Metabolic Studies on Salt Tolerance of Various Mangrove Plants

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Mangrove plants may produce large amounts of adenosine triphosphate (ATP) to facilitate the removal and/or transport of salts into vacuoles and to synthesize compounds that function as compatible solutes to lower the osmotic potential of their tissues. In the present study, we examined adenosine metabolism in leaves of various mangrove plants grown in the Iriomote Island, Okinawa. The activity of adenosine salvage, i.e., synthesis of adenine nucleotides from adenosine, was extremely high in the typical mangrove plants, *Rhizophora mucronata, Burugiera gymnorrhiza, Kandelia candel and Sonneratia alba.* In these mangrove plants, up to 90% of [8-^{14}C]adenosine taken up by leaf segments were converted to adenine nucleotides. This adenosine salvage seems to be catalyzed by adenosine kinase. In contrast to mangrove plants which contain high levels of sugar alcohol compatible solutes, *Avicennia marina* which produces glycine betaine as a compatible solute showed a different pattern of adenosine metabolism. The glycine betaine biosynthetic pathway from ethanolamine in *A marina,* includes three methylation steps that utilize *S*-adenosylmethionine (SAM) as the methyl donor. In this process SAM is converted to S-adenosylhomocysteine (SAH) which in turn is hydrolyzed to homocysteine and adenosine. SAH hydrolase catalyzes both the synthesis and hydrolysis of SAH. As SAH is a potent inhibitor of the *N*-methyltransferase reactions, removal of SAH is essential to maintain the biosynthesis of the compatible solute. Probably for this reason, very active adenosine nucleosidase is present in *A. marina*, and 50-60% of exogenously supplied [8-^{14}C]adenosine was recovered as adenine. Compared to ordinary biomass plants, such as poplar, activity of adenosine salvage is extremely high in most mangrove plants where may act as a very efficient ATP regenerating system. Furthermore, high adenosine nucleosidase activity in glycine betaine producing mangrove plants may be related to the continuous supply of methyl donors for biosynthesis of the compatible solute. These results obtained in this study open up novel strategies for using genetic engineering to produce transgenic salt-tolerant biomass plants which can be grown in desert to assist in their restoration to a terrestrial environment.