STUDIES ON VOLATILE COMPONENTS AND COLOR OF MONASCUS SUFU PRODUCTS

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ABSTRACT

TAIWAN SUFU IS A TRADITIONALLY FERMENTED SOYBEAN CURD PRODUCT. IT IS GENERALLY PREPARED USING TOFU AND SOYBEAN MOULDS AND AGEING IN THE SALT-SUGAR BRINE SOLUTION WITH ETHANOL. IN THIS STUDY, MONASCUS SUFU WAS PREPARED USING MONASCUS SP-FERMENTED RICE AND AGING IN BRINE SOLUTION WITH OR WITHOUT ETHANOL. FROM THE 75-DAY AGED SUFU PRODUCTS BY SENSORY-EVALUATION ANALYSIS, THE SUITABLE BRINE SOLUTION CONTAINED 20G NACL AND 30G SUGAR WITHOUT ETHANOL. BY VIEWING COLOR EVALUATION, THE ACCEPTABLE BRINE SOLUTION CONTAINED 20G NACL AND 60G SUGAR WITH 40-DEGREE ETHANOL. THE COLOR OF SUFU PRODUCTS CHANGED TO RED AS INCREASING SUGAR CONTENT IN BRINE SOLUTION. IN THIS STUDY, THE VOLATILE COMPOUNDS IN MONASCUS SUFU PRODUCTS WERE IDENTIFIED AND QUANTIFIED BY GC AND GC-MS. A TOTAL OF 55VOLATILE COMPOUNDS WERE IDENTIFIED INCLUDING 20 ESTERS, 17 ALCOHOLS, 4 KETONES, 4 ACIDS, 4 ALDEHYDES, 3 HYDROCARBONS AND 3 OTHER COMPOUNDS FROM THE 75-DAY AGED SUFU PRODUCTS. FOR MONASCUS SP-FERMENTED RICE, THE TOTAL OF 75 VOLATILE COMPOUNDS WERE IDENTIFIED INCLUDING 17 KETONES, 14 ALCOHOLS, 6 ACIDS, 12 ALDEHYDES, 9 HYDROCARBONS, 1 PYRAZINE, 7 ESTERS AND 9 OTHERS, WHILE THE TOTAL OF 34 VOLATILE COMPOUNDS WERE IDENTIFIED INCLUDING 4 KETONES, 10 ALCOHOLS, 4 ACIDS, 7 ALDEHYDES, 4 HYDROCARBONS, 2 ESTERS AND 3 OTHERS FOR COMMERCIAL TOFU. THE FLAVOR OF MONASCUS SUFU, PARTICULARLY ESTER AND ALCOHOL, INCREASED DURING THE AGEING PERIOD. THIS MAY BE DUE TO THE CONTRIBULION OF LARGE AMOUNT CONTENTS OF KETONES, ALCOHOLS AND ALDEHYDES IN THE MONASCUS SP-FERMENTED RICE AND TOFU. IN ADDITION, THE IMPACT OF ALCOHOL ON THE FORMATION OF VOLATILE COMPONENTS, PARTICULARLY ESTER, WAS INCREASED AS INCREASING THE CONTENT OF SUGAR ADDITION. UNFORTUNATELY, THE FLAVOR OF SUFU PRODUCTS BECAME NOT ACCEPTABLE AS A SIGNIFICANTLY HIGH AMOUNT OF ALCOHOL WAS ADDED. IN GENERAL, AS THE INCREASE OF SUGAR CONTENT IN BRINE SOLUTION, THE COLOR, FLAVOR AND TEXTURE OF THE MONASCUS SUFU PRODUCTS WAS ENHANCED OR IMPROVED.

Keywords : TOFU, MONASCUS SUFU, FLAVOR, MONASCUS.

