S_NAr analysis on thiophene derivative with conceptual DFT

POUZENS Jean-Thomas;[A] SOUISSI Salma;[B] INGROSSO Francesca;[C] BOUBAKER Taoufik,[D] HIERSO Jean-Cyrille,[A] FLEURAT-LESSARD Paul;[A]

A) Institut de Chimie Moléculaire de l'Université de Bourgogne (ICMUB, UMR-CNRS 6302), Université de Bourgogne, 9 Avenue Alain Savary, 21000 Dijon, France ; B) Laboratoire de Chimie Théorique, Sorbonne Université (LCT, UMR-CNRS 7614-8233) ; C) Laboratoire de Chimie et Physique Théoriques (LPCT, UMR-CNRS 7019), Université de Lorraine, 1 Rue Grandville, 54000 Nancy, France ; D) Université de Monastir, Faculté des Sciences, Laboratoire de Chimie Hétérocyclique, Produits Naturels et Réactivité (LR11S39), Avenue de l'Environnement, 5019 Monastir, Tunisie.

Jean-Thomas.Pouzens@u-bourgogne.fr

Thiophenes are heterocycles of industrial interest which have attracted considerable attention due to the wide scope of applications. For instance, substituted thiophenes are currently used to synthetize materials with photophysical properties and electrochemical systems but also more and more for therapeutical applications (Figure 1).[1,2]

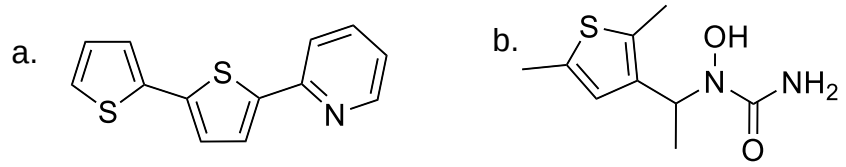

Figure 1. Structure of thiophenes derivatives for polymers (a) and anti-inflammatory (b) applications.

We studied the formation of amino substituted thiophenes through aromatic nucleophilic substitution. S_NAr on thiophenes have been thoroughly studied experimentally.[3,4] In particular, Boubaker *et al.* measured the electrophilicities of many thiophenes derivatives in the Mayr electrophilicity scale.[5] However, quantum analysis are rarely provided.

In this work, we used quantum approaches to study the influences of 7 substituents on the S_NAr mechanism (Figure 2).

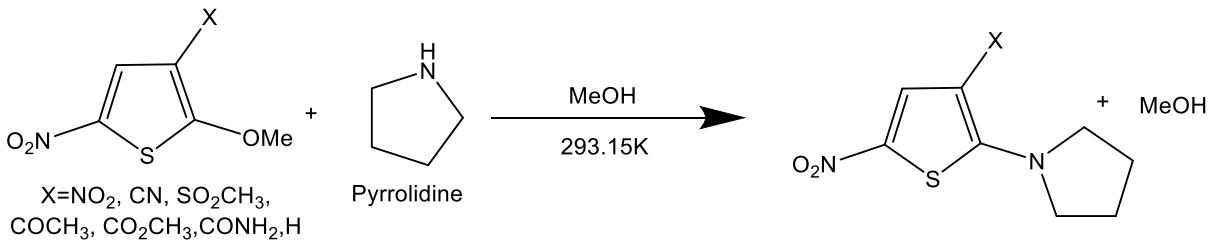

Figure 2. Reaction equation of the substituent substitution on thiophenes

We then used conceptual DFT and Topological approaches to rationalize the evolution of the computed activation energies with quantum descriptors, such as Parr electrophilicity or the LUMO energy We will show that the reactivity of the thiophene derivatives nicely correlates with global descriptors but that explaining the relative reactivity of the thiophenes sites is not as easy.

Keywords: Thiophene, mechanism, conceptual DFT, quantum descriptor.

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