

Changes of the Antioxidants in *Gynura Bicolor* Under Different Light Sources

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Abstract: During the space flight, the high-energy radiation in the universe may cause a number of health-relative problems such as the increased risk of cancer induction in astronauts. Recent studies have shown that a diet rich in antioxidants can mitigate the harmful effects of the radiation with high energy and particle charge during long-term space flight. Therefore, planting the vegetables rich in antioxidants in the space environment can not only increase the dietary diversity of the astronauts, but also reduce the risk of space radiation to the astronauts. *Gynura bicolor* D.C which is a stem less herb vegetable and is unique in China, belongs to Composite and *Gynura*, is rich in antioxidants and serve as one of the candidate plants in the life support system. In this study, different light sources including high pressure sodium, fluorescent light and light-emitting diodes were utilized to investigate their effects on the changes of the antioxidants in *Gynura bicolor* D.C. The effects of different light sources on the antioxidants in *Gynura bicolor* D.C were studied through analysis on the changes of the antioxidant activity indicators including polyphenols, flavonoids, glutathione, FRAP and DPPH in *Gynura bicolor* D.C. And then the photoregulation

mechanism on the synthesis and decomposition of antioxidants were analyzed and explained. Finally, the feasibility of cultivating *Gynura bicolor* D.C with three different light sources was evaluated and the most suitable type of light source for the formation of antioxidants in *Gynura bicolor* D.C was determined.

Key words: *Gynura bicolor* D.C, Antioxidants, Light Sources

Introduction

During the space flight, the high-energy radiation in the universe may cause a number of health-relative problems such as the increased risk of cancer induction in astronauts.

Recent studies have shown that a diet rich in antioxidants can mitigate the harmful effects of the radiation with high energy and particle charge during long-term space flight. Therefore, planting the vegetables rich in antioxidants in the space environment can not only increase the dietary diversity of the astronauts, but also reduce the risk of space radiation to the astronauts.

Gynura bicolor D.C which is a stem less herb vegetable and is unique in China, belongs to Composite and Gynura, is rich in antioxidants and serve as one of the candidate plants in the life support system

Materials and Methods

Plant Cultivation

Gynura bicolor D.C were hydroponically grown in the environmental growth

chambers with 22°C, 70% relative humidity, a photoperiod of 16/8 light/dark.

Three different light sources were utilized: high pressure sodium, fluorescent T-5 light and light-emitting diodes.

Sampling and Extract Preparation

30 day old plants were sampled and freeze-dried. 0.2g of freeze-dried tissue was extracted with 80% methanol 3 times, and then removed the methanol with rotary evaporation, extracted the remains with water. Extracts were tested for total antioxidant activity on the same day of extraction.

Sample analysis

The effects of different light sources on the antioxidants in *Gynura bicolor* D.C were studied through analysis on the changes of the antioxidant activity indicators including polyphenols, flavonoids, glutathione, FRAP and DPPH in *Gynura bicolor* D.C.

Results and Discussion

The contents of phenolic compounds and flavonoids in *Gynura bicolor* D.C were greatly increased by the Fluorescent T-5 lamp treatment. The phenolic compounds found in fruits and vegetables have received substantial interest because of their potential antioxidant benefits, while flavonoids are strong free-radical scavengers. Therefore, these compounds are often used to assess the antioxidant status for vegetable quality. Interestingly, the contents of all these antioxidants in *Gynura bicolor* D.C were greatly increased by the Fluorescent T-5 lamp treatment (Fig. 1),

