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ENZYMIC ANTIOXIDANTS AND LIPID PEROXIDATION OF THE SELECTED GLVS GROWN IN FRESH WATER, 75% SILK DYEING EFFLUENT AND BIOTREATED EFFLUENT

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ABSTRACT

The Green Leafy Vegetables (GLVs) such as *Brassica juncea* (mustard), *Trigonella foenum* (fenugreek), *Amaranthus polygonoides* (sirukeerai), *Amaranthus tristis* (araikeerai) and *Sesbania grandiflora* (agati) were grown to study their Enzymic antioxidants, Non enzymic antioxidants and Lipid peroxidation parameters in normal, 75% of silk dyeing effluent and biotreated effluent conditions as pot study. The parameters of Enzymic antioxidants namely Superoxide dismutase, Peroxidase activity were analyzed. Also parameters of Lipid peroxidation such as H_2O_2 Scavenging assay, DPPH activity were evaluated on its 45th day of its growth. Among the GLVs, *Amaranthus polygonoides* grown in silk dyeing effluent shows the highest Superoxide dismutase and Peroxidase activity. Among the GLVs, *S.grandiflora* had shown the highest H_2O_2 scavenging activity. A comparable DPPH activity was noticed in all the GLVs with the maximum activity for *B.juncea*.

KEYWORDS: mustard, fenugreek, sirukeerai, araikeerai, agati, Superoxide dismutase, Peroxidase activity, H_2O_2 Scavenging assay, DPPH activity.

INTRODUCTION

Water contamination caused by industrial effluent discharges with enhanced concentration of nutrients, sediments and toxic substances has become an alarming trend worldwide. It has become a question of considerable public and scientific concern in the light of evidence of their acute toxicity to human health, to biological ecosystems.[3] The crop development and eco-specific bioinoculants acts as biofertilizers is perceived as one of the most exciting areas owing to its potential of solving multifarious environmental problems concurrently.[2] Impact of the textile wastewater on agricultural crops has been studied previously by several researchers. Here in this paper an attempt was made to analyse the biofertilizer mediated decolorization and degradation of Silk dyeing effluent and its effect on the enzymic and lipid peroxidation of GLVs with different treatments.

MATERIALS AND METHOD

Collection of silk dyeing effluent: The silk dyeing effluent was collected from the effluent disposal site of small scale silk dyeing industry in airtight plastic containers, located at Seelanaickenpatti in Salem district.

Collection of Biofertilizers: The biofertilizer *Pseudomonas fluorescens* was collected from the Tamil Nadu Agricultural University,Coimbatore.

Soil preparation for the study: The red soil and the sand were mixed at the ratio of 3:1. Each pot was filled with 7 kg of soil. The five GLVs were grown with four replicates in fresh water, 75% of silk dyeing effluent and the biofertilizer treated effluent (The biofertilizer *Pseudomonas fluorescens* was mixed at the rate of 5 tonnes ha-1 in 75% of crude effluent. The bacterial concentration of the biofertilizer was 10^8 Colony forming units (CFU) ml^{-1}.

Collection of Seeds: Seeds of mustard (*Brassica juncea*), fenugreek (*Trigonella foenum*), Sirukeerai (*Amaranthus polygonoides*), Araikeerai (*Amaranthus tristis)* and Agati (*Sesbania grandiflora*) were collected from Superseeds Nursery, Coimbatore.

Seed sowing and maintenance of plants: About 20 seeds were sown in each pot and were allowed to germinate. Neem cake was mixed with water and poured around the pots as pest control. Fresh water, 75% of silk dyeing effluent and biotreated effluent with *Pseudomonas fluorescens* have been used as different treatments to the selected GLVs and plants were harvested on the 45^{th} day.

Estimation of superoxide dismutase activity: The superoxide dismutase activity was determined by the protocol given in Misra and Fridovich, 1972.

Estimation of peroxidase activity: The peroxidase activity was determined by the procedure given in Reddy *et al.*, 1995.

Estimation of Hydrogen peroxide scavenging assay: The peroxidase activity was determined by Ruch *et al.*, 1989.

Estimation of DPPH assay: The DPPH assay was determined by the method given in Mensor *et al.*, 2001.