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REFERENCES

1.中澤亮治、佐籐喜吉，1930，台灣產紅麴中?MONASCUS?就?。日本農藝化學會誌6:352-356。 2.內藤巖、兒玉正，1932，台灣專賣局酒課試驗報告，第2號，239頁。經佐籐喜吉，1934，優良紅麴 菌的檢索。釀造學雜誌12(2):119，引用。 3.王義雄，1981，豆類製造類似乾酪，食品工業，11（1）:20。 4.台灣省菸酒公賣局業務手冊，1965，紅露酒製造。台灣省菸酒公賣局編印，台北。 5.佐籐喜吉，1930

，滿洲、朝鮮產麴子中?MONASCUS?就?。(第一報) 日本農藝化學會誌6:957-965。 6.佐籐喜吉，1932，紅腐乳中?MONASCUS?就?。釀造學雜誌10:544-550。 7.佐籐喜吉，1933，支那產麴子及?醱酵製品中?MONASCUS?就?。(第三報)，釀造學雜誌11:493-503。 8.佐籐喜吉，1934，支那產麴子及?醱酵製品中?MONASCUS?就?。(第四報)，釀造學雜誌12:439-444。 9.佐籐喜吉，1936，東洋產MONASCUS屬分類?對??一考察。日本農藝化學會誌12:583-586。 10.宋應星，1637，天工開物，麴糵第十七卷。 11.李昭蓉，1997，漫談紅麴菌，食品工業月刊，29（2）:33-39。 12.李時珍，1590，本草綱目，穀部第二十五卷。 13.李喬苹，1975，中國化學史，在增台一版，210，台灣商務印書館，台北。 14.林讚峰，1980，紅露酒之展望，製酒科技專論彙編，第二期，36-39。 15.林讚峰，1982，紅麴菌研究發展之演進，製酒科技專論彙編，第四期，66-77。 16.林讚峰，1983，紅麴菌之鑑定及實用分類法。製酒科技專論彙編，第五期，104-113。 17.林讚峰，1986，紅麴菌及代謝產物的經濟性評估及增產策略，製酒科技專論彙編，第8期，81-99。 18.林讚峰，1992，紅麴菌在保健食品上的新應用，食品工業24（10）:41-45。 19.林讚峰，1992，紅麴菌研究發展之演進，科學農業，40(3-4):193-198 20.林讚峰，黃正財，1983，紅麴菌釀造性質之研究（一）澱粉分解酵素，酒類試驗所研究報72年度, 157-167。 21.邱建人，1977，紅麴色素之各種性質及其應用。食品科學文摘，第五卷，第十一期8-14。 22.津畸真一，1998，大豆???????癌予防效果????. NEW FOOD INDUSTRY 40(4):59-64。 23.姬野國夫，1997，紅麴的機能性食品的利用，日本食品工業，49-55。 24.徐茂揮，傳統紅麴及功能紅麴的研究開發與進展，食品資訊，14-19。 25.陳世爵，1997，防癌及抗疾病的一大福音-異黃醣素。健康世界八月號:111-112。 26.陳彥霖，李昭蓉，陳建州，袁國芳，1998，紅麴菌種的研究開發與應用，食品工業月刊，30(7): 1-10。 27.黃瓊軒，1989，豆腐乳風味物質之探討-不同菌株與酒精添加對豆腐乳風味成份之影響。國立台灣大 學食品科技研究所碩士論文。 28.黃顯宗，1985，紅麴菌研究之回顧與展望，真菌學之最近發展，曾聰徹、陳瑞青主編，109-124， 國科會生物科學研究中心專刊第十二號，台北。 29.黃顯宗、鮑運生，1978，談古代中國的真菌學，科學月刊9（10）:23-25。 30.鄭大青，1997，東方乾酪-豆腐乳，食品工業，27（7）33-39。 31.魏琬櫻，1981，中間水分再製豆腐乳之製造研究，中興大學食品科學研究所碩士論文。 32.蘇遠志，1979，台灣的發酵食品。發酵的工業37(2):102-112。 33.ADLERCREUTZ, H., BANNWART, C., WAHALA, K., MAKELA, T., BRUNOW, G., HASE, T., AROSEMENA, P. J., KELLIS, J. T., AND VICKERY, L. E., 1993, INHIBITION OF HUMAN AROMATASE BY MAMMAL -IAN LIGNANS AND ISOFLAVONOID PHYTOESTROGENS. J. STEROID BIOCHEM. MOL. BIOL. 44: 147-15 3. 34.AKIYAMA, T., ISHIDA, J., NAKAGAWA, S., OGAWARA, H., WATANABE, S. I., AND ITOH, N., 1987 , GENISTEIN, A SPECIFIC INHIBITOR OF TYROSINE SPECIFIC PROTEIN KINASES. J. BIOL. CHEM. 262:5592-5595. 