

The effects of biotic and abiotic elicitors on gene expression (*Hyp-1*) in St Johns Wort (*Hypericum perforatum*)

Abstract

Hypericum perforatum belongs to Hypericaceae family. Due to the presence of secondary substances and metabolites such as Hypericin and Pseudohepyrisine, it has several properties such as anti-depressant, antibacterial, antiviral and anti-tumor. The gene (*Hyp-1*) is a phenolic coupling protein that catalyzes the synthesis of hyperforin. Meanwhile, Stimulating the enzyme with the help of elicitors is one of the important methods for increasing the production of effective biosynthetic pathways. In this research, the expression of the gene (*Hyp-1*) under the influence of silver nanoparticles and chitosan elicitors in a *Hypericum perforatum* plant was investigated in a factorial arrangement with three replications. In this regard, after planting and placing under conditions of treatment, plant sampling was done with considering silver nanoparticles in four levels (0, 30, 60 and 90 ppm) and chitosan at four levels (200, 100, 50, 0 ppm) at time intervals of 48 and 72 Clock. Gene expression analysis (*Hyp-1*) was performed using Real Time PCR method. Analysis of the results of the findings based on the melting curve of the graphs shows the different stages of replication using the $\Delta\Delta CT$ method. The results showed that the application of chitosan and silver nanoparticle elicitors changed the gene expression pattern (*Hyp-1*). The highest expression of the gene was observed 48 hours after treatment with 50 ppm chitosan and a significant decrease in gene expression occurred with an increase in chitosan concentration and a 72-hour period. In interaction treatments of chitosan and silver nanoparticles, there was a significant decrease compared to the control group. The use of silver nanoparticles also negatively expressed the gene expression at all concentrations.

Keywords: Gene expression, Chitosan, *Hypericum perforatum*, Silver nanoparticles.



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