

Antioxidant and Its Applications

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ABSTRACT

An antioxidant is a molecule that inhibits the oxidation of other molecules. Oxidation is a chemical reaction that can produce free radicals, leading to chain reactions that may damage cells. Antioxidants such as ascorbic acid (vitamin C) terminate these chain reactions. Different abiotic stresses lead to the overproduction of responsive oxygen species (ROS) in plants and creatures which are exceedingly receptive and poisonous making harm proteins, lipids, starches and DNA consequently prompts oxidative anxiety. This oxidative anxiety causes harm to tissues and results in vast number of sicknesses. Antioxidants balance the impacts of ROS and in this manner help in counteracting ailments. Antioxidants can be characteristic or engineered. Common cancer prevention agents can be taken up through eating regimen as they are available in organic products, vegetables and flavours. There are additionally sure engineered cancer prevention agents like BHT and BHA that likewise hinder oxidation. However, these synthesized cancer prevention agents have now been accounted for to be risky to people so the quest for non-poisonous cancer prevention agents have strengthened in the late years.

INTRODUCTION

Oxygen is significant for the life of aerobic living beings. However, it might get to be poisonous if supplied at higher amount. Dioxygen in its ground state is moderately lifeless; its fractional decrease offers ascend to dynamic oxygen species e.g., singlet oxygen, super oxide radical anion, and hydrogen peroxide. This is somewhat due to the oxidative anxiety that is essentially the unfriendly impact of oxidant on physiological capacity. Oxidative stress is an after effect of imbalance between receptive oxygen species (ROS) and antioxidants protections. This oxidative anxiety deregulates a progression of cell capacities and also prompts different neurotic conditions like AIDS, maturing, joint inflammation, asthma, immune system diseases, carcinogenesis, cardiovascular brokenness, waterfall, diabetes, neurodegenerative ailments, Alzheimer's diseases, Parkinson's dementia etc. [1-5]

The oxidative harm to DNA may assume essential part in maturing and the presence of intracellular oxygen additionally can be dependable to start a chain of unintentional reaction at the cell level and these response cause harm to basic cell biomolecules. These radicals are exceedingly dangerous and in this manner produce oxidative stress in plants. [1] [6-10].

Free radicals are an atoms or molecules that bear an unpaired electron and are to a great degree receptive, fit for engaging in fast change response that destabilize different particles and create numerous all the more free radicals. In plants and creatures these free radicals are deactivated by Antioxidant. These antioxidants go about as an inhibitor of the process of oxidation, even at moderately little focus and therefore have various physiological parts in the body. Antioxidant constituents of plat materials go about as radical foragers and believer the radicals to less receptive species [5] [11-15]. An antioxidant is any substance that at low fixation delays the oxidation of proteins, starches, lipids and DNA.

Three Principle Classifications

1. The primary line barrier antioxidants which incorporate superoxide dismutase (SOD), catalase (CAT), glutathione reductase (GR) and minerals like Se, Cu, Zn and so on [16].
2. The second line protection antioxidants which incorporate glutathione (GSH), vitamin C, egg whites, vitamin E, carotenoids, flavonoids and so on [5,17].
3. The third line antioxidants which incorporate a complex gathering of proteins for repair of harmed DNA, harmed proteins, oxidized lipids and peroxides. Cases: Lipase, Protease, DNA repair proteins, Transferases, Methionine Sulphoxide Reductase etc. [5,18]

Antioxidants that have customarily been utilized to inhibit oxidation in sustenance additionally extinguish dreaded free radicals and stop oxidation chains *in-vivo*, so they have become to be seen by numerous as nature's answer to ecological and physiological anxiety, atherosclerosis, and growth. The nutraceutical pattern towards multiplying the effect of normal cancer prevention agents that settle sustenance and augment wellbeing sway presents unmistakable difficulties in assessing cancer prevention agent action of cleansed singular mixes, blended concentrates, and endogenous nourishment networks and advancing applications [19-22].