35.ASO, K., SUZUKI, Y., KATO, F., NISHIKAWA, J., AND IIZUKA, H., 1989, COMPARATIVE ELECTRO -PHORESIS AND SOME PROPERTIES OF ALKALINE PROTEINASES PRODUCED BY MONASCUS SPP. J. GEN. APPL. MICROBIOL, 25:281-288. 36.AXELSON, M., AND SETCHELL, K. D. R., 1981, THE EXCRETION OF LIGNANS IN RATS-EVIDENCE FOR AN INTESTINAL BACTERIAL SOURCE FOR THIS NEW GROUP OF COMPOUNDS. FEBS LETTERS 123: 337-342. 37.AXELSON, M., SJOVALL, J., GUSTAFSSON, B. E., AND SETCHELL, K. D. R., 1984, SOYA-A DIETA -RY SOURCE OF THE NON-STEROIDAL OESTROGEN EQUOL IN MAN AND ANIMALS. J. ENDOCRINOL. 102: 49-56. 38.BARNES, S., 1995, EFFECT OF GENISTEIN ON IN VITRO AND IN VIVO MODELS OF CANCER. J. NUTR . 125: 777S-783S. 39.BARNES, S., PETERSON, T. G., AND COWARD, L., 1995, RATIONALE FOR THE USE OF GENISTEIN- CONTAINING SOY MATRIXES IN CHEMOPREVENTION TRIALS FOR BREAST AND PROSTATE CANCER. J. CELL. BIOCHEM. SUPPL. 22:181-187. 40.BROWN, J. P., 1988, HYDROLYSIS OF GLYCOSIDES AND ESTERS. IN: ROLE OF THE GUT FLORA IN TOXICITY AND CANCER (ROWLAND, I. R., ED.), PP. 109-144. 41.DP, S. OW, P. 1963, QUANTITATIVE ANALYSIS OF METHYL KETONESIN BLUE CHEESE FAT. J DAIRY SCI. 46:989-990. 42.ELDRIDGE, A. C., AND KWOLEK, W. F., 1983, SOYBEAN ISOFLAVONES: EFFECT OF ENVIRONMENT AND VARIETY ON COMPOSITION. J. AGRI. FOOD CHEM. 31: 394-396. 43.ENDO, A., 1979, MONACOLIN K, A NEW HYPOCHOLESTEROLEMIC AGENT PRODUCED BY MONASCUS SPECI -ES. THE JOURNAL OF ANTIBIOTICS, 32:852-854. 44.ENDO, A., HASUMI, K., AND NEGISHI, S., 1985, MONASCOLINS J AND L, NEW INHIBITORS OF CHO -LESTEROL BIOSYNTHESIS PRODUCED BY MONASCUS RUBBER. J. ANTIBIOTICS, 38(3):420-422. 45.FARMAKALIDIS, E., AND MURPHY, P. A., 1985, ISOLATION OF 6"-O-ACETYLDAIDZEIN AND 6"-O-AC -ETYLGENISTEIN FROM TOASTED DEFATTED SOY FLAKES. J. AGRIC. FOOD CHEM. 33: 385-389. 46.FUJIMAKI, M., YAMASHITA, M., OKAZAWA, Y., AND ARAI, S., 1970, APPLING PROTEOLYTIC ENZYM -ES ON SOYBEAN. 3. DIFFUSABLE BITTER PEPTIDES AND FREE AMINO ACIDS IN PEPTIC HYDROLYZAT -E OF SOYBEAN PROTEIN. J. FOOD SCI. 35:215. 47.GAUDETTE, D. C., AND HOLUB, B. J., 1990, EFFECT OF GENISTEIN, A TYROSINE KINASE INHIBI -TOR, ON U46619-INDUCED PHOSPHOINOSITIDE PHOSPHORYLATION IN HUMAN PLATELETS. BIOCHEM. BIOPHYS. RES. COMMUN. 