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Journal of Plant Biochemistry & Physiology

Perspective

Potential of Plant Lutein and Its Applications

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DESCRIPTION

Lutein is the most abundant xanthophyll in the photosynthetic apparatus of higher plants. It binds to site L1 of all Lhc proteins, whose occupancy is indispensable for protein folding and quenching chlorophyll triplets. Thus, the lack of a visible phenotype in mutants lacking lutein has been surprising. Even though lutein actually has a yellowish color, it's found in the highest amounts in green, leafy vegetables like kale, spinach and collard greens their green chlorophyll masks the yellow pigments. Zucchini, squash, broccoli, corn, peas and brussels sprouts also provide lutein. Light on the remarkable potential of plant lutein and its significance in promoting optimal health. Plant lutein, renowned for its ability to shield plants from the damaging effects of sunlight, serves a similar protective role within our bodies. Acting as a potent antioxidant, lutein helps neutralize harmful free radicals and combat oxidative stress, thus minimizing cellular damage. Studies have revealed that lutein plays a pivotal role in maintaining eye health, specifically by protecting against Age-Related Macular Degeneration and cataracts. By absorbing blue light and reducing oxidative stress in the macula, lutein acts as a natural shield for our precious eyesight. Lutein is composed of a polyene chain consisting of 40 carbon atoms and two oxygen atoms. It belongs to the class of carotenoids, which are tetraterpenes synthesized by plants and some microorganisms.

The specific structure of lutein includes a conjugated system of double bonds along the polyene chain, which gives it its characteristic yellow to orange color. In plants, lutein plays a crucial role in photosynthesis, the process by which plants convert sunlight into chemical energy to fuel their growth and development. Lutein is one of the primary pigments involved in capturing light energy and transferring it to chlorophyll molecules for the production of glucose and oxygen. Lutein helps in absorbing light energy across a broad range of wavelengths. It acts as an accessory pigment, complementing chlorophyll in capturing light and expanding the range of light that can be utilized by plants. This helps optimize the efficiency of photosynthesis. While light is essential for photosynthesis, excessive light can also be harmful to plants. High-intensity light and certain wavelengths can lead to the production of harmful Reactive Oxygen Species (ROS) within plant cells. Lutein acts as a photo protective agent by dissipating excess light energy as heat and preventing the formation of ROS. This helps protect the plant's delicate photosynthetic machinery from damage. Lutein, like other carotenoids, possesses antioxidant properties. It helps neutralize free radicals produced during normal metabolic processes or as a result of environmental stresses such as UV radiation, pollution, or drought. By scavenging these free radicals, lutein helps reduce oxidative stress and prevents cellular damage in plants. Lutein is involved in a process called Non-Photochemical Quenching (NPQ), which helps dissipate excess energy as heat. When light intensity exceeds the capacity for energy utilization in photosynthesis, lutein participates in non-photochemical quenching to prevent the formation of reactive oxygen species and protect the photosystems from damage. Overall, lutein plays a crucial role in protecting plants from photo damage, oxidative stress, and other harmful effects of environmental factors. It contributes to the efficient functioning of photosynthesis and ensures the plant's survival and productivity in various conditions.

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Received: 09-Jan-2023, Manuscript No. JPBP-23-24400; **Editor assigned:** 11-Jan-2023, PreQC No. JPBP-23-24400 (PQ); **Reviewed:** 25-Jan-2023, QC No. JPBP-23-24400; **Revised:** 01-Feb-2023, Manuscript No. JPBP-23-24400 (R); **Published:** 08-Feb-2023, DOI: 10.35248/2329-9029.23.11.264

Citation: Andrew J (2023) Potential of Plant Lutein and Its Applications. J Plant Biochem Physiol. 11:264.