RESULTS AND DISCUSSION

Activities Enzymic, Non enzymic antioxidants and Lipid peroxidation of the selected GLVs grown in fresh water

The activity of SOD of all GLVs ranges between 1.00- 3.10 U/g and the highest activity was reported in *A.tristis* and *S.grandiflora* and the lowest activity in *B.juncea*. A comparative study by Karthikeyan *et al.* (2007) reported that the application of biofertilizers resulted in increased SOD activity in the *Catharanthus roseus* plant. A significantly higher ($p<0.05$) peroxidase activity was recorded by *S.grandiflora* which was followed by *A.tristis* and *B.juncea* whereas the *T.foenum* and *A.polygonoides* were shown the minimum peroxidase activity. A similar peroxidase activity was reported in *Cephalandra indica* by Vijayakumari *et al.* (2012). A study by Mahmood (2010) also reported that the application of Rhizobacteria significantly increased the peroxidase activity in the leaves of banana plants.

The free radical scavenging activity of H_2O_2 was in the range of 61-93%. *S.grandiflora* had shown a significantly ($p<0.05$) H_2O_2 scavenging activity which was followed by *B.juncea* and *A.tristis*. The *T.foenum* and *A.polygonoides* had shown similar H_2O_2 scavenging activity. *S.grandiflora* was also found to be superior with maximum DPPH activity followed by *A.tristis* and *A.polygonoides* with similar activity. The *B.juncea* and *T.foenum* had shown the minimum and comparable DPPH activity. The results of this study were comparable to the study by Kubola *et al.* (2011) with similar DPPH activity in *Flacourtia indica*. Thus the green leafy vegetables grown in biotreated effluent provide a good source of antioxidant activity which in turn reflects that the GLVs were grown in a healthy environment. This was supported by the study of Shailu and Ramesh, (2011) that the enzymic antioxidants were improved in *Brassica juncea* plants grown in bioremediated effluent.

Influence of fresh water, silk dyeing effluent and biotreated effluent on the enzymic antioxidant and lipid peroxidation activity of the selected GLVs

The enzymic antioxidant activity such as SOD and peroxidase and lipid peroxidation such as H_2O_2 scavenging activity and DPPH activity of the selected GLVs grown in various treatments were depicted graphically in Figure 1, 2 and 3 respectively.

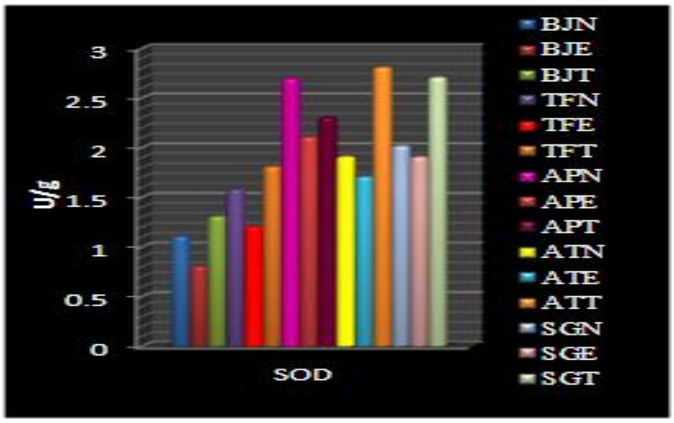

Figure 1 Superoxide dismutase activity of the selected GLVs in different treatments

