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Mass Spectrometry & Purification Techniques

Perspective

Resources for Extraction, Evaluation, and Assessment of Natural Antioxidants in Foods and Medicinal Plants

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ABOUT THE STUDY

Reactive Oxygen and Nitrogen Species (ROS and RNS), including superoxide, hydroxyl, and nitric oxide radicals, can harm DNA in biological systems and cause oxidation of lipids and proteins in cells. Normally, the body's antioxidant system can scavenge free radicals, maintaining the proper balance between oxidation and anti-oxidation. However, excessive ROS and RNS are produced when people are exposed to radiation, alcohol, tobacco, or environmental pollutants, which upset the balance between oxidation and anti-oxidation and leads to various chronic and degenerative disorders. By preventing the start or spread of an oxidative chain reaction, functioning as free radical scavengers, quenchers of singlet oxygen, and reducing agents, increasing the intake of exogenous antioxidants might lessen the harm caused by oxidative stress.

Exogenous antioxidants come mostly from plants used as food and medicine, including fruits, vegetables, cereals, mushrooms, drinks, flowers, spices, and traditional medicinal herbs. In addition, the sectors that process agricultural by-products provide additional potential sources of natural antioxidants. Polyphenols (phenolic acids, flavonoids, anthocyanins, lignans, and stilbenes), carotenoids (xanthophylls and carotenes), and vitamins make up the majority of these naturally occurring antioxidants derived from plant sources (Vitamin E and C). These natural antioxidants typically have a wide range of biological effects, including anti-inflammatory, antibacterial, antiviral, anti-aging, and anticancer. Polyphenols and carotenoids, in particular, are particularly effective at this.

Considering their significant health benefits, food science and nutrition are paying close attention to effective extraction techniques for natural antioxidants, adequate measurement of antioxidant activity, and their primary sources in foods and medicinal plants. Several environmentally friendly non-conventional techniques have been developed to decrease operational time and the use of organic solvents in order to increase the extraction efficiency of antioxidant components from plant materials. These techniques include ultrasound-assisted extraction, microwave-assisted extraction, enzyme-assisted extraction, pressurized liquid extraction, supercritical fluid extraction, high hydrostatic pressure extraction, pulsed electric field extraction, and high voltage electrical discharge.

Diverse evaluation assays, such as the Trolox Equivalence Antioxidant Capacity (TEAC) assay, the Ferric Ion Reducing Antioxidant Power (FRAP) assay, the Oxygen Radical Absorbance Capacity (ORAC) assay, the inhibiting the oxidation of Low-Density Lipoprotein (LDL) assay, the cellular antioxidant activity assay, etc., have been developed in order to further assess the antioxidant capacities of extracts from natural products, particularly those frequently consumed.

These tests have been employed to rank antioxidant plants and suggest the eating of the best antioxidant foods. The goal of this paper is to provide an overview of the processes used to extract natural antioxidants, measure antioxidant activity, and identify their primary sources in foods and medicinal plants.

In the past three decades, the food and pharmaceutical industries have used Ultrasound Assisted Extraction (UAE) extensively as an effective extraction technique. The cavitation phenomena serve as the basis for the mechanism. Ultrasound propagates through a succession of compression and rarefaction waves in liquid systems, which can cause cavitation bubbles to form in the fluid. These bubbles expand over a few cycles until they reach a critical size, at which time they burst and release a huge amount of energy that would cause them to reach extremely high temperatures (5000 K) and pressures (1000 atmospheres) at room temperature. High warmth and pressure would break plant cell walls during the ultrasound-assisted extraction of bioactive components from plant materials, allowing bioactive compounds to more easily leak out and improving mass transfer. In contrast to microwave assisted extraction, heat transfer in UAE occurs from the outside of the plant cell to the interior.

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Received: 02-Jan-2023, Manuscript No. MSO-23-21761; **Editor assigned:** 06-Jan-2023, Pre QC No. MSO-23-21761 (PQ); **Reviewed:** 27-Jan-2023, QC No. MSO-23-21761; **Revised:** 03-Feb-2023, Manuscript No. MSO-23-21761 (R); **Published:** 10-Feb-2023, DOI: 10.35248/2469-9861.23.9.174

Citation: Dashbazar J (2023) Resources for Extraction, Evaluation, and Assessment of Natural Antioxidants in Foods and Medicinal Plants. J Mass Spectrum Purif Tech. 9:174.