Physiological and proteomic analyses of 1-MCP treatment on lignification in fresh common bean (*Phaseolus vulgaris* L) during storage

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Abstract

1-methylcyclopropene (1-MCP) had widely used in postharvest technology to maintain the quality and prolong the storage life of fruit and vegetables. The present work aimed to investigate the regulation of 1-MCP on lignification of common bean during storage by physiology and proteomics. As expected, 1-MCP treatment inhibited lignification and decline in relative thickness of pods after fifteen days of storage by suppressing respiration rate and lignin synthesis-related enzymes, including phenylalanine ammonialyase (PAL), 4-coumarate: coenzyme A ligase (4CL), cinnamyl-alcohol dehydrogenase (CAD), peroxidase (POD), and slowing the increase of lignin content. These biochemical and physicochemical data showed the fifteen day is critical day during storage of common bean treated by 1-MCP. Therefore, we performed proteomics for CK0, CK15, and T15 group, respectively. A total 609 differentially expressed proteins (Fold change ≥1.2, $P<0.05$) were successfully identified, and classified into eight main categories based on their biological function, involved in the 'catalytic activity', 'cell', 'cell part', 'binding', 'metabolic process', 'cellular process', and 'membrane', in CK15 *vs*. T15. The top three KEGG pathways in CK15 *vs*. T15 were the phenylpropanoid biosynthesis, plant - pathogen interaction and starch and sucrose metabolism during the storage. Down-regulation of proteins involved in oxidative phosphorylation, phenylpropanoid biosynthesis and protein processing in endoplasmic reticulum, and up-regulation of galactose metabolism, glycan degradation, and glycolysis/gluconeogenesis provided molecular evidence that oxidative phosphorylation and phenylpropanoid metabolism play a crucial role in lignification regulation. Expression of four genes related to lignin synthesis was inhibited at the transcriptional level during storage and were decreased by 1-MCP treatment. These results might improve our understanding of the mechanisms of 1- MCP inhibition of common bean postharvest lignification.