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Summary of PhD dissertation entitled:

**Determination of the intermolecular interactions in solutions from  
the motion of single molecules**

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Intermolecular interaction in solution appears in all types of biochemical reactions and can be quantified by equilibrium and rate constants of the reactions. Due to the presence of intermolecular interactions, the free motion of each molecule taking part in the reaction is affected to some extent depending on these constants. Before the advent of single-molecule techniques in 90s, experiments aiming at the study of the intermolecular interactions were usually performed on an ensemble of molecules in bulk. As a result, behaviors of individual molecule in the processes of interaction could not be fully distinguished, and only average characteristics were measured.

Within this thesis, I proposed a convenient and reliable method mainly based on one type of single-molecule technique called fluorescence correlation spectroscopy (FCS) for the qualitative and quantitative determination of intermolecular interactions in solutions from the motion of single molecule. Other auxiliary techniques such as dynamic lighting scattering (DLS), Taylor dispersion analysis (TDA), etc., were also employed in this work. The diffusion coefficients of probes, equilibrium and rate constants for the complex-formation were determined from the analysis of experimental data using proper theoretical models. The validity and reliability of my method has been proved by several examples of intermolecular interactions in this thesis, such as protein-surfactant interaction (Chapter 2), dye-micelle interaction (Chapter 3) and drug-DNA interaction *in vitro* (Chapter 4). The thesis paves a promising application of FCS toward the quantitative determination of intermolecular interactions in chemical and biological systems.