Surprisingly, chemists find, some solvents can alter chemical bonds

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New University at Buffalo research demonstrates that some solvents can significantly enhance certain acid-base interactions and strengthen the bonding interaction between two molecules when one is electron-deficient and one is electron-rich.

The research, published recently in the *Journal of Physical Chemistry A*, suggests a potentially powerful new tool for initiating these interactions, which occur in many important inorganic cluster complexes, including biological enzymes.

“Any time a chemist can focus chemistry at a particular bond and find a new way to weaken chemical bonds in order to initiate chemical reactions, that gives you leverage,” said James F. Garvey, Ph.D., UB professor of chemistry and a co-author on the paper.

According to the UB researchers, solvent molecules surrounding Lewis acid-base complexes can significantly affect the strength of chemical bonds within that complex.

Lewis acids are molecules that act as electron-pair acceptors, while a Lewis base molecule will act as an electron-pair donor; the base donates electron density to the acid to form an acid-base complex.

“What was surprising was our observation that solvation made that interaction stronger, inducing the base to donate more electron density to the acid, thereby strengthening the bonding interaction,” said Garvey.

In the UB studies, the solvent reaction actually changed the nature of the carbon-nitrogen bond between the Lewis acid (a benzene radical cation) and the Lewis base (ammonia).

“We found that when the chemical bond is generated by the mechanism of electron transfer, microsolvation can play a tremendous role in effecting the nature of that bond,” said Garvey.

The experimental results were generated through molecular-beam studies of gas-phase ions using a tandem quadrupole mass spectrometer and were supported by calculations performed at UB’s Center for Computational Research in the New York State Center of Excellence in Bioinformatics and Life Sciences.

Source: University at Buffalo

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