DEUTERATION EFFECT STUDY ON THE VIBRATIONAL DYNAMICS OF PHENOL AND PHENOL-WATER COMPLEX BY PICOSECOND TIME-RESOLVED IR-UV PUMP-PROBE SPECTROSCOPY IN A SUPERSONIC MOLECULAR BEAM

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The vibrational energy relaxations of the OH and OD stretch of phenol-d_0 and phenol-d_0-(H_2O) complex and phenol-d_1 and phenol-d_1-(D_2O) complex, respectively, are investigated by picosecond IR-UV pump-probe spectroscopy. The key to understand their dynamic is well-suited to a two-step Tier model. For phenol-d_0, an energy flow is described by the intramolecularVR steps: "$OH\ stretching\ level$" $\rightarrow$ "$doorway\ state$" $\rightarrow$ "$bath\ state$". The intramolecularVR lifetime of phenol-d_0 is obtained to be 14 ps. On the other hand, the OD stretching vibration of phenol-d_1 exhibits quantum beats, followed by the intramolecularVR with a lifetime of 90 ps. In contrast, for the phenol-water complex, the intramolecularVR lifetime of OH(OD) stretch becomes 4.3 ps(12 ps) and an energy flow is described by the intramolecular and intermolecular processes, which lead to VP (vibratinal predisocciation). Although the energy difference is 1000 cm^{-1}, no remarkable change of intermolecularVR and VP lifetimes is found in the hydrogen-bonded phenol-water complexes.