# Effect of the side-chain length of poly(3-akylthiophenes) on the optical VOCs detection

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Since the discovery of the unique electronic and optical properties from conjugated polymers, these polymers have been extensively studied due to their potential use in several applications such as gas sensors. The advantages of using conjugated polymers as gas sensing materials compared to inorganic materials are their easy synthesis, their diversity and, mainly, their sensitivity at room temperature. In this study, our purpose is to investigate the performance of polythiphenes derivatives, the poly(3-hexythiophene) - P3HT and poly(3-dodecylthiophene) - P3DT, as active layers in optical sensors to VOCs (volatile organic compounds) detection as well as to investigate the effect of the side-chain length on this behavior. These polythiophenes derivatives were synthesized via oxidative polymerization using ferric trichloride. Their number-average molecular weights (Mn) values, estimated by HPSEC, were around 10.000 g/mol and their structures were confimed by FTIR and $^{1}$H NMR spectroscopies. Detections of VOCs (n-hexane, dichloromethane, chloroform, toluene, THF, methanol) and humidity (water) were carried out in their spin-coated films by UV-vis spectroscopy, exposing the films for ten minutes to dynamic controlled flow of nitrogen and volatile dragged by nitrogen. The UV-vis spectra of P3HT and P3DT did not show any change for methanol and humidity (water). However in the presence of n-hexane, toluene, chloroform, dichloromethane and THF the absorbance at 495 nm decreased (Figure 1) and the wavelength of the maximum absorption peak (λmax) showed a blue shift. These values returned to the initial ones upon nitrogen exposition with some hysteresis, showing that this change is reversible. It was found that the response is less than 10% for all analytes and polymers, and the length of alkyl side-chain exerts influence on the response intensity. These results show that poly(3-alkylthiophenes) were viable for VOCs detection by optical measurements and different lengths of alkyl side-chain change the sensitivity of the sensor.

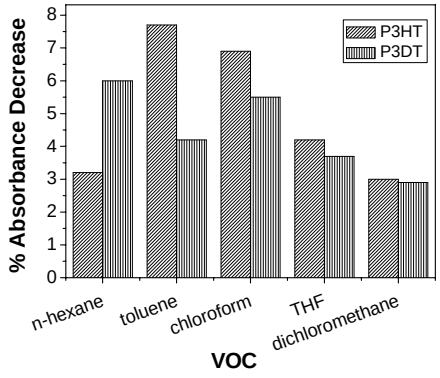


Figure1: Absorbance decrease degree for all VOCs and both polymers.

Keywords: poly(3-alkylthiophenes), gas sensor, volatile organic compounds.
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