



## REFERENCES

- Acar, O., Tunçeli, A., & Türker, A. R. (2016). Comparison of Wet and Microwave Digestion Methods for the Determination of Copper, Iron and Zinc in Some Food Samples by FAAS. *Food Analytical Methods*, 9(11), 3201–3208. <https://doi.org/10.1007/s12161-016-0516-4>
- Akash, M. S. H., & Rehman, K. (2020). *Essentials of Pharmaceutical Analysis*. Springer Singapore. <https://doi.org/10.1007/978-981-15-1547-7>
- AOAC International. (2016). *Appendix F: Guidelines for Standard Method Performance Requirements*.
- AOAC International. (2019). *Appendix K: Guidelines for Dietary Supplements and Botanicals*.
- Baranowska, I. (Ed.). (2016). *Handbook of Trace Analysis*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-19614-5>
- Bashir, K., & Nishizawa, N. K. (2013). Iron Proteins, Plant Iron Transporters. In R. H. Kretsinger, V. N. Uversky, & E. A. Permyakov (Eds.), *Encyclopedia of Metalloproteins* (pp. 1015–1023). Springer New York. [https://doi.org/10.1007/978-1-4614-1533-6\\_356](https://doi.org/10.1007/978-1-4614-1533-6_356)
- Belitz, H.-D., Grosch, W., & Schieberle, P. (2009). *Food Chemistry* (4th revised and extended ed.). Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-540-69934-7>
- Castro, M. D. L., & García, J. L. L. (2002). *Acceleration and Automation of Solid Sample Treatment* (Vol. 24). Elsevier Science B.V.
- Chen, L., Apostolides, Z., & Chen, Z. (Eds.). (2012). *Global tea breeding: Achievements, challenges and perspectives*. Zhejiang University Press ; Springer.
- Chen, Y., Yu, M., Xu, J., Chen, X., & Shi, J. (2009). Differentiation of eight tea (*Camellia sinensis*) cultivars in China by elemental fingerprint of their leaves: Elemental fingerprint of eight tea cultivars. *Journal of the Science of Food and Agriculture*, 89(14), 2350–2355. <https://doi.org/10.1002/jsfa.3716>
- Ciftci, H., & Er, C. (2013). Solid-phase extraction and separation procedure for trace aluminum in water samples and its determination by high-resolution continuum source flame atomic absorption spectrometry (HR-CS FAAS). *Environmental Monitoring and Assessment*, 185(3), 2745–2753. <https://doi.org/10.1007/s10661-012-2745-3>
- deMan, J. M., Finley, J. W., Hurst, W. J., & Lee, C. Y. (2018). *Principles of Food Chemistry*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-63607-8>
- Direktorat of Food Crops, Horticulture, and Estate Crops Statistics. (2020). *Indonesian Tea Statistics 2020*. BPS-Statistics Indonesia.



- Enamorado-Báez, S. M., Abril, J. M., & Gómez-Guzmán, J. M. (2013). Determination of 25 Trace Element Concentrations in Biological Reference Materials by ICP-MS following Different Microwave-Assisted Acid Digestion Methods Based on Scaling Masses of Digested Samples. *ISRN Analytical Chemistry*, 2013, 1–14. <https://doi.org/10.1155/2013/851713>
- Eskina, V. V., Baranovskaya, V. B., Karpov, Yu. A., & Filatova, D. G. (2020). High-resolution continuum source atomic absorption spectrometry: A review of current applications. *Russian Chemical Bulletin*, 69(1), 1–16. <https://doi.org/10.1007/s11172-020-2718-6>
- Esteki, M., Memarbashi, N., & Simal-Gandara, J. (2022). Classification and authentication of tea according to their geographical origin based on FT-IR fingerprinting using pattern recognition methods. *Journal of Food Composition and Analysis*, 106, 104321. <https://doi.org/10.1016/j.jfca.2021.104321>
- Eurachem. (2014). *The Fitness for Purpose of Analytical Methods: A Laboratory Guide to Method Validation and Related Topics* (2nd ed.). [https://www.eurachem.org/images/stories/Guides/pdf/MV\\_guide\\_2nd\\_ed\\_EN.pdf](https://www.eurachem.org/images/stories/Guides/pdf/MV_guide_2nd_ed_EN.pdf)
- Fairulnizal, M. N. M., Vimala, B., Rathi, D. N., & Naeem, M. N. M. (2019). Atomic absorption spectroscopy for food quality evaluation. In *Evaluation Technologies for Food Quality* (pp. 145–173). Elsevier. <https://doi.org/10.1016/B978-0-12-814217-2.00009-3>
- Fernández, B., Lobo, L., & Pereiro, R. (2018). Atomic Absorption Spectrometry: Fundamentals, Instrumentation and Capabilities. In *Reference Module in Chemistry, Molecular Sciences and Chemical Engineering* (p. B9780124095472140000). Elsevier. <https://doi.org/10.1016/B978-0-12-409547-2.14116-2>
- Frentiu, T., Ponta, M., & Hategan, R. (2013). Validation of an analytical method based on the high-resolution continuum source flame atomic absorption spectrometry for the fast-sequential determination of several hazardous/priority hazardous metals in soil. *Chemistry Central Journal*, 7(1), 43. <https://doi.org/10.1186/1752-153X-7-43>
- Gab-Allah, M. A., & Shehata, A. B. (2021). Determination of iron, nickel, and vanadium in crude oil by inductively coupled plasma optical emission spectrometry following microwave-assisted wet digestion. *Chemical Papers*, 75(8), 4239–4248. <https://doi.org/10.1007/s11696-021-01633-8>
- Gaffney, J. S., & Marley, N. A. (2018). Chemical Measurements and Instrumentation. In *General Chemistry for Engineers* (pp. 493–532). Elsevier. <https://doi.org/10.1016/B978-0-12-810425-5.00015-1>
- Gonzalez, A. G., & Herrador, M. A. (2007). A practical guide to analytical method validation, including measurement uncertainty and accuracy profiles. *Trends in Analytical Chemistry*, 26(3), 12.