PLANT SOURCE OF ANTIOXIDANTS

Medicinal plants are an important source of antioxidants. Natural antioxidants increase the antioxidant capacity of the plasma and reduce the risk of certain diseases such as cancer, heart diseases and stroke. The secondary metabolites like phenolic and flavonoids from plants have been reported to be potent free radical scavengers. They are found in all parts of plants such as leaves, fruits, seeds, roots and bark [23-26]. In nature there are a wide variety of naturally occurring antioxidants which are different in their composition, physical and chemical properties, mechanism and site of action [27]. There is a long list of antioxidant plants of which, some have been discussed in

Table No 1.

| S. No. | Name of plants | Common English name | Family | Plant part used |
|--------|-----------------------------|---------------------|-------------------------|-----------------|
| 1. | <i>Aeglemarmelos</i> | Bengal quince | <i>Rutaceae</i> | Fruit pulp |
| 2. | <i>Allium cepa</i> | Onion | <i>Amaryllidaceae</i> | Bulb |
| 3. | <i>Aloe vera</i> | Indian aloe | <i>Xanthorrhoeaceae</i> | Leaf |
| 4. | <i>Asparagus racemosus</i> | Satavar | <i>Liliaceae</i> | Shoot |
| 5. | <i>Azadirachtaindica</i> | Neem | <i>Meliaceae</i> | Leaf |
| 6. | <i>Bacopamonniera</i> | Brahmi | <i>Plantaginaceae</i> | Leaf |
| 7. | <i>Beta vuulgaris</i> | Beet root | <i>Amaranthaceae</i> | Root |
| 8. | <i>Camellia sinensis</i> | Green tea | <i>Theaceae</i> | Green tea |
| 9. | <i>Cinnamomum tamala</i> | Tejpat | <i>Lauraceae</i> | Tejpat |
| 10. | <i>Curcuma longa</i> | Turmeric | <i>Zingiberaceae</i> | Turmeric |
| 11. | <i>Daucuscarota</i> | Carrot | <i>Apiaceae</i> | Root |
| 12. | <i>Embllica officinalis</i> | Amla | <i>Euphorbiaceae</i> | Fruit |
| 13. | <i>Ocimum sanctum</i> | Tulsi | <i>Lamiaceae</i> | Leaf |
| 14. | <i>Prunus domestica</i> | Plums | <i>Rosaceae</i> | Fruit |
| 15. | <i>Zingiber officinale</i> | Ginger | <i>Zigiberaceae</i> | Rhizome |
| 16. | <i>Solanum nigrum</i> | Black nightshade | <i>Solanaceae</i> | Leaf |
| 17. | <i>Solanum tuberosum</i> | Potato | <i>Solanaceae</i> | Tuber |
| 18. | <i>Terminalia bellarica</i> | Behda | <i>Combretaceae</i> | Fruit |

Table 1: Some of the plants commonly used as the potential source of antioxidants[28-33].

Due to toxicological concerns of synthetic antioxidants there have been increasing interests in identifying phenolic compounds in plants to minimize or retard lipid oxidation in lipid-based food products. Most of these natural antioxidants come from fruits, vegetables, spices, grains, and herbs [2,34-35].

Hundreds of natural phenolic compounds have been reported to possess high antioxidant properties. Their use in foods, however, is limited by certain requirements not the least of which is adequate proof of safety. Only a few of them can be commercially applied in foods. The main lipid-soluble antioxidants currently used in food are monohydric or polyhydric phenols with various ring substitutions [36-37].

For maximum efficiency, primary antioxidants are often used in combination with other phenolic antioxidants or with various metal sequestering agents, e.g., tocopherols with citric acid and isopropyl citrate. Most important commercially available natural antioxidants are tocopherols (vitamin E), ascorbic acid (vitamin C) and rosemary extract [38-40]. Compounds such as β -carotene, ascorbic acids have demonstrated to have antioxidant and synergistic activity in despite of their non-phenolic structure [41].

APPLICATIONS OF ANTIOXIDANTS

Food Antioxidant

Peoples in this day and age need to eat more beneficial nourishment to stay fit and this is being accomplished by adding unsaturated and polyunsaturated fats in the food items being promoted. The nature of any item is measured on the size of certain parameters and the endorsement of the same by its shoppers [42].

Essentially, as far as nourishment quality it is measured on parameters like odor, taste and its appearance. As the human way of life furthermore its perspective towards nourishment are changing along these lines there is an expanded movement saw from helpful sustenance to ready to eat item classification. For this there is need of certain potential wellbeing ensuring elements named as Antioxidants [43-45].

Antioxidants have wide application as these are used as added substances in fats and oils and in sustenance handling businesses to forestall nourishment deterioration. It is contemplated that flavors and a few herbs are great wellsprings of numerous potential cancer prevention agents. These are added to nourishment which contains unsaturated fats to make them last more and to keep them from turning malodorous under oxidative anxiety. Accordingly, endeavors are being made to lessen oxidation by expanding expansion of cancer prevention agents to sustenance. Manufactured phenolic cancer prevention agents (butylatedhydroxyanisole [BHA], butylatedhydroxytoluene [BHT], and propyl gallate) have restrained activity on oxidation; chelating specialists, for example, ethylene diamine tetra acidic corrosive (EDTA), tie metals and in along these lines diminish its metal support in the response [18,46-48].