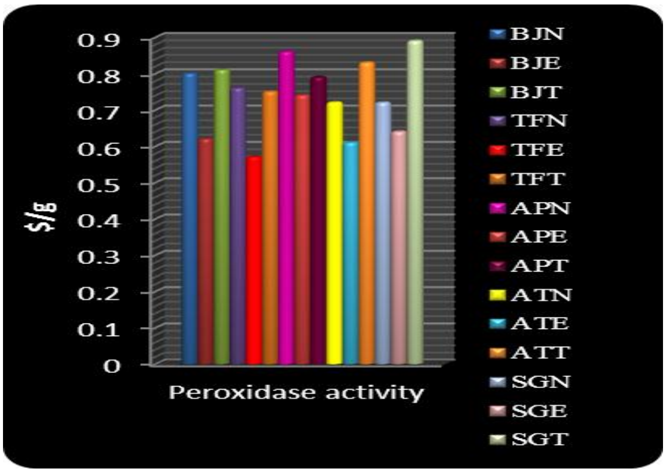

Figure 2Peroxidase activity of the selected GLVs in different treatments

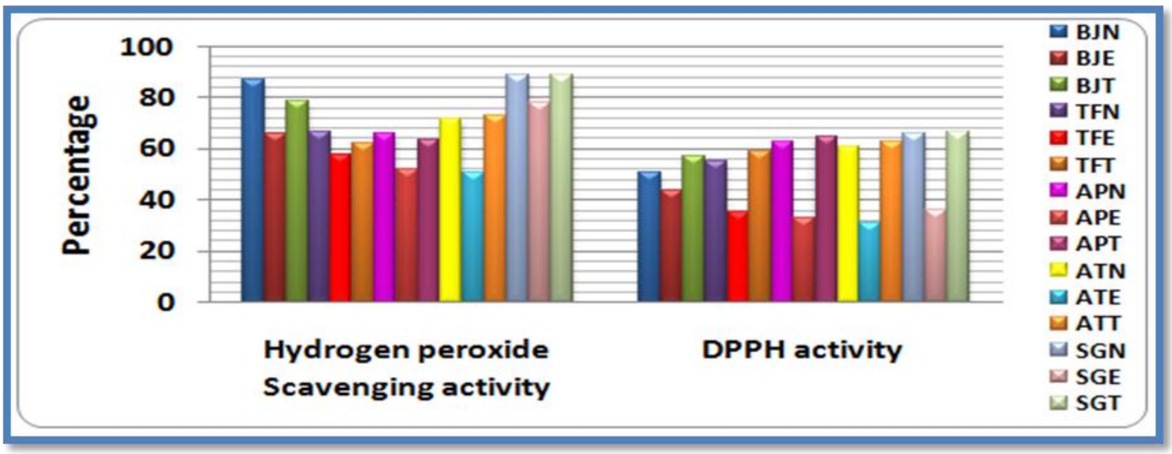

Figure 3 Hydrogen peroxide scavenging activity and DPPH activity of the selected GLVs in different treatments

[a]U = Amount of enzyme that gives 50% inhibition of the extent of NBT reduction in 1 min

$/unit – Change of absorbance / minute at 430 nm

BJN: *Brassica juncea*, TFN: *Trigonella foenum*, APN: *Amaranthus polygonoides*, ATN: *Amaranthus tristis*, SGN: *Sesbania grandiflora* were grown in fresh water.

BJE: *Brassica juncea*, TFE: *Trigonella foenum*, APE: *Amaranthus polygonoides*, ATE: *Amaranthus tristis*, SGE: *Sesbania grandiflora* were grown in 75% effluent water.

BJT: *Brassica juncea*, TFT: *Trigonella foenum*, APT: *Amaranthus polygonoides*, ATT: *Amaranthus tristis*, SGT: *Sesbania grandiflora* were grown in biotreated effluent.

The SOD activity in all the GLVs except *A.polygonoides* was found to be maximum for biotreated effluent when compared to the plants grown in fresh water and untreated effluent. Among the GLVs the biotreated *A.tristis* and *S.grandiflora* were found to be superior with the highest SOD activity. A similar study by Chaparzadeh *et al.* (2004) was in agreement with the above results that the application of biofertilizers influenced the SOD activity in *Calendula officinalis*. The GLVs grown in biotreated and fresh water had shown the higher peroxidase activity, H_2O_2 activity and DPPH activity when compared to the GLVs grown in crude effluent. Kina and Nikitina (2009) also stated that the application of biofertilizers increased the peroxidase activity in the roots of wheat seedlings. There was a significant difference in peroxidase activity as well as lipid peroxidation for all the GLVs grown in various treatments.

CONCLUSION

Findings of this study overall concludes that the selected GLVs grown in the biotreated effluent had a good amount of enzymic and lipid peroxidation compared to the control GLVs grown in fresh water and 75% Silk dyeing effluent exposed GLVs. The results obtained thus validate the biotreated GLVs be used as dietary supplement. It can be used regularly as functional food which encourage eating them every day which promotes health benefits.

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