- Greenwood, N. N., & Earnshaw, A. (1997). *Chemistry of the elements* (2nd ed). Butterworth-Heinemann.
- Habashi, F. (2013a). Iron, Physical and Chemical Properties. In R. H. Kretsinger, V. N. Uversky, & E. A. Permyakov (Eds.), *Encyclopedia of Metalloproteins* (pp. 1033–1034). Springer New York. [https://doi.org/10.1007/978-1-4614-1533-6\\_417](https://doi.org/10.1007/978-1-4614-1533-6_417)
- Habashi, F. (2013b). Zinc, Physical and Chemical Properties. In R. H. Kretsinger, V. N. Uversky, & E. A. Permyakov (Eds.), *Encyclopedia of Metalloproteins* (pp. 2537–2538). Springer New York. [https://doi.org/10.1007/978-1-4614-1533-6\\_179](https://doi.org/10.1007/978-1-4614-1533-6_179)
- Hacisalihoglu, G. (2020). Zinc (Zn): The Last Nutrient in the Alphabet and Shedding Light on Zn Efficiency for the Future of Crop Production under Suboptimal Zn. *Plants*, 9(11), 1471. <https://doi.org/10.3390/plants9111471>
- Hajiboland, R. (2017). Environmental and nutritional requirements for tea cultivation. *Folia Horticulturae*, 29(2), 199–220. <https://doi.org/10.1515/fhort-2017-0019>
- Harris, D. C. (2010). *Quantitative chemical analysis* (8th ed). W.H. Freeman and Co.
- Hu, Z., & Qi, L. (2014). Sample Digestion Methods. In *Treatise on Geochemistry* (pp. 87–109). Elsevier. <https://doi.org/10.1016/B978-0-08-095975-7.01406-6>
- International Conference on Harmonization (ICH). (2005). *Validation of Analytical Procedures: Text and Methodology Q2(R1)*.
- International Organization for Standardization (ISO). (2017). *ISO/IEC 17025 General Requirements for The Competence of Testing and Calibration Laboratories* (3rd ed.). ISO.
- Jin, J.-Q., Dai, W.-D., Zhang, C.-Y., Lin, Z., & Chen, L. (2022). Genetic, morphological, and chemical discrepancies between *Camellia sinensis* (L.) O. Kuntze and its close relatives. *Journal of Food Composition and Analysis*, 108, 104417. <https://doi.org/10.1016/j.jfca.2022.104417>
- Kailasa, S. K., & Wu, H.-F. (2012). Inorganic Contaminants. In *Comprehensive Sampling and Sample Preparation* (pp. 743–782). Elsevier. <https://doi.org/10.1016/B978-0-12-381373-2.00112-5>
- Khan, N., & Mukhtar, H. (2018). Tea Polyphenols in Promotion of Human Health. *Nutrients*, 11(1), 39. <https://doi.org/10.3390/nu11010039>
- Khandpur, R. S. (2020). *Compendium of Biomedical Instrumentation* (1st ed.). Wiley. <https://doi.org/10.1002/9781119288190>
- Klepacka, J., Tońska, E., Rafałowski, R., Czarnowska-Kujawska, M., & Opara, B. (2021). Tea as a Source of Biologically Active Compounds in the Human Diet. *Molecules*, 26(5), 1487. <https://doi.org/10.3390/molecules26051487>
- Koch, W., Kukula-Koch, W., Czop, M., Baj, T., Kocki, J., Bawiec, P., Casasnovas, R. O., Głowniak-Lipa, A., & Głowniak, K. (2021). Analytical Assessment of Bioelements in Various Types of Black Teas from Different



