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Potentiometry in antioxidant activity evaluation of microsuspensions, extracts and living plants

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Antioxidants are a large group of scavengers of reactive oxygen and nitrogen active species in living organism, that are an integral part of the body's antioxidant defense system, which prevents (or reduces) the development of oxidative stress. Plants are the main source of antioxidants. The potentiometric method of Antioxidant Activity (AOA) estimation is the most attractive. The method is based on the interaction of antioxidants with components of the mediator system $K_3[Fe(CN_6)]/K_4[Fe(CN_6)]$. Shift of potential of mediator system when analysed sample introduced into it serves as source of information. The purpose of this study is to develop a potentiometric method for estimating plant AOA. The objects of the study were dried leaves of fruit and berry plants growing in the Urals (*Fragária, Ríbes nígrum, Ríbes úva-críspa*) and living leaves of indoor plants (*Crassula, Schlumbergera, Sansevieria*). AOA of plant extracts and microsuspensions were evaluated without separating the liquid and solid phases, as well as the living leaves without additional sample preparation. It was shown that the water extract obtained for 20 minutes at 80°C has the largest AOA. The use of a water-alcohol extractant (1:1 by volume) increases AOA of plant extracts and microsuspensions by a factor of 1.5–2, which is associated with the involvement of both water- and fat-soluble antioxidants in the zone of the signal-forming reaction. For the first time, the AOA study of a living leaf was performed and it was shown that the AOA of the pulp on the longitudinal section of the leaf plate is approximately an order of magnitude higher than the AOA of the skin of the leaf. The duration of AOA assessment of a living leaf without preliminary sample preparation does not exceed 20 minutes, which is 3 times faster than analysis of plant extracts and microsuspensions, including additional operations of grinding, sifting and heating of plant material. Simplicity and speed, the lack of a multi-stage and long-term preparation of the sample when assessing the AOA living leaf make this method very promising for both laboratory and non-laboratory analysis.

Notes:

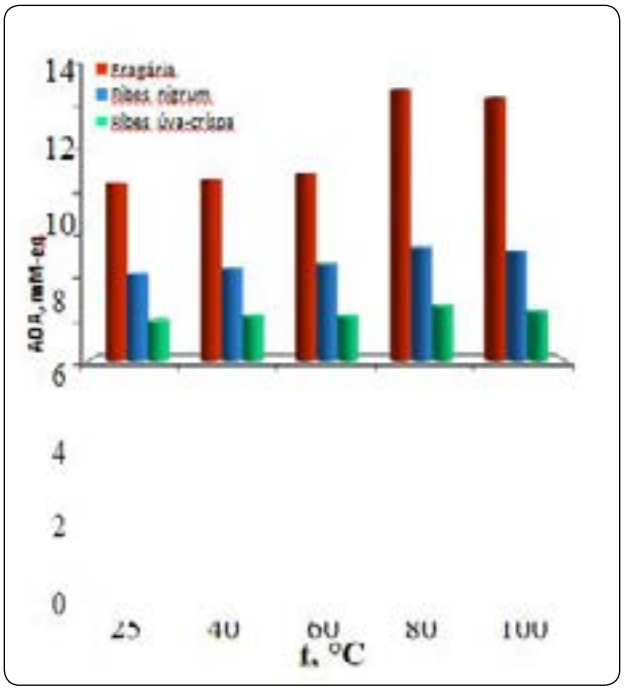

Figure 1: Effect of extraction temperature on AOA

Recent Publications

1. Tian Y, Puganen A, Alakomi H L, et al. (2018) Antioxidative and antibacterial activities of aqueous ethanol extracts of berries, leaves, and branches of berry plants. Food Research International 106:291-303.
2. Cömert E D and Gökmen V (2018) Evolution of food antioxidants as a core topic of food science for a century. Food Research International 105:79-93.
3. Pisoschi A M and Negulescu G P (2011) Methods for total antioxidant activity determination: A review. Biochemistry and Analytical Biochemistry 1:1-10.
4. Ivanova A V, Gerasimova E L and Brainina K Z (2015) Potentiometric study of antioxidant activity: Development and prospects. Critical Reviews in Analytical Chemistry 45:311-322.

Biography

Brainina Kh Z Prof., DSc Ural State Economic University, Honored Scientist of RF, Member-correspondent of Academy of Natural Science of Russia. Education in Chemistry: Ural State, Doctorate degree in Chemistry in Ural State University, DSc Degree in Chemistry in Moscow State University, Professor in Chemistry. From 1968 till now she works for Ural State Economic University in Yekaterinburg (RF). Her research interests are in: electrochemical sensors, stripping voltammetry, environmental monitoring, nanostructured materials electrochemical characterization, oxidative stress and antioxidant activity investigations. She has published more than 500 papers and abstracts in Russian and International Journals and 5 books in stripping analysis in "Chemistry" Moscow (three of them in 1972, 1982, 1988) and by "Willey & Sons", USA (two of them in 1974 and 1993). She has 15 Russian Patents.

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