170: 238-242. 48.HAWKSWORTH, D. L., AND PITT, J. L., 1983, A NEW TAXONOMY FOR MONASCUS SPECIES BASED ON CULTURE AND MICROSCOPICAL CHARACTER. AUST. J. BOT. 31:51-61. 49.HELLER, S. R., AND MILNE, G. W. A., 1978, EPA/NIH MASS SPECTRAL DATABASE. VOL. 1., U. S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C., USA. 50.HENDRICH, S., LEE, K. W., XU, X., WANG, H. J., AND MURPHY, P. A., 1994, DEFINING FOOD COMPONENTS AS NEW NUTRIENTS. J. NUTR. 124: 1789S-1792S. 51.HWAN, C. H., AND CHOU, C. C., 1999, VOLATILE COMPONENTS OF THE CHINESE FERMENTED SOYA BEAN CURD AS AFFECTED BY THE ADDITION OF ETHANOL IN AGEING SOLUTION. JOURNAL OF THE SC -IENCE OF FOOD AND AGRICULTURE； 79(2) 243-248. 52.IMANAKA, T., KAIEDA, T., AND TAGUCHI, H., 1973, OPTIMIZATION OF A -GALACTOSIDASE PRODUC -TION IN MULTI-STAGE CONTINUOUS CULTURE OF MOLD. J. FERMENT. TECHNOL., 51(6):431-439. 53.KRANZ, C., PANITZ, C., AND KUNZ, B., 1992, BIOTRANSFORMATION OF FREE FATTY ACIDS IN MIX -TURES TO METHYL KETONES BY MONASCUS PURPUREUS, APPL MICROBIOL BIOTECHNOL, 36:436-439.

54.LEE, H. P., GOURLEY, L., DUFFEY, S. W., ESTEVE, J., LEE J., AND DAY, N. E., 1991, DIETA -RY EFFECTS ON BREAST-CANCER RISK IN SINGAPORE. 337: 1197-1200. 55.MASAAKI, Y., IKEHARA, K., TAWCCTA, S., KOBAMOTO, N., AND TOYAWA, S., 1995, PURIFICATION AND PROPERTIES OF A RIBONUCLEASE FROM A SPECIES OF THE GENUS MONASCUS. BIOSCI. BIOTECH. BIOCHEM., 59(2):327-328. 56.MATSUKAWA, Y., MARUI, N., SAKAI, T., SATOME, Y., YOSHIDA, M., MATSUMOTO, K., NISHIMO, H., AND AOIKE, A., 1993, GENISTEN ARRESTS CELL CYCLE PROGRESSION AT G2-M. CANCER RAS. 53: 1328-1331. 57.ME, M., EO, A., 1956, THE NEUTRAL CARBONYL COMPOUNDS IN BLUE-MOLD TYPE CHEESE. J DAIRY SCI. 39:253-260. 58.MESSINA, M. J., AND BARNES, S., 1991, THE ROLE OF SOY PRODUCTS IN REDUCING CANCER RISK. J. NATL. CANCER INST. 83: 541-546. 59.MESSINA, M. J., PERSKY, V., SETCHELL, K. D. R., AND BARNES, S., 1994, SOY INTAKE AND CANCER RISK : A REVIEW OF THE IN VITRO AND IN VIVO DATA. NUTR. CANCER 21: 113-131. 60.NIL. 1996. ????大豆???????製品化?著手今秋??本格的營養?-骨粗???症、更年期障礙、痴??、前 立腺??、乳???抑制、予防?效果。食品工業。 39(21): 28-31。 