- Geographical Origins in View of Chemometric Approach. *Molecules*, 26(19), 6017. <https://doi.org/10.3390/molecules26196017>
- Kole, C. (Ed.). (2007). *Technical crops*. Springer.
- Li, W., Cheng, H., Mu, Y., Xu, A., Ma, B., Wang, F., & Xu, P. (2021). Occurrence, accumulation, and risk assessment of trace metals in tea (*Camellia sinensis*): A national reconnaissance. *Science of The Total Environment*, 792, 148354. <https://doi.org/10.1016/j.scitotenv.2021.148354>
- Lim, C. M., Carey, M., Williams, P. N., & Koidis, A. (2021). Rapid classification of commercial teas according to their origin and type using elemental content with X-ray fluorescence (XRF) spectroscopy. *Current Research in Food Science*, 4, 45–52. <https://doi.org/10.1016/j.crfs.2021.02.002>
- López-García, I., & Hernández-Córdoba, M. (2015). Atomic absorption spectrometry. In M. de la Guardia & S. Garrigues (Eds.), *Handbook of Mineral Elements in Food* (pp. 189–217). John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118654316.ch10>
- Maier, J. A. (2013). Magnesium and Cell Cycle. In R. H. Kretsinger, V. N. Uversky, & E. A. Permyakov (Eds.), *Encyclopedia of Metalloproteins* (pp. 1227–1232). Springer New York. [https://doi.org/10.1007/978-1-4614-1533-6\\_279](https://doi.org/10.1007/978-1-4614-1533-6_279)
- Matusiewicz, H. (2017). Sample Preparation for Inorganic Trace Element Analysis. *Physical Sciences Reviews*, 2(5). <https://doi.org/10.1515/psr-2017-8001>
- McMurry, J., & Fay, R. C. (2012). *Chemistry* (6th ed). Prentice Hall.
- Memić, M., Mahić, D., Žero, S., & Muhić-Šarac, T. (2014). Comparison of different digestion methods of green and black tea at the Sarajevo market for the determination of the heavy metal content. *Journal of Food Measurement and Characterization*, 8(2), 149–154. <https://doi.org/10.1007/s11694-014-9175-6>
- Moldovan, M. (2018). Atomic Absorption Spectrometry—Flame. In *Reference Module in Chemistry, Molecular Sciences and Chemical Engineering* (p. B9780124095472000000). Elsevier. <https://doi.org/10.1016/B978-0-12-409547-2.00022-6>
- Nielsen, F. (2013). Ultratrace Elements. In *Encyclopedia of Human Nutrition* (pp. 299–310). Elsevier. <https://doi.org/10.1016/B978-0-12-375083-9.00270-1>
- Nielsen, S. S. (Ed.). (2017). *Food Analysis*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-45776-5>
- Nieves-Cordones, M., Al Shiblawi, F. R., & Sentenac, H. (2016). Roles and Transport of Sodium and Potassium in Plants. In A. Sigel, H. Sigel, & R. K. O. Sigel (Eds.), *The Alkali Metal Ions: Their Role for Life* (Vol. 16, pp. 291–324). Springer International Publishing. [https://doi.org/10.1007/978-3-319-21756-7\\_9](https://doi.org/10.1007/978-3-319-21756-7_9)
- Peña-Vázquez, E., Barciela-Alonso, M. C., Pita-Calvo, C., Domínguez-González, R., & Bermejo-Barrera, P. (2015). Use of High-Resolution Continuum Source Flame Atomic Absorption Spectrometry (HR-CS FAAS) for



