An Electrodynamic Approach to the Colligative Properties of Solutions through Thermodynamic and Quantum Consideration of Ionic Hydration Systems

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The colligative properties of solutions, including the boiling point elevation, are said to be dependent only on the concentration of particles dissolved, not the identity of the particles. Departures from this model are evident in experimental data and can be attributed to non-ideal behavior in solutions of moderate to high concentrations. The boiling point elevation, which is dependent on the magnitude of solute-solvent interactions, can be more accurately modeled in moderate and high concentration ranges through the consideration of various aspects of solute nature. Further improvements to the mathematical model have been made, most notably through the consideration of solvent polarization, London dispersion interactions, and various quantum effects. Through the proposed methodology, a means of calculating boiling point elevation, starting with the quantum numbers of the electrons in the electron cloud of the solvated ions has been established, yielding a model of the boiling point elevation, that exceeds the accuracy of the accepted colligative property model of boiling point elevation by a notable degree, likely owing its reflection of experimental trends to its thorough consideration of the ion-solvent system. Statistical analysis for solutions of sodium chloride shows a close fit, reflected in a 67.9 percentage point reduction in mean absolute error.

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