Specific nucleophile-electrophile interactions in nucleophilic aromatic substitutions

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We herein report results obtained from an integrated experimental and theoretical study on aromatic nucleophilic substitution (SNAr) reactions of a series of amines towards 1-fluoro-2,4-dinitrobenzene in water. Specific nucleophile-electrophile interactions in the title reactions have been kinetically evaluated. The whole series undergoes SNAr reactions where the formation of the Meisenheimer complex is rate determining. Theoretical studies concerning specific interactions are discussed in detail. It is found that H-bonding effects along the intrinsic reaction coordinate profile promote the activation of both the electrophile and the nucleophile. Using these results, it is possible to establish a hierarchy of reactivity that is in agreement with the experimental data. Second order energy perturbation energy analysis highlights the strong interaction between the ortho-nitro group and the acidic hydrogen atom of the amine. The present study strongly suggests that any theoretical analysis