A few vitamins (ascorbic acid [AA] and tocopherol), numerous herbs and spices (rosemary, thyme, oregano, sage, basil, pepper, clove, cinnamon, and nutmeg), and plant extract (tea and grape seed) contain cell antioxidants segments accordingly giving antioxidant properties to the compound. The normal phenolic cell reinforcements regularly go about as diminishing specialists, end the free radical chain response by expelling the same, assimilate light in the bright (UV) district (100 - 400 nm), and chelate move metals, in this way repress oxidation responses without anyone else's input being oxidized furthermore keep the creation of off-scents also tastes [49-52]. In spite of the fact that oxidation responses are life essential they can be harming also, consequently it is extremely key to keep up the complex arrangement of numerous cancer prevention agents healthfully such as selenium, vitamin C and E which have huge immunostimulant, calming and against cancer-causing impacts. In addition, they have a critical part in ensuring the basic uprightness of ischemic or hypoxic tissues and, to some extent in against thrombotic activities as well. In this manner in light of such different utilizations of antioxidants, their utilizations are in effect broadly contemplated in pharmacology, more specifically in the treatment for growth, stroke, cardiovascular furthermore, neurodegenerative sicknesses and certain diabetic difficulties [53-57].

Role in Food

Antioxidants assume an essential part in both sustenance frameworks and in addition in the human body to lessen oxidative procedures. In nourishment frameworks, impeding lipid peroxidation and development of auxiliary lipid peroxidation item can be forestalled by the utilization of wholesome cancer prevention agents along these lines keeping up flavor, surface, and the shade of the nourishment item amid capacity. Additionally cancer prevention agents are useful in lessening protein oxidation and in addition the communication of lipid-determined carbonyls with proteins that prompts a change of protein function [3] [58-60].

Common cancer prevention agents, for example, vitamin C and tocopherols along with natural concentrates like rosemary, sage and tea have as of now been marketed to be utilized as contrasting options to engineered cancer prevention agents in nourishment systems. Proteins and protein hydrolysates derived from sources like milk, soya, egg, and fish too show cancer prevention agent movement in different muscle foods [61-63].

In the human body, oxidative harm brought on by receptive oxygen and responsive nitrogen species, for example, hydroxyl radicals, peroxy radicals, superoxide anion, furthermore, peroxy nitrite is ensured with the assistance of

endogenous antioxidants. The endogenous antioxidative frameworks incorporate compounds, for example, superoxide dismutase, catalase, and glutathione peroxidase, alongside different nonenzymatic mixes, for example, selenium, α -tocopherol, and vitamin C. Apart from these, commitment of amino acids, peptides, and proteins likewise helps in general antioxidative limit of cells and towards keeping up the strength of organic tissues [64-67]. For instance, blood proteins are assessed to search 10-50% of the peroxy radicals framed in the plasma. Peptides like carnosine, anserine, and glutathione are notable for their endogenous antioxidative activity. However, with movement of age the antioxidant prooxidants parity in human body changes alongside other variables, for example, natural poisons, exhaustion, over the top liquor admission, and high fat eating methodologies. The plasma and cell cancer prevention agent potential and additionally the assimilation of supplements, counting cancer prevention agents, steadily decrease with advancing age. Researchers have additionally shown an amassing of protein carbonyls with the maturing procedure in people as a after effect of the activity of free radicals on the proteins [68-70].

Use of dietary cancer prevention agents has been perceived as conceivably successful to advance human wellbeing by expanding the body's cancer prevention agent load. Dietary cancer prevention agent supplements and practical nourishments containing cancer prevention agents like α -tocopherol, vitamin C, or plant derived phytochemicals, for example, lycopene, lutein, green tea concentrate, and grape seed extricates locate a gigantic interest in the current marketplace [71-72].

Role of Antioxidants in Diabetes

Diabetes is a noteworthy issue in all living being. It is a chronic metabolic confusion described by outright or relative inadequacies in insulin discharge or non-emission of insulin bringing about unending hyperglycaemia and unsettling influences of starch, lipid, and protein digestion system. As a result of the metabolic de-courses of action in diabetics, different entanglements create including both large scale and small scale vascular dysfunctions. Various studies have appeared that diabetes mellitus is connected with expanded development of free radicals and declines cancer prevention agent potential which, prompts unsettling influences in a critical position between radical arrangement also, insurance against which eventually brings about oxidative harm of cell parts, for example, proteins, lipids, and nucleic acids. An expanded oxidative anxiety can be seen in both insulin subordinate (Type 1) and noninsulin-subordinate diabetes (type 2) [73-75].

