Clusters of carboxylic acids with water, sulfuric acid, and other atmospheric species potentially increase the rate of new particle formation in the troposphere. Here, we present high-resolution pure rotational spectra of o-toluic acid and its complex with water in the range of 5-14 GHz, measured with a cavity-based molecular beam Fourier-transform microwave spectrometer. In both the monomer and the complex, the carboxylic acid functional group adopts a syn conformation, with the acidic proton oriented away from the aromatic ring. In the complex, water participates in two hydrogen bonds, forming a six-membered intermolecular ring. Despite its large calculated c-dipole moment, no c-type transitions were observed for the complex, because of a large amplitude "wagging" motion of the unbound hydrogen of water, similar to the case of the benzoic acid-water complex. No methyl internal rotation splittings were observed, consistent with a high barrier (7 kJ mol$^{-1}$) calculated for the monomer at the B3LYP/6-311++G(d,p) level of theory. Using statistical thermodynamics, experimental rotational constants were combined with a theoretical frequency analysis and binding energy to give an estimate of the percentage of hydrated acid in the atmosphere under various conditions.

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