004. Effect of drying method and length of storage on tannin and total phenol concentrations in Pigeon pea seeds. Food Chem. 86: 17-23. 35.Groff, J. L. and Gropper S. S. 1999. Advanced nutrition and human metabolism (3rd ed). Belmont, CA: Wadsworth/Thomson

Learing. 36.Halliwell, B., Murcia H. A., Chirico, S. and Aruoma O. I. 1995. Free radicals and antioxidants in food and in vivo:what they do and how they work. Crit Rev Food Sci Nutr 35（1-2）:7-20. 37.Ivonne, M. C. M.R., Marelle, G. B., Laura, D. H., Bert, S., Hanem, M. A., Nicole, H. P. C., Jelmer, J. V. Z., Hester, V. D. W., Gerrit, M. A. and Jan, H. K. 2002. The pro-oxidant chemistry of the natural antioxidant vitamin C, vitamin E, carotenoids and flavonoids. Envirion. Toxicol. Pharmacol. 11: 321-33. 38.Jacob, H. A. 1995. The integrated antioxidant system. Nutr. Res. 15 : 755-766. 39.Jenkins, D. J. A., Kendall, C. W. C., D ' Costa, M. A., Jackson, C. J. A., Vidgen, E., Singer, W., Silverman, J.A., Koumbridis, G., Honey, J., Rao, A. V., Fleshner, N. and Klotz, L. 2003. Soy consumption and phytoestrogens: effect on serum prostate specific antigen when blood lipids and oxidized low-density lipoprotein are reduced in hyperlipidemicmen. J. Urol. 169: 507 – 511. 40.Kannol, C. 1988. Plant Med. 54(5): 417-419. 41.Keaney, J. R. and Frei B. 1994. Antioxidant protection of low-density lipoprotein and its role in the prevention of atherosclerotic vascular disease. In " Nature Antioxidants in Human Health and Disease. " ed. by B Frei, p.303-351. Academic Press:San Diego, CA. 42.Khan, M. R., Kihara, M. and Omoloso, A. D. 2001. Anti-microbial activity of Bidens pilosa, Bischofia javanica, Elmerillia papuana and Sigesbekia orientalis. Fitoterapia. 72: 662 – 665. 43.Kim, S., Han, D., Moon, K. D. and Rhee, J. S. 1995. Measurement of superoxide dimutase – like activity of natural antioxidants. Biosci. Biotech. Biochem. 59(5):822-826. 44.Lai, L.-S., Chou, S.-T. And Chao, W.-W. 2001. Studies on the antioxidative activities of Hsian-tsao (Mesona procumbens Hemsl) leaf gum . J. Agric. Food Chem. 49(2):963-968. 45.Larson R. A. 1988. The antioxidants of higher plants. Phytochem. 27（4）:969-978. 46.Liao, K. L. and Yin, M. C. 2000. Individual and combined antioxidant effects of seven phenolic agents in human erythrocyte membrane ghosts and phosphatidylcholine liposome systems : importance of the partition coefficient. J.Agric. Food Chem. 48:2266-2270. 47.Liu, J., Chang, S. K. and Wiesenborn, D. 2005. Antioxidant properties of soybean isoflavone extract and tofu in vitro and in vivo. J. Agric. Food Chem. 53(6): 2333-2340. 48.Mak, O. D., Huang, D. D. and Law, C. S. 1990. Rock Anoectochilus formosanus Hay. Contains substances that affect arachidonic acid metabolism. Phytotherapy Res. 4 : 45-48. 49.Makris, D. P., Psarra, E., Kallithraka, S. and Kefalas, P. 2003. The effect of polyphenolic composition as related to antioxidant capacity in white wines. Food Res. Intl. 36: 805 – 814. 50.Martinez-Cayuela, M. 1995. Oxygen free radical and human disease. Biochimie .77: 147-161. 51.Miguel, G., Sim~oes, M., Figueiredo,A. C., Barroso, J. G., Pedro, L.G. and Carvalho, L. 2004. Composition and antioxidant activities of the essential oils of Thymus caespititius, Thymus camphoratus and Thymus mastichina. Food Chem. 86 183 – 188. 52.Meir. S., Kanner. B., Akiri B., and Philosoph-Hadas. 1995. Determination and involvement of aqueous reducing compounds in oxidative defense system of various senescencing leaves. J Agric. Food Chem. 43:1813-1819. 53.Namiki, M. 1990. Antioxidants/antimutagens in food. Crit. Rev. Food Sci. Nutr. 29:213-300. 