suggesting that the antioxidant capacity had

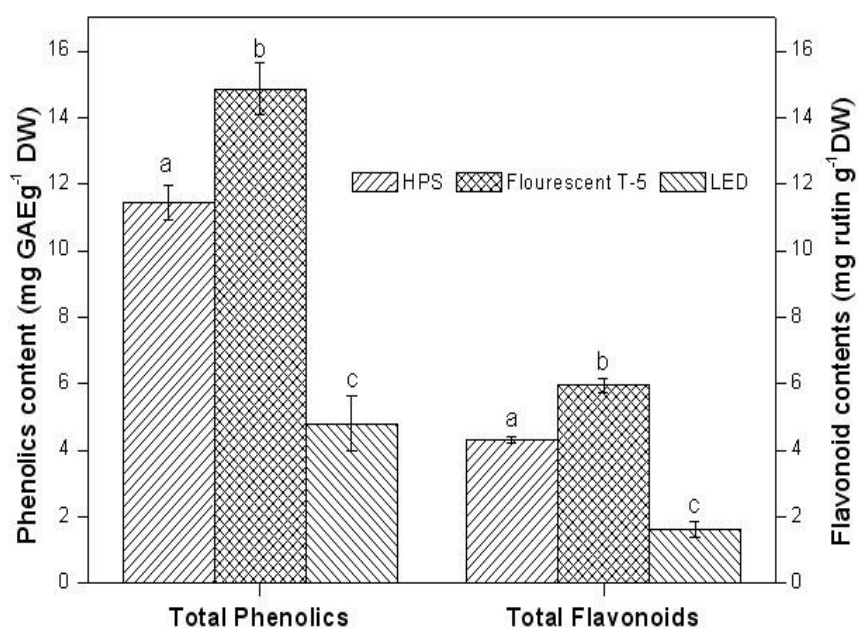


Fig. 1 The contents of phenolic compounds and fiavonoids in *Gynura bicolor* D.C

The DPPH radical-scavenging activities of the extracts of treatment of Fluorescent T-5 lamp increased higher than others. (Fig. 2) The more antioxidants in the extract, the more the DPPH reduction will occur. More complete reduction of DPPH is related to the high scavenging activity performed by a particular sample. Prasad et al. (2009) reported that phenolic compounds reduced DPPH radicals through their hydrogen donating ability. The result obtained in this investigation revealed that the DPPH radical scavenging activities of treatment of Fluorescent T-5 lamp might be attributed to their hydrogen-donating ability.

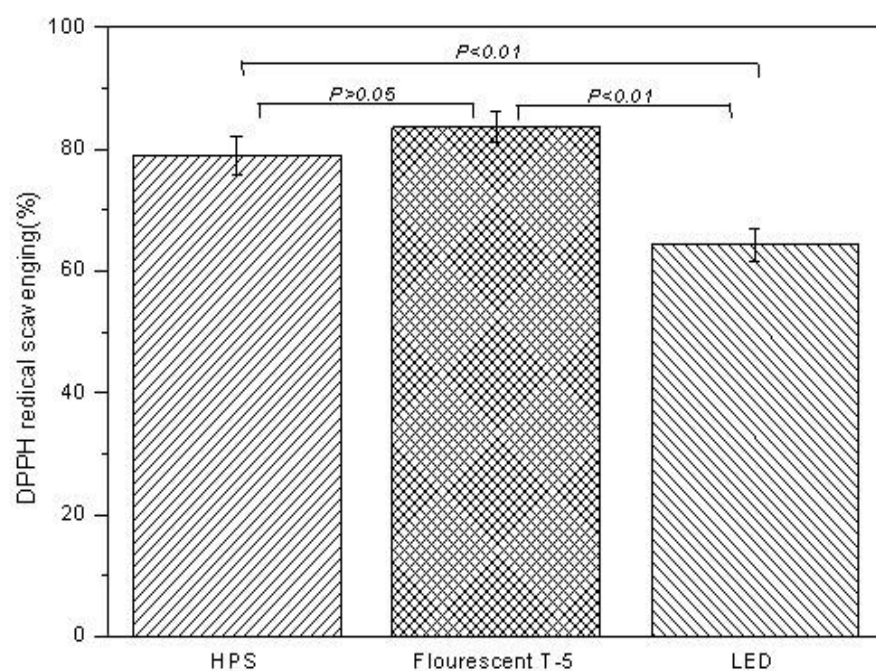


Fig. 2 DPPH radical scavenging activity of the extracts of *Gynura bicolor* D.Cunder different light sources

The FRAP of extracts were, in descending order, Fluorescent T-5 lamp > HPS > LED. (Fig. 3) Principally, FRAP assay treats the antioxidants in the sample as a reductant in a redox-linked colorimetric reaction. This assay is relatively simple and easy to conduct. The FRAP assay measures the reducing potential of antioxidants by reaction with ferric tripyridyltriazine (Fe^{3+} -TPTZ) complex, producing a blue color from the ferrous form that can be detected at absorbance 593 nm. Antioxidant compounds that act as reducing agents exert their effect by donating a hydrogen atom to the ferric complex and thus breaking the radical chain reaction.