- Sequential Multi-Element Determination of Metals in Seawater and Wastewater Samples. *Journal of Applied Spectroscopy*, 82(4), 681–686. <https://doi.org/10.1007/s10812-015-0164-2>
- Ramdani, D., Chaudhry, A. S., & Seal, C. J. (2013). Chemical Composition, Plant Secondary Metabolites, and Minerals of Green and Black Teas and the Effect of Different Tea-to-Water Ratios during Their Extraction on the Composition of Their Spent Leaves as Potential Additives for Ruminants. *Journal of Agricultural and Food Chemistry*, 61(20), 4961–4967. <https://doi.org/10.1021/jf4002439>
- Rashid, Md. H., Fardous, Z., Chowdhury, M. A. Z., Alam, Md. K., Bari, Md. L., Moniruzzaman, M., & Gan, S. H. (2016). Determination of heavy metals in the soils of tea plantations and in fresh and processed tea leaves: An evaluation of six digestion methods. *Chemistry Central Journal*, 10(1), 7. <https://doi.org/10.1186/s13065-016-0154-3>
- Ren, Y., Feng, C., Ye, Z., Zhu, H., Hou, R., Granato, D., Cai, H., & Peng, C. (2022). Keemun black tea: Tracing its narrow-geographic origins using comprehensive elemental fingerprinting and chemometrics. *Food Control*, 133, 108614. <https://doi.org/10.1016/j.foodcont.2021.108614>
- Resano, M., Flórez, M. R., & García-Ruiz, E. (2014). Progress in the determination of metalloids and non-metals by means of high-resolution continuum source atomic or molecular absorption spectrometry. A critical review. *Analytical and Bioanalytical Chemistry*, 406(9–10), 2239–2259. <https://doi.org/10.1007/s00216-013-7522-9>
- Rosenberg, E., & Panne, U. (2014). Atomic Absorption Spectrometry (AAS) and Atomic Emission Spectrometry (AES). In G. Gauglitz & D. S. Moore (Eds.), *Handbook of Spectroscopy* (pp. 507–582). Wiley-VCH Verlag GmbH & Co. KGaA. <https://doi.org/10.1002/9783527654703.ch15>
- Royal Society of Chemistry (RSC). (2022). *Periodic Table*. <https://www.rsc.org/periodic-table/>
- Shuai, M., Peng, C., Niu, H., Shao, D., Hou, R., & Cai, H. (2022). Recent techniques for the authentication of the geographical origin of tea leaves from camellia sinensis: A review. *Food Chemistry*, 374, 131713. <https://doi.org/10.1016/j.foodchem.2021.131713>
- Szymczycha-Madeja, A., Welna, M., & Pohl, P. (2016). Comparison and Validation of Different Alternative Sample Preparation Procedures of Tea Infusions Prior to Their Multi-Element Analysis by FAAS and ICP OES. *Food Analytical Methods*, 9(5), 1398–1411. <https://doi.org/10.1007/s12161-015-0323-3>
- USGS, L. B. T. (2013). *Integrated Taxonomic Information System (ITIS)*. <https://doi.org/10.5066/F7KH0KBK>
- Welz, B., Vale, M. G. R., Florek, S., Okruss, M., Huang, M.-D., & Becker-Ross, H. (2010). High-resolution Continuum Source Atomic Absorption Spectrometry-Theory and Applications. In R. A. Meyers (Ed.),



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NIA ARYANI, Prof. Dr. apt. Abdul Rohman, M.Si. ; Dr. apt. Agustina Ari Murti Budi Hastuti, M.Sc/ <sup>1</sup>  
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*Encyclopedia of Analytical Chemistry* (p. a9124). John Wiley & Sons, Ltd.  
<https://doi.org/10.1002/9780470027318.a9124>

- Wijayanto, A., Indradewa, D., & Putra, E. T. S. (2015). Quantity and Quality Fresh Yield of Six Sinensis Tea (*Camellia sinensis* (L.) O. Kuntze var *Sinensis*) Clones in Kayulandak Sub-estate PT. Pagilaran. *Vegetalika*, 4, 42–56.
- Zhang, J., Yang, R., Chen, R., Li, Y., Peng, Y., & Liu, C. (2018). Multielemental Analysis Associated with Chemometric Techniques for Geographical Origin Discrimination of Tea Leaves (*Camelia sinensis*) in Guizhou Province, SW China. *Molecules*, 23(11), 3013. <https://doi.org/10.3390/molecules23113013>
- Zhang, J., Yang, R., Li, Y. C., & Ni, X. (2021). The Role of Soil Mineral Multi-elements in Improving the Geographical Origin Discrimination of Tea (*Camellia sinensis*). *Biological Trace Element Research*, 199(11), 4330–4341. <https://doi.org/10.1007/s12011-020-02527-8>
- Zhang, J., Yang, R., Li, Y. C., Wen, X., Peng, Y., & Ni, X. (2020). Use of mineral multi-elemental analysis to authenticate geographical origin of different cultivars of tea in Guizhou, China. *Journal of the Science of Food and Agriculture*, 100(7), 3046–3055. <https://doi.org/10.1002/jsfa.10335>
- Zhao, H., Yu, C., & Li, M. (2017). Effects of geographical origin, variety, season and their interactions on minerals in tea for traceability. *Journal of Food Composition and Analysis*, 63, 15–20. <https://doi.org/10.1016/j.jfca.2017.07.030>
- Zhao, H., Zhang, S., & Zhang, Z. (2017). Relationship between multi-element composition in tea leaves and in provenance soils for geographical traceability. *Food Control*, 76, 82–87. <https://doi.org/10.1016/j.foodcont.2017.01.006>