Among different elements that are in charge of expanded oxidative anxiety, glucose autooxidation is most in charge of the generation of free radicals. Different variables incorporate cell oxidation/ diminishment lopsided characteristics and decrease in cell reinforcement guards (counting diminished cell cancer prevention agent levels and a diminishment in the movement of chemicals that discard free radicals). What's more, expanded levels of some prooxidants for example, ferritin and homocysteine are likewise watched. Another essential component is the communication of cutting edge glycation final results (AGEs) with particular cell receptors called AGE receptors (RAGE) [76-80].

It has been found in people with larger amounts of serum cancer prevention agents; especially serum tocopherol appears lower danger of sort 2 diabetes mellitus. The essential protection against oxidative anxiety in the cell incorporates decreased glutathione and glutathione peroxidase. The most normal cell reinforcement insufficiencies reported in diabetes are lower levels of ascorbate, glutathione and superoxide dismutase. In diabetic neutrophils and monocytes lower centralizations of lessened glutathione have been reported [81-84].

Plants especially those with abnormal states and solid cell reinforcement mixes have an imperative part in moving forward the clutters including oxidative stretch, for example, diabetes mellitus. There are numerous examinations which have considered the impact of these plants and their cell reinforcement fixings on diabetes and its difficulties and accomplished great results demonstrating that impacts of plants with large amounts of cancer prevention agents in the administration of diabetes mellitus [82,85-88].

Antioxidants and Their Therapeutic Usage

Significant utilization of antioxidants through natural products or vegetables, which are considered as great wellsprings of cancer prevention agents help in avoidance of cardiovascular maladies. Cancer prevention agents are also considered as possible treatments for Neurodegenerative diseases, e.g., Alzheimer's ailment, Parkinson's diseases and Amyotrophic lateral sclerosis. Inordinate oxidative harm to the cells prompts a few obsessive conditions, for example, rheumatoid, joint inflammation, cardiovascular clutters, ulcerogenesis and gained immunodeficiency sicknesses. Cancer prevention agents have been accounted for to play a particular part in the treatment of these diseases/issues [89-92].

An incomprehensible number of studies have explained the pretended by the cell reinforcements amid oxidative anxiety prompting end number of wellbeing ailments, including leukemia, thalassaemia, ischemic stroke,

hemodialysis, rheumatoid joint inflammation, fundamentally sick patients and post menopause of ladies, schizophrenia and dejection. There has been a huge significance of cancer prevention agents in tending to the issue identified with male barrenness what's more, adequacy and wellbeing of cell reinforcement supplementation has affirmed in the therapeutic treatment of idiopathic male barrenness [93-95].

In the last couple of years, different antioxidants have been examined that prevent hyperoxaluria mediated Nephrolithiasis. It has been found that antioxidants have an incredible potential for treatment of Nephrolithiasis (Urinary tract stone illness). There are reports recommending cancer prevention agent supplement treatment as an adjuvant treatment is helpful in patients with anxiety initiated psychiatric scatters and summed up tension disarranges [96-100].

CONCLUSION

Numerous substances devoured by a man either through foods, beverages and inhalation, even impact of exogenous material like UV radiation on the skin might be damaging to the wellbeing and along these lines shortening the life range of man. Whenever free radicals are created in the body system of an individual it causes harm which inevitably leads demise in a short time [5]. Era of free radicals through lipid peroxidation is created because of nonstop utilization of the same vegetable oil which is not even appropriately stored and by re-utilizing the rancid oil. The reason now and again could financial however at that point it is very harming to the wellbeing [80] [99]. Today, smoking and unending liquor abuses are socio-social issues on the planet because of diminishing level of numerous imperative antioxidants in the serum which is impeding to the wellbeing. The report has demonstrated that appropriate admission of cancer prevention agents will help in extinguishing all these unavoidably free radicals present in the body and along these lines enhancing the wellbeing by bringing down the danger of different ailments, e.g., growth. Cancer prevention agents are additionally making a difference in shielding the skin from sun presentation unpleasantness, wrinkle profundity, ultraviolet induced skin tumor and skin swelling from daylight. Thus these cancer prevention agents are utilized as a part of body creams, in order to shield the skin from daylight. To overcome these issues, there is a requirement for legitimate introduction on the need of adjusted eating regimen admission which will supply the much needed antioxidants [1] [100].

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