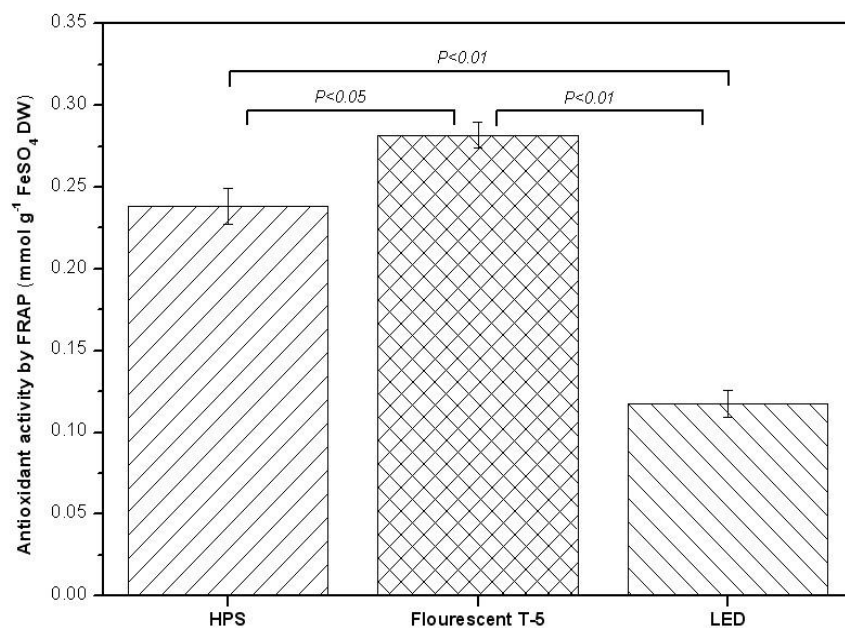


Fig. 3 FRAP of the extracts of *Gynura bicolor* D.C under different light sources

Treatment of Flourescent T-5 lamp could significantly increase the content of the GSH. (Fig. 4) It is widely accepted that GSH serve as good oxidant scavengers. In the present research, treatment of Flourescent T-5 lamp could significantly increase the content of the GSH.

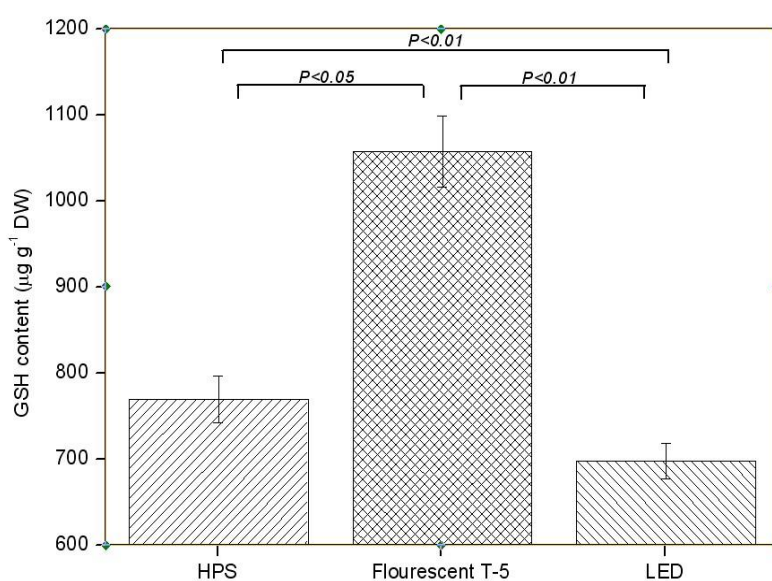


Fig. 4The GSH in *Gynura bicolor* D.C under different light sources

These results are generally showed that the antioxidant potential of extracts were, in descending order, Flourescent T-5 lamp> HPS >LED. These data indicate that the bioprotectant properties of *Gynura bicolor D.C* can be increased by altering the spectral quality of light. These differences are likely associated with photomorphogenic control of development.

Flourescent T-5 lamp is more benefit for improving the quality of *Gynura bicolor D.C*, which is the optimal light source in this study.

Conclusion

LED constituted by simple color is not conducive to the accumulation of antioxidants in *Gynura bicolor D.C*, and lower the quanlity of the plants. Hence, we cannot rule out the possibility of the Spectral composition.

Additional work is required to research the effect of the quanlity of *Gynura bicolor D.C* under LED constituted by different composition of color and elucidate the photoregulatory control of the synthesis and degradation of the antioxidants.

Acknowledgement

This work was supported by Grants from Ministry of Science and Technology of China (2009DFR30650)

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