54.Neuza. P., Perestrelo. R., Camara, J. S. and Marques, J. C. 2007. Relationship between antioxidant capacity and total phenolic concent of red, rose and white wines. Food chem.. 105:204-214. 55.Njenga, E. W. and Viljoen, A. M. 2006. In vitro 5-lipoxygenase inhibition and anti-oxidant activity of Eriocephalus L.(Asteraceae) species. South African Journal of Botany, 72:637-641. 56.Packer L. 1992. Vitamin E in Health and Disease, Marcel Dekker, Inc. NewYork.Basel.Hong Kong. 57.York.Basel.Hong KongPannala, A. S., Rice-Evans, C. In: Flavonoids and Other Polyphenols (Methods in Enzymology Vol. 335); Packer, L. Ed. Academic Press: San Diego, 2001. p 266-72. 58.Porasuphatana, S., Tsai, P. and Rosen, G.. M. 2003. The generation of free radicals by nitric oxide synthase .Comp. Biochem. Physiol. 134(3): 281-289. 59.Pyo, Y. H., Lee, T. C., Logendra. L. and Rosen. R. T. 2004. Antioxidant activity and phenolic compounds of Swiss chard (Btea vulgaris subspecies cycla) extracts. Food chem. 85；19-26. 60.Rabe, T., VanStaden, J. 1997. Antibacterial activity of South African plants used for medicinal purposes. J. Environ. 56: 81 – 87. 61.Reiter R. J. 1998. Oxidative damage in the central nervous system:protection by melatonin. Prog Neurobiol. 56: 359-384. 62.Rice-Evans, C., Miller, N., and Paganga, G. 1997. Antioxidants properties of phenolic compound. Trends in Plant Sci. 2(4): 152-159. 63.Irenen, P., Bastida, J., Vuladomat, F. and Codina, C. 2005. Acylated quercetagetin glycosides with antioxidant activity from Tagetes maxima. Phytochem, 66:2356-2362. 64.Rouseff, R. and Nagy, S. 1994. Health and nutritional benefits of citrus fruit component. Article. 48:125-126. 65.Sarker, S. D., Bartholomew, B., Nash, R. J. and Robinson, N. 2000. 5-OMethylhoslundin: an unusual flavonoid from Bidens pilosa (Asteraceae). Biochem. Syst. Ecol. 28: 591 – 593. 66.Saeedeh, A. S. and Urooj, A. 2007. Antioxidant properties of various solvent extracts of mulberry (Morus indica L.) leaves. Food Chem. 102:1233-1240. 67.Siddhuraju, P., Mohan, P. S. and Becker, K. 2002 Studies on the antioxidant activity of Indian Laburnum (Cassia fistula L.): a preliminary assessment of crude extracts from stem bark, leaves, flowers and fruit pulp. Food Chem. 79(1):61-67. 68.Sofija, D., Petrovic, S., Dobric, S., Milenkovic, M., Vucicevid, D., Zizic, S. and Kukic, J. 2007. Antimicrobial, anti-inflammatory, anti-ulcer and antioxidant activities of Carlina acanthifolia root essential oil. J. Ethnopharmacology, 109: 458-463. 69.Temple, N. J. 2000.: Antioxidants and disease: more questions than answers. Nutr Res 20: 449-459. 70.Tepe, B., D. Dimitra, A. S. Tepe, P. Moschos, S. Atalay. 2007. Antioxidant activity of the essential oil and various extracts of Nepeta flavida Hub.-Mor. From Turkey. Food chem.. 103: 1358-1364. 71.Ubillas, R. P., Mendez, C. D., Jolad, S.D., Luo, J., King, S.R., Carlson, T.J. and Fort, D.M. 2000. Antihyperglycemic acetylenic glucosides from Bidens pilosa. Planta Medica. 66: 82 – 83. 72.Yildirim, A., Mavi, A. and Kara, A. A. 2001. Determination of antioxidant and antimicrobial activities of Rumex crispus L. extracts. Journal of Agricultural and Food Chem. 49: 4083 – 4089. 73.Zhang, Z., Chang, Q., Zhu, M., Hung, Y., Ho, W. K. K. and Chen, Z. Y. 2001. Characterization of antioxidants present in hawthorn fruits. J. Nutr. Biochem. 12:144-152. 74.Zoran. M. 2008. In vitro antioixdant activity of ragweed (Ambrosia artemisiifolia L., Asteraceae)herb. ELSEVIER.XXX:XXX-XXX. 75.Zulueta, C. A., Zulueta, A., Tada, M. and Ragasa, C.Y. 1995. A diterpene from Bidens pilosa. Phytochem. 38: 1449 – 1450.