Fabrication and evaluation of the gas sensor based on polyvinyl alcohol/polyaniline nanocomposite for detection of nitroaromatic vapor

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Chemiresistor gas sensors have been developed extensively for sensing trace concentrations of the vapors of explosive materials. The chemiresistor gas sensors compared to other techniques offer numerous benefits such as high sensitivity, wide linear range of response, and minimum space requirement along with the low-cost devices. 2,4-Dinitrotoluene (DNT) as the most common nitroaromatic explosive has wide range of applications in ammunition. It is mainly released to environment during military activities such as ammunition production and packing. Also, this nitroaromatic is released as a vapor from in the most land mines including anti-personnel and anti-vehicle mines. In this study, an electrochemical sensor based on deposition of polyvinyl alcohol/ polyaniline (PVA/PANI) nanocomposite was designed. The synthesized PVA/PANI nanