UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

REFERENCES

Alston, J.M., Sambucci, O. (2019). Grapes in the World Economy. In: Cantu, D., Walker, M. (eds) The Grape Genome. Compendium of Plant Genomes. Springer, Cham. https://doi.org/10.1007/978-3-030-18601-2_1

Arite, Tomotsugu, Kana Ishizaki, Ayaka Date, Kenichi Matsuda, Tetsuya Sasaki, & Akira Miwa. (2015). Analysis of sugars, organic acids and volatile components of grape 'Ruby Roman'. 有手友嗣, 石崎佳奈, 伊達彩香, 松田賢一, 笹木哲也, & 三輪章志. (2015). ブドウ 'ルビーロマン'の糖, 有機酸および揮発性成分の分析.

Artés-Hernández, F., Aguayo, E., & Artés, F. (2004). Alternative atmosphere treatments for keeping quality of 'Autumn seedless' table grapes during long-term cold storage. *Postharvest biology and Technology*, *31*(1), 59-67. https://doi.org/10.1016/S0925-5214(03)00116-9

Asproudi, A., Petrozziello, M., Cavalletto, S., & Guidoni, S. (2016). Grape aroma precursors in cv. Nebbiolo as affected by vine microclimate. *Food chemistry*, *211*, 947-956. https://doi.org/10.1016/j.foodchem.2016.05.070

Baek, H. H., & Cadwallader, K. R. (1999). Contribution of free and glycosidically bound volatile compounds to the aroma of muscadine grape juice. *Journal of food Science*, *64*(3), 441-444. https://doi.org/10.1111/j.1365-2621.1999.tb15059.x

Bartley, I. M., Stoker, P. G., Martin, A. D., Hatfield, S. G., & Knee, M. (1985). Synthesis of aroma compounds by apples supplied with alcohols and methyl esters of fatty acids. *Journal of the Science of Food and Agriculture*, *36*(7), 567-574. https://doi.org/10.1002/jsfa.2740360708

Bhat, N. R., Desai, B. B., & Suleiman, M. K. (2010). Flavor in grapes: its characterization and commercial applications. *Handbook of Fruit and Vegetable Flavors*, 279-302. https://doi.org/10.1002/9780470622834.ch17

Boss, P. K., & Davies, C. (2009). Molecular biology of anthocyanin accumulation in grape berries. In *Grapevine molecular physiology & biotechnology* (pp. 263-292). Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-90-481-2305-6_10

Capone, S., Tufariello, M., & Siciliano, P. (2013). Analytical characterisation of Negroamaro red wines by "Aroma Wheels". *Food Chemistry*, *141*(3), 2906-2915. https://doi.org/10.1016/j.foodchem.2013.05.105

Chang, E. H., Jeong, S. M., Hur, Y. Y., Koh, S. W., & Choi, I. M. (2015). Changes of volatile compounds in Vitis labrusca 'Doonuri'grapes during stages of

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

fruit development and in wine. *Horticulture, Environment, and Biotechnology*, *56*, 137-144. https://doi.org/10.1007/s13580-015-0068-3

Cheng, G. T., Wang, X. Y., Li, Y. S., Qi, S. M., Wang, J., Zhao, P., ... & Liang, Y. (2021). Comparison of volatile components and aroma profiles between peel and flesh of tomatoes (Solanum lycopersicum). https://doi.org/10.7506/spkx1002-6630-20200930-374

Choi, K. O., Hur, Y. Y., Park, S. J., Lee, D. H., Kim, S. J., & Im, D. (2022). Relationships between instrumental and sensory quality indices of shine muscat grapes with different harvesting times. *Foods*, *11*(16), 2482. https://doi.org/10.3390/foods11162482

Darriet, P., Thibon, C., Dubourdieu, D., Gerós, H., Chaves, M. M., & Delrot, S. (2012). Aroma and aroma precursors in grape berry. *The biochemistry of the grape berry*, *26*, 111-136.

Davies, C., & Böttcher, C. (2009). Hormonal control of grape berry ripening. In *Grapevine molecular physiology & biotechnology* (pp. 229-261). Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-90-481-2305-6_9

de Ancos, B., Ibanez, E., Reglero, G., & Cano, M. P. (2000). Frozen storage effects on anthocyanins and volatile compounds of raspberry fruit. *Journal of agricultural and food chemistry*, *48*(3), 873-879. https://doi.org/10.1021/jf990747c

Deng, H., He, R., Long, M., Li, Y., Zheng, Y., Lin, L., ... & Xia, H. (2021). Comparison of the fruit volatile profiles of five muscadine grape cultivars (Vitis rotundifolia Michx.) using HS-SPME-GC/MS combined with multivariate statistical analysis. *Frontiers in plant science*, *12*, 728891. https://doi.org/10.3389/fpls.2021.728891

Doligez, A., Audiot, E., Baumes, R., & This, P. (2006). QTLs for muscat flavor and monoterpenic odorant content in grapevine (Vitis vinifera L.). *Molecular Breeding*, *18*(2), 109-125. https://doi.org/10.1007/s11032-006-9016-3

Dunlevy, J., Kalua, C., Keyzers, R., Boss, P. (2009). The Production of Flavour & Aroma Compounds in Grape Berries. In: Roubelakis-Angelakis, K.A. (eds) Grapevine Molecular Physiology & Biotechnology. Springer, Dordrecht. https://doi.org/10.1007/978-90-481-2305-6_11

Dutra, M. D. C. P., de Souza, J. F., Viana, A. C., de Oliveira, D., Pereira, G. E., & dos Santos Lima, M. (2018). Rapid determination of the aromatic compounds methyl-anthranilate, 2′-aminoacetophenone and furaneol by GC-MS: Method validation and characterization of grape derivatives. *Food research international*, *107*, 613-618. https://doi.org/10.1016/j.foodres.2018.03.020

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

El Hadi, M. A. M., Zhang, F. J., Wu, F. F., Zhou, C. H., & Tao, J. (2013). Advances in fruit aroma volatile research. *Molecules*, *18*(7), 8200-8229. https://doi.org/10.3390/molecules18078200

Falchi, M., Bertelli, A., Lo Scalzo, R., Morassut, M., Morelli, R., Das, S., ... & Das, D. K. (2006). Comparison of cardioprotective abilities between the flesh and skin of grapes. *Journal of agricultural and food chemistry*, *54*(18), 6613-6622. https://doi.org/10.1021/jf061048k

Fan, W., Xu, Y., Jiang, W., & Li, J. (2010). Identification and quantification of impact aroma compounds in 4 nonfloral Vitis vinifera varieties grapes. *Journal of food science*, *75*(1), S81-S88. https://doi.org/10.1111/j.1750-3841.2009.01436.x

Fenoll, J., Manso, A., Hellín, P., Ruiz, L., & Flores, P. (2009). Changes in the aromatic composition of the Vitis vinifera grape Muscat Hamburg during ripening. *Food Chemistry*, *114*(2), 420-428. https://doi.org/10.1016/j.foodchem.2008.09.060

Fernández-Fernández, A. M., Iriondo-DeHond, A., Nardin, T., Larcher, R., Dellacassa, E., Medrano-Fernandez, A., & Castillo, M. D. D. (2020). In Vitro bioaccessibility of extractable compounds from tannat grape skin possessing health promoting properties with potential to reduce the risk of diabetes. *Foods*, *9*(11), 1575. https://doi.org/10.3390/foods10030672

Fisher, W. B., & VanPeppen, J. F. (2000). Cyclohexanol and cyclohexanone. *Kirk-Othmer Encyclopedia of Chemical Technology*. https://doi.org/10.1002/0471238961.0325031206091908.a01

Flamini, R., & Traldi, P. (2009). *Mass spectrometry in grape and wine chemistry*. John Wiley & Sons. DOI:10.1002/9780470552926

Forney, C. F., Kalt, W., & Jordan, M. A. (2000). The composition of strawberry aroma is influenced by cultivar, maturity, and storage. *HortScience*, *35*(6), 1022-1025. https://doi.org/10.21273/HORTSCI.35.6.1022

Francis, I. L., & Newton, J. L. (2005). Determining wine aroma from compositional data. *Australian Journal of Grape and Wine Research*, *11*(2), 114-126. https://doi.org/10.1111/j.1755-0238.2005.tb00283.x

Franco, M., Peinado, R. A., Medina, M., & Moreno, J. (2004). Off-vine grape drying effect on volatile compounds and aromatic series in must from Pedro Ximénez grape variety. *Journal of Agricultural and Food Chemistry*, *52*(12), 3905-3910. DOI: 10.1021/jf0354949

García-Carpintero, E. G., Sánchez-Palomo, E., Gallego, M. G., & González-Viñas, M. A. (2011). Volatile and sensory characterization of red wines from cv. Moravia Agria minority grape variety cultivated in La Mancha region over five consecutive vintages. *Food Research International*, *44*(5), 1549-1560. https://doi.org/10.1016/j.foodres.2011.04.022

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

García, E., Chacón, J. L., Martínez, J., & Izquierdo, P. M. (2003). Changes in volatile compounds during ripening in grapes of Airén, Macabeo and Chardonnay white varieties grown in La Mancha region (Spain). *Food science and technology international*, *9*(1), 33-41. https://doi.org/10.1177/1082013203009001006

García-Lomillo, J., & González-SanJosé, M. L. (2017). Applications of wine pomace in the food industry: Approaches and functions. *Comprehensive reviews in food science and food safety*, *16*(1), 3-22. https://doi.org/10.1111/1541-4337.12238

Genovese, A., Lamorte, S. A., Gambuti, A., & Moio, L. (2013). Aroma of Aglianico and Uva di Troia grapes by aromatic series. *Food research international*, *53*(1), 15-23. https://doi.org/10.1016/j.foodres.2013.03.051

Genovese, A., Basile, B., Lamorte, S. A., Lisanti, M. T., Corrado, G., Lecce, L., ... & Gambuti, A. (2021). Influence of Berry Ripening Stages over Phenolics and Volatile Compounds in Aged Aglianico Wine. *Horticulturae*, *7*(7), 184. https://doi.org/10.1016/j.foodres.2013.03.051

Gomez, E., Martinez, A., & Laencina, J. (2015). Localization of free and bound aromatic compounds among skin, juice and pulp fractions some grape varieties. *VITIS-Journal of Grapevine Research*, *33*(1), 1.

González-Centeno, M. R., Rosselló, C., Simal, S., Garau, M. C., López, F., & Femenia, A. (2010). Physico-chemical properties of cell wall materials obtained from ten grape varieties and their byproducts: Grape pomaces and stems. *LWT - Food Science and Technology*, *43*(10), 1580–1586. https://doi.org/10.1016/j.lwt.2010.06.024

Gonçalves, G. A., Resende, N. S., Carvalho, E. E., de Resende, J. V., & Vilas Boas, E. V. D. B. (2018). Physicochemical and volatile profile alterations in pasteurized and frozen strawberry pulp during storage. *Journal of Food Processing and Preservation*, *42*(1), e13317. https://doi.org/10.1111/jfpp.13317

Gougoulias, N., & Mashev, N. (2008). Evaluation of polyphenols antioxidant activity of grape seeds (V. vinifera). *Oxidation Communications*, *31*(1), 88.

Gunata, Y. Z., Bayonove, C. L., Baumes, R. L., & Cordonnier, R. E. (1985). The aroma of grapes. Localisation and evolution of free and bound fractions of some grape aroma components cv Muscat during first development and maturation. *Journal of the Science of Food and Agriculture*, *36*(9), 857-862. https://doi.org/10.1002/jsfa.2740360915

Gu, X., Zhang, X., Wang, K., Lv, X., Li, R., & Ma, W. (2022). GC–MS Untargeted analysis of volatile compounds in four red grape Varieties (Vitis vinifera

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

L. cv) at Different Maturity Stages near Harvest. *Foods*, *11*(18), 2804. https://doi.org/10.3390/foods11182804

Hirano, K., Shibahara, R., Asaoka, K., & Okamoto, G. (1998). Seasonal changes in monoterpenes of'Muscat of Alexandria'grape juice during berry development. *Journal of the Japanese Society for Horticultural Science*, *67*(6), 907-911. https://doi.org/10.2503/jjshs.67.907

Jayaprakasha, G. K., Kumar, C. K., Chaudhary, P., Murthy, K. C., & Patil, B. S. (2013). Identification of volatiles from Kumquats and their biological activities. In *Tropical and subtropical fruits: Flavors, color, and health benefits* (pp. 63-92). American Chemical Society. **DOI:** 10.1021/bk-2013-1129.ch004

Ji ShuJuan, J. S., Bu QingZhuang, B. Q., Li JiangKuo, L. J., & Zhang Ping, Z. P. (2012). Effects of 1-MCP treatment on aroma components of'Nanguo'pear during shelf life after cold storage.

Ju, Y. L., Liu, M., Zhao, H., Meng, J. F., & Fang, Y. L. (2016). Effect of exogenous abscisic acid and methyl jasmonate on anthocyanin composition, fatty acids, and volatile compounds of Cabernet Sauvignon (Vitis vinifera L.) grape berries. *Molecules*, *21*(10), 1354. https://doi.org/10.3390/molecules21101354

Kalua, C. M., & Boss, P. K. (2009). Evolution of volatile compounds during the development of Cabernet Sauvignon grapes (Vitis vinifera L.). *Journal of agricultural and food chemistry*, *57*(9), 3818-3830. https://doi.org/10.1021/jf803471n

Kaminaga, Y., Schnepp, J., Peel, G., Kish, C. M., Ben-Nissan, G., Weiss, D., ... & Dudareva, N. (2006). Plant phenylacetaldehyde synthase is a bifunctional homotetrameric enzyme that catalyzes phenylalanine decarboxylation and oxidation. *Journal of Biological Chemistry*, *281*(33), 23357-23366. https://doi.org/10.1074/jbc.M602708200

Kandylis, P. (2021). Grapes and their derivatives in functional foods. *Foods*, *10*(3), 672. https://doi.org/10.3390/foods10030672

Kang, S., Yan, H., Zhu, Y., Liu, X., Lv, H. P., Zhang, Y., ... & Lin, Z. (2019). Identification and quantification of key odorants in the world's four most famous black teas. *Food Research International*, *121*, 73-83. https://doi.org/10.1016/j.foodres.2019.03.009

Khalil, M. N., Fekry, M. I., & Farag, M. A. (2017). Metabolome based volatiles profiling in 13 date palm fruit varieties from Egypt via SPME GC–MS and chemometrics. *Food chemistry*, *217*, 171-181. https://doi.org/10.1016/j.foodchem.2016.08.089

Koyama, R., M. Demura, S. Noma, N. Hayashi, T. Haraguchi, E. Miyamoto, ... & Ueno, Daisuke. (2021). Identification of odorous substances in the violet

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

spider Trentepohlia aurea (Linnaeus) Martius by sniffing gas chromatography. Journal of Odour, Scent and Environment, 52(4), 226-232. 小山玲音, 出村幹英, 野間誠司, 林信行, 原口智和, 宮本英揮, ... & 上野大介. (2021). スミレモ Trentepohlia aurea (Linnaeus) Martius のにおい嗅ぎガスクロマトグラフィーによるにおい物質の同定. *におい・かおり環境学会誌*, *52*(4), 226-232. https://doi.org/10.2171/jao.52.226

Khan, N., Fahad, S., Naushad, M., & Faisal, S. (2020). Grape production critical review in the world. *Available at SSRN 3595842*. https://dx.doi.org/10.2139/ssrn.3595842

Kumazawa, K., & Masuda, H. (2002). Identification of potent odorants in different green tea varieties using flavor dilution technique. *Journal of Agricultural and Food Chemistry*, *50*(20), 5660-5663. https://doi.org/10.1021/jf020498j

Langos, D., Granvogl, M., & Schieberle, P. (2013). Characterization of the key aroma compounds in two Bavarian wheat beers by means of the sensomics approach. *Journal of agricultural and food chemistry*, *61*(47), 11303-11311. https://doi.org/10.1021/jf403912j

Li, X. L., Luan, K. A. N. G., HU, J. J., LI, X. F., & Xiang, S. H. E. N. (2008). Aroma volatile compound analysis of SPME headspace and extract samples from crabapple (Malus sp.) fruit using GC-MS. *Agricultural Sciences in China*, *7*(12), 1451-1457. https://doi.org/10.1016/S1671-2927(08)60402-2

Li, C., Xin, M., Li, L., He, X., Yi, P., Tang, Y., ... & Li, Z. (2021a). Characterization of the aromatic profile of purple passion fruit (Passiflora edulis Sims) during ripening by HS-SPME-GC/MS and RNA sequencing. *Food chemistry*, *355*, 129685. https://doi.org/10.1016/j.foodchem.2021.129685

Li, S., Chen, K., & Grierson, D. (2021b). Molecular and hormonal mechanisms regulating fleshy fruit ripening. *Cells*, *10*(5), 1136. https://doi.org/10.3390/cells10051136

Li, D., Zeng, Y., Ye, Z. K., Li, H. K., Li, Y. Z., Dong, B., ... & Zhong, H. N. (2023). Analysis of volatile organic compounds and potential odour compounds in food contact paperboard using headspace two-dimensional GC-QTOF-MS. *Food Additives & Contaminants: Part A*, *40*(11), 1482-1493. https://doi.org/10.1080/19440049.2023.2259029

Li, Y., He, L., Song, Y., Zhang, P., Chen, D., Guan, L., & Liu, S. (2023). Comprehensive study of volatile compounds and transcriptome data providing genes for grape aroma. *BMC Plant Biology*, *23*(1), 171. https://doi.org/10.1186/s12870-023-04191-1

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Lin, J., Massonnet, M., & Cantu, D. (2019). The genetic basis of grape and wine aroma. Horticulture Research, 6. https://doi.org/10.1038%2Fs41438-019-0163-1

Ma, C., Li, J., Chen, W., Wang, W., Qi, D., Pang, S., & Miao, A. (2018). Study of the aroma formation and transformation during the manufacturing process of oolong tea by solid-phase micro-extraction and gas chromatography–mass spectrometry combined with chemometrics. *Food Research International*, *108*, 413-422. https://doi.org/10.1016/j.foodres.2018.03.052

Mahattanatawee, K., Perez-Cacho, P. R., Davenport, T., & Rouseff, R. (2007). Comparison of three lychee cultivar odor profiles using gas chromatography-olfactometry and gas chromatography-sulfur detection. *Journal of agricultural and food chemistry*, *55*(5), 1939–1944. https://doi.org/10.1021/jf062925p

Matsumoto, H., & Ikoma, Y. (2016). Effect of postharvest temperature on the muscat flavor and aroma volatile content in the berries of ‘‘Shine Muscat’’(Vitis labruscana Baily× V. vinifera L.). *Postharvest Biology and Technology*, *112*, 256-265. https://doi.org/10.1016/j.postharvbio.2015.09.004

Maoz, I., Rikanati, R. D., Schlesinger, D., Bar, E., Gonda, I., Levin, E., ... & Lewinsohn, E. (2018). Concealed ester formation and amino acid metabolism to volatile compounds in table grape (Vitis vinifera L.) berries. *Plant science*, *274*, 223-230. https://doi.org/10.1016/j.plantsci.2018.05.020

Maoz, I., Kaplunov, T., Raban, E., Dynkin, I., Degani, O., Lewinsohn, E., & Lichter, A. (2020). Insights into the chemosensory basis of flavor in table grapes. *Journal of the Science of Food and Agriculture*, *100*(4), 1405-1417. https://doi.org/10.1002/jsfa.10102

McCARTHY, A. I., PALMER, J. K., SHAW, C. P., & ANDERSON, E. E. (1963). Correlation of Gas Chromatographic Data with Flavor Profiles of Fresh Banana Fruit a. *Journal of Food Science*, *28*(4), 379-384. https://doi.org/10.1111/j.1365-2621.1963.tb00214.x

Mihaylova, D., Popova, A., & Dincheva, I. (2022). Pattern recognition of varieties of peach fruit and pulp from their volatile components and metabolic profile using HS-SPME-GC/MS combined with multivariable statistical analysis. *Plants*, *11*(23), 3219. https://doi.org/10.3390/plants11233219

Ministry of Agriculture, Forestry and Fisheries Public Relations Office. (2019). Special Feature 1 Grape. Agriculture Forestry Fisheries. *50*(5), p.8.

Modise, D. M. (2008). Does freezing and thawing affect the volatile profile of strawberry fruit (Fragaria× ananassa Duch.). *Postharvest Biology and*

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Technology, *50*(1), 25-30. https://doi.org/10.1016/j.postharvbio.2008.03.009

Moriyama, K., Kono, A., Matsuzaki, R., Azuma, A., Onoue, N., Sekozawa, Y., ... & Sugaya, S. (2024). Diversity of flavour characteristics of table grapes and their contributing volatile compounds analysed by the solvent-assisted flavour evaporation method. *Horticulture Research*, *11*(4), uhae048. https://doi.org/10.1093/hr/uhae048

Noguerol-Pato, R., González-Barreiro, C., Cancho-Grande, B., Santiago, J. L., Martínez, M. C., & Simal-Gándara, J. (2012). Aroma potential of Brancellao grapes from different cluster positions. *Food chemistry*, *132*(1), 112-124. https://doi.org/10.1016/j.foodchem.2011.10.042

Nouri, B., Mohtasebi, S. S., & Rafiee, S. (2020). Quality detection of pomegranate fruit infected with fungal disease. *International Journal of Food Properties*, *23*(1), 9-21. https://doi.org/10.1080/10942912.2019.1705851

Okamoto, G., Liao, K., Fushimi, T., & Hirano, K. (2001). Aromatic substances evolved from the whole berry, skin, and flesh of Muscat of Alexandria grapes. *岡山大学農学部学術報告*, *90*(1), 21-25.

OuYang, Y. N., Gao, J. S., Li, R. L., Zhu, M. R., Hu, X. H., Min, Z., ... & Fang, Y. L. (2015). Changes in volatile profiles and activity of hydroperoxide lyase and alcohol dehydrogenase during the development of Cabernet Sauvignon grapes (Vitis vinifera L.). *South African Journal of Enology and Viticulture*, *36*(3), 328-342. https://doi.org/10.21548/36-3-966

Panighel, A., Vedova, A. D., De Rosso, M., Gardiman, M., & Flamini, R. (2014). A solid-phase microextraction gas chromatography/ion trap tandem mass spectrometry method for simultaneous determination of ‘foxy smelling compounds’ and 3-alkyl-2-methoxypyrazines in grape juice. *Rapid Communications in Mass Spectrometry*, *24*(14), 2023-2029. https://doi.org/10.1002/rcm.4611

Park, S. K., Morrison, J. C., Adams, D. O., & Noble, A. C. (1991). Distribution of free and glycosidically bound monoterpenes in the skin and mesocarp of Muscat of Alexandria grapes during development. *Journal of agricultural and food chemistry*, *39*(3), 514-518. https://doi.org/10.1021/jf00003a017

Pashaei, M., & Hassanpour, H. (2024). Phenolic, amino acids, and fatty acids profiles and the nutritional properties in the fresh and dried fruits of black rosehip (Rosa pimpinellifolia L.). *Scientific Reports*, *14*(1), 19665.https://doi.org/10.1038/s41598-024-70574-5

Peinado, R. A., Moreno, J., Bueno, J. E., Moreno, J. A., & Mauricio, J. C. (2004). Comparative study of aromatic compounds in two young white wines subjected to pre-fermentative cryomaceration. *Food Chemistry*, *84*(4), 585-590. https://doi.org/10.1016/S0308-8146(03)00282-6

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Pico, J., Nozadi, K., Gerbrandt, E. M., Dossett, M., & Castellarin, S. D. (2023). Determination of bound volatiles in blueberries, raspberries, and grapes with an optimized protocol and a validated SPME-GC/MS method. *Food Chemistry*, *403*, 134304. https://doi.org/10.1016/j.foodchem.2022.134304

Pollner, G., & Schieberle, P. (2016). Characterization of the key odorants in commercial cold-pressed oils from unpeeled and peeled rapeseeds by the sensomics approach. *Journal of agricultural and food chemistry*, *64*(3), 627-636. https://doi.org/10.1021/acs.jafc.5b05321

Qi, Y., Wang, M., Wan, N., Yin, D., Wei, M., Sun, X., ... & Ma, T. (2024). Sensory characteristics of ‘‘Shine Muscat’’ grapes based on consumer reviews and human and intelligent sensory evaluation. *LWT*, 115810. https://doi.org/10.1016/j.lwt.2024.115810

Qin, D., Wang, Q., Jiang, X., Ni, E., Fang, K., Li, H., ... & Wu, H. (2023). Identification of key volatile and odor-active compounds in 10 main fragrance types of Fenghuang Dancong tea using HS-SPME/GC-MS combined with multivariate analysis. *Food Research International*, *173*, 113356. https://doi.org/10.1016/j.foodres.2023.113356

Reineccius, G. (2005). Flavor Chemistry and Technology (2nd ed.). CRC Press. https://doi.org/10.1201/9780203485347

Reisch, B.I., Owens, C.L., Cousins, P.S. (2012). Grape. In: Badenes, M., Byrne, D. (eds) Fruit Breeding. Handbook of Plant Breeding, vol 8. Springer, Boston, MA. https://doi.org/10.1007/978-1-4419-0763-9_7

ROBINSON, S. P., & DAVIES, C. (2000). Molecular biology of grape berry ripening. *Australian journal of grape and wine research*, *6*(2), 175-188. https://doi.org/10.1111/j.1755-0238.2000.tb00177.x

Rolle, L., Torchio, F., Zeppa, G., & Gerbi, V. (2009). Relationship between skin break force and anthocyanin extractability at different ripening stages. *American Journal of Enology and Viticulture*, *60*(1), 93-97. DOI : 10.5344/ajev.2009.60.1.93

Sasaki, K., Takase, H., Matsuyama, S., Kobayashi, H., Matsuo, H., Ikoma, G., & Takata, R. (2016). Effect of light exposure on linalool biosynthesis and accumulation in grape berries. *Bioscience, Biotechnology, and Biochemistry*, *80*(12), 2376-2382. https://doi.org/10.1080/09168451.2016.1217148

Sasaki, T., Koshi, E., Take, H., Michihata, T., Maruya, M., & Enomoto, T. (2017). Characterisation of odorants in roasted stem tea using gas chromatography–mass spectrometry and gas chromatography-olfactometry analysis. *Food chemistry*, *220*, 177-183. https://doi.org/10.1016/j.foodchem.2016.09.208

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Sasaki, T., Ando, S., Miyazawa, T., Yamauchi, D., Take, H., Yamazaki, Y., & Enomoto, T. (2020). Characterisation of 'Ruby Roman'table grapes (Vitis Labruscana Bailey) by sensory evaluation and analysis of aroma and taste compounds. *Food Science and Technology Research*, *26*(3), 423-434. https://doi.org/10.3136/fstr.26.423

Sato, M., Suzuki, Y., Okuda, T., & Yokotsuka, K. (1997). Contents of resveratrol, piceid, and their isomers in commercially available wines made from grapes cultivated in Japan. *Bioscience, biotechnology, and biochemistry*, *61*(11), 1800-1805. https://doi.org/10.1271/bbb.61.1800

Schwab, W., & Schreier, P. (2002). Enzymic formation of flavor volatiles from lipids. In *Lipid biotechnology* (pp. 342-372). CRC Press.

Schwab, W., Davidovich-Rikanati, R., & Lewinsohn, E. (2008). Biosynthesis of plant-derived flavor compounds. *The plant journal*, *54*(4), 712-732. https://doi.org/10.1111/j.1365-313X.2008.03446.x

SHIRAISHI, S. I., & WATANABE, Y. (1988). Anthocyanin Pigments in the Blue-Black Tetraploid Grape Cultivars 'Black Olympia','Pione''and 'Izunishiki'(Vitis vinifera L.× V. labrusca L.). *Journal of the Japanese Society for Horticultural Science*, *57*(1), 17-21. https://doi.org/10.2503/jjshs.57.17

Shiraishi, M. (1993). Three descriptors for sugars to evaluate grape germplasm. *Euphytica*, *71*, 99-106. https://doi.org/10.1007/BF00023472

Shiraishi, M. (2000). Comparison in changes in sugars, organic acids and amino acids during berry ripening of sucrose-and hexose-accumulating grape cultivars. *Journal of the Japanese Society for Horticultural Science*, *69*(2), 141-148. https://doi.org/10.2503/jjshs.69.141

Shiraishi, M., Shinomiya, R., & Chijiwa, H. (2012). Preliminary genetic analysis of sucrose accumulation in berries of table grapes. *Scientia horticulturae*, *137*, 107-113. https://doi.org/10.1016/j.scienta.2012.01.024

Shiraishi, M., Shinomiya, R., & Chijiwa, H. (2018). Varietal differences in polyphenol contents, antioxidant activities and their correlations in table grape cultivars bred in Japan. *Scientia horticulturae*, *227*, 272-277. https://doi.org/10.1016/j.scienta.2017.09.032

Slegers, A., Angers, P., Ouellet, É., Truchon, T., & Pedneault, K. (2015). Volatile compounds from grape skin, juice and wine from five interspecific hybridgrape cultivars grown in Québec (Canada) for wine production. *Molecules*, *20*(6), 10980-11016. https://doi.org/10.3390/molecules200610980

Stevens, K. L., Bomben, J., Lee, A., & McFadden, W. H. (1966). Volatiles from grapes. Muscat of Alexandria. *Journal of Agricultural and Food Chemistry*, *14*(3), 249-252. https://doi.org/10.1021/jf60145a015

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Strauss, C. R., Wilson, B., Gooley, P. R., & Williams, P. J. (1986). Role of monoterpenes in grape and wine flavor. DOI: 10.1021/bk-1986-0317.ch018

Suehiro, Y., Mochida, K., Tsuma, M., Yasuda, Y., Itamura, H., & Esumi, T. (2019). Effects of abscisic acid/ethephon treatments on berry development and maturation in the yellow-green skinned ‘‘Shine Muscat’’grape. *The Horticulture Journal*, *88*(2), 189-201. https://doi.org/10.2503/hortj.UTD-045

Sugiura, T., Shiraishi, M., Konno, S., & Sato, A. (2018). Prediction of skin coloration of grape berries from air temperature. *The Horticulture Journal*, *87*(1), 18-25. https://doi.org/10.2503/hortj.OKD-061

Sun, Q., Gates, M. J., Lavin, E. H., Acree, T. E., & Sacks, G. L. (2011). Comparison of odor-active compounds in grapes and wines from Vitis vinifera and non-foxy American grape species. *Journal of agricultural and food chemistry*, *59*(19), 10657-10664. https://doi.org/10.1021/jf2026204

Swiegers, J. H., Bartowsky, E. J., Henschke, P. A., & Pretorius, I. (2005). Yeast and bacterial modulation of wine aroma and flavour. *Australian Journal of grape and wine research*, *11*(2), 139-173. https://doi.org/10.1111/j.1755-0238.2005.tb00285.x

Tanaka, F., Miyazawa, T., Okazaki, K., Tatsuki, M., & Ito, T. (2015). Sensory and metabolic profiles of “Fuji” apples (Malus domestica Borkh.) grown without synthetic agrochemicals: the role of ethylene production. *Bioscience, biotechnology, and biochemistry*, *79*(12), 2034-2043. https://doi.org/10.1080/09168451.2015.1062713

Verries, C., Pradal, M., Chatelet, P., Torregrosa, L., & Tesniere, C. (2004). Isolation and analysis of the promoter of VvAdh2, a grapevine (Vitis vinifera L.) ripening-related gene. *Plant Science*, *167*(5), 1067-1074. https://doi.org/10.1016/j.plantsci.2004.06.003

Wang, J., & Luca, V. D. (2005). The biosynthesis and regulation of biosynthesis of Concord grape fruit esters, including ‘foxy’methylanthranilate. *The Plant Journal*, *44*(4), 606-619. https://doi.org/10.1111/j.1365-313X.2005.02552.x

Wang, Q., Shao, Y., Cao, T. & Shen, J. (2018). Identification of Key Odor Compounds from Three Kinds of Wood Species. In Y. Wang (Ed.), *ESSE 2017: Proceedings of the International Conference on Environmental Science and Sustainable EnergyEd.by ZhaoYang Dong* (pp. 101-116). Berlin, Boston: De Gruyter. https://doi.org/10.1515/9783110540048-011

Wang, J., Han, Y., Chen, C., Sam, F. E., Guan, R., Wang, K., ... & Jiang, Y. (2023). Influence of Benzothiadiazole on the Accumulation and Metabolism of C6

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Compounds in Cabernet Gernischt Grapes (Vitis vinifera L.). *Foods*, *12*(19), 3710. https://doi.org/10.3390/foods12193710

Williams, P. J., Strauss, C. R., & Wilson, B. (1980). Hydroxylated linalool derivatives as precursors of volatile monoterpenes of Muscat grapes. *Journal of Agricultural and Food Chemistry*, *28*(4), 766-771. https://doi.org/10.1021/jf60230a037

Willner, B., Granvogl, M., & Schieberle, P. (2013). Characterization of the key aroma compounds in Bartlett pear brandies by means of the sensomics concept. *Journal of agricultural and food chemistry*, *61*(40), 9583-9593.

Wilson, B., Strauss, C. R., & Williams, P. J. (1984). Changes in free and glycosidically bound monoterpenes in developing Muscat grapes. *Journal of Agricultural and Food Chemistry*, *32*(4), 919-924. https://doi.org/10.1021/jf00124a054

Winkler, A. J. (1974). *General viticulture*. Univ of California Press.

Wu, Y., Duan, S., Zhao, L., Gao, Z., Luo, M., Song, S., ... & Wang, S. (2016). Aroma characterization based on aromatic series analysis in table grapes. *Scientific reports*, *6*(1), 31116. https://doi.org/10.1038/srep31116

Wu, Y., Zhang, W., Duan, S., Song, S., Xu, W., Zhang, C., ... & Wang, S. (2018). In-depth aroma and sensory profiling of unfamiliar table-grape cultivars. *Molecules*, *23*(7), 1703. https://doi.org/10.3390/molecules23071703

Wu, Y., Zhang, W., Yu, W., Zhao, L., Song, S., Xu, W., ... & Wang, S. (2019). Study on the volatile composition of table grapes of three aroma types. *Lwt*, *115*, 108450. https://doi.org/10.1016/j.lwt.2019.108450

Wu, Y., Zhang, W., Song, S., Xu, W., Zhang, C., Ma, C., ... & Wang, S. (2020). Evolution of volatile compounds during the development of Muscat grape ‘‘Shine Muscat’’(Vitis labrusca× V. vinifera). *Food chemistry*, *309*, 125778. https://doi.org/10.1016/j.foodchem.2019.125778

Xue, H., Sekozawa, Y., & Sugaya, S. (2023). Investigating the aromatic compound changes in table grape varieties during growth and development, using HS-SPME-GC/MS. *Horticulturae*, *9*(1), 85. https://doi.org/10.3390/horticulturae9010085

Yaginuma, Y. (2024). Varietal differences in aroma compounds in 12 grape varieties. Faculty of Agriculture, Yamagata University, Japan.

Yamada M., Yamane H., Sato A., Hirakawa N., Iwanami H., Yoshinaga K., Ozawa T., Mitani N., Shiraishi M., Yoshioka M. et al. (2008). New grape cultivar ''Shine Muscat''. Bull. Natl. Inst. Fruit Tree Sci. 7, 21-38.

Yamada, M., & Sato, A. (2016). Advances in table grape breeding in Japan. *Breeding science*, *66*(1), 34-45. https://doi.ocrg/10.1270/jsbbs.66.34

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Yamada, M., Yamane, H., & Sato, A. (2017). Breeding and dissemination of a new grape variety 'Shine Muscat'. Journal of Horticultural Research, 16(3), 229-237. **山田昌彦, 山根弘康, & 佐藤明彦**. (2017). **ブドウ新品種 'シャインマスカット'の育成と普及**. ***園芸学研究***, *16*(3), 229-237. https://doi.org/10.2503/hrj.16.229

Yamane, H., Kurihara, A., Yamada, M., Nagata, K., Yoshinaga, K., Matsumoto, R., Kishi, M., Ozawa, S., Kado, T., Hirabayashi, T.,Kadotani, M., Sato, A., and Hirakawa, N. (1992). A new grape variety, 'Honey Black'. Fruit Tree Experimental Report. 23: 25–36.山根弘康・栗原昭夫・山田昌彦・永田賢嗣・吉永勝一・松 本亮司・小沢俊治・角 利昭・平林利郎・角谷真奈 美. 1991. ブドウ新品種'ノースレッド'. 果樹試報. 20: 41–48.

Yang, C., Wang, Y., Liang, Z., Fan, P., Wu, B., Yang, L., ... & Li, S. (2009). Volatiles of grape berries evaluated at the germplasm level by headspace-SPME with GC–MS. *Food Chemistry*, *114*(3), 1106-1114. https://doi.org/10.1016/j.foodchem.2008.10.061

Yang, C., Wang, Y., Wu, B., Fang, J., & Li, S. (2011). Volatile compounds evolution of three table grapes with different flavour during and after maturation. *Food Chemistry*, *128*(4), 823-830. https://doi.org/10.1016/j.foodchem.2010.11.029

Yang, J., & Xiao, Y. Y. (2013). Grape phytochemicals and associated health benefits. *Critical reviews in food science and nutrition*, *53*(11), 1202-1225.https://doi.org/10.1080/10408398.2012.692408

Yang, Y., Cuenca, J., Wang, N., Liang, Z., Sun, H., Gutierrez, B., ... & Zhong, G. Y. (2020). A key 'foxy'aroma gene is regulated by homology-induced promoter indels in the iconic juice grape 'Concord'. *Horticulture research*, *7*. https://doi.org/10.1038/s41438-020-0304-6

Yu, H., Xie, T., Xie, J., Ai, L., & Tian, H. (2019). Characterization of key aroma compounds in Chinese rice wine using gas chromatography-mass spectrometry and gas chromatography-olfactometry. Food Chemistry, 293, 8-14. https://doi.org/10.1016/j.foodchem.2019.03.071

Zhang, P., Fuentes, S., Siebert, T., Krstic, M., Herderich, M., Barlow, E. W. R., & Howell, K. (2016). Terpene evolution during the development of Vitis vinifera L. cv. Shiraz grapes. *Food Chemistry*, *204*, 463-474. https://doi.org/10.1016/j.foodchem.2016.02.125

Zhou, D. D., Li, J., Xiong, R. G., Saimaiti, A., Huang, S. Y., Wu, S. X., ... & Li, H. B. (2022). Bioactive compounds, health benefits and food applications of grape. *Foods*, *11*(18), 2755. https://doi.org/10.3390/foods11182755

Ziółkowska, A., Wąsowicz, E., & Jeleń, H. H. (2016). Differentiation of wines according to grape variety and geographical origin based on volatiles

UNIVERSITAS
GADJAH MADA
ANALYSIS OF VOLATILE AROMA COMPOUNDS IN THE PEEL AND FLESH OF JAPANESE GRAPES USING SPME GC-MS
Narindra Kusuma Rara Pratiwi, Prof. Dr. Ir. Djagal Wiseso Marseno, M.Agr; Dr. Manikharda, S.TP., M.Agr
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

profiling using SPME-MS and SPME-GC/MS methods. *Food Chemistry*, *213*, 714-720. https://doi.org/10.1016/j.foodchem.2016.06.120