Substituents controlled selectivity of 1,8-naphthalimide-based dual signaling sensors for F⁻ & CN⁻ with copper mediated discrimination of F⁻/CN⁻ and application of silsesquioxane polymer as fluoride adsorbent

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Abstract: Chemosensors based on 1,8-naphthalimide with furan, thiophene and furan with methyl and nitro as substituents are successfully synthesized with excellent yield. The compounds show outstanding results in terms of discrimination and being sensor molecules for fluoride and cyanide ions. The molecules show fluorescent quenching when the anions are detected as well as visible colorimetric changes due to intra molecular charge transfer (ICT), briefly, hydrogen on NH side is deprotonated which affects directly to n to π* electronic transition in visible light absorption region. The results also show that 1,8-naphthalimide which connects furan and thiophene can only detect fluoride ion, whilst in methyl and nitro furan can detect even cyanide and fluoride ion and discrimination of fluoride and cyanide ions were achieved by addition of copper(II) ion in a sensoring solution in order to induce copper-cyanide complex formation before addition of the anions. 1,8-naphthalimide with thiophene has very low detection limit at 0.04 ppm for fluoride and 1,8-naphthalimide with methyl furan has detection limit at 0.07 ppm for cyanide detection. We also present silsesquioxane polymer for adsorption purposes particularly fluoride ion.

Keywords: Furan/thiophene; Anions; Discrimination; Test strips; Silsesquioxane polymer