61.PATTON, S., 1950, THE METHYL KETONES OF BLUE CHEESE AND THEIR RELATION TO ITS FLAVOR. J DAIRY SCI. 33:680-684. 62.PETERS, N., PANITZ, C., AND KUNZ, B., 1993, THE INFLUENCE OF CARBOHYDRATE DISSIMILATION ON THE FATTY ACID METABOLISM OF MONASCUS PURPUREUS, APPL MICROBIOL BIOTECHNOL, 39:589- 592. 63.SETCHELL, K. D. R., BORRIELLO, S. P., HULME, P., KIRK, D. N., AND AXELSON, M., 1984, NONSTEROIDAL ESTROGENS OF DIETARY ORIGIN: POSSIBLE ROLES IN HORMONE-DEPENDENT DISEASE. AM. J. CLIN. NUTR. 40: 569-578. 64.SU,Y. C., 1980, TRADITIONAL FERMENTAL FOODS IN TAIWAN. P.15. IN PROC. ORIENTAL FERM. FOOD INDUSTRY AND DEVELOPMENT INSTITATE, HSINCHU, TAIWAN, ROC. 65.TEW, B. Y., XU, X., WANG, H. J., MURPHY, P. A., AND HENDRICH, S., 1996, A DIET HIGH IN WHEAT FIBER DECREASES THE BIOAVAILABILITY OF SOYBEAN ISOFLAVONES IN A SINGLE MEAL FED TO WOMEN. J. NUTRI. 126: 871-877. 66.TNO 1988, COMPILATION OF MASS SPECTRA OF VOLATILE COMPOUNDS IN FOOD, CENTRAL INSTITUTE FOR NUTRITION AND FOOD RESEARCH-TNO. THE NETHERLANDS. 67.VAN TIEGHEM, P., 1884, MONASCUS, GENRE NOUVEAU DE 1'ORDRE DES ASCOMYCETES. BULLETIN SOCIETE BOTANIQUE DE FRANCE. 31:226-231. 68.WANG, H., AND MURPHY, P. A., 1994, ISOFLAVONE COMPOSITION OF AMERICAN AND JAPANESE SOYB -EANS IN IOWA: EFFECT OF VARIETY, CROP YEAR, AND LOCATION J. AGRIC. FOOD CHEM. 42: 1674 -1677. 69.WANG, H., AND MURPHY, P. A., 1996, MASS BALANCE STUDY OF ISOFLAVONES DURING SOYBEAN PROCESSING. J. AGRIC. FOOD CHEM. 44: 2377-2383. 70.WANG, H. L., AND HESSELTINE, C. W., 1970, SUFU AND LAOCHAO. FOOD CHEM.18:572. 71.WEI, H., WEI, L., FRENKEL, K., BOWEN, R., AND BARNES, S. 1993, INHIBITION OF TUMOR PROMOTER-INDUCED HYDROGEN PEROXIDE FORMATION IN VITRO AND IN VIVO BY GENISTEIN. NUTR. CANCER 20: 1-12. 72.WEIDENBORNER, M., HINDORF, H., JHA, H. C., TSOTSONOS, P., AND EGGE, H. 1990. ANTIFUNGAL ACTIVITY OF ISOFLAVONOIDS IN DIFFERENT REDUCED STAGES ON RHIZOCTONIA SOLANI AND SCLEROT -IUM ROLFSII. PHYTOCHEMISTRY 29: 801-803. 73.WELLING, P. G., 1986, FIRST-PASS METABOLISM. ENTEROHEPATIC CIRCULATION, AND PHYSICOCHE -MICAL FACTORS AFFECTING ABSORPTION. IN: PHARMACOKINETICS-PROCESSES AND MATHEMATICS (WEKLLING, P. G., ED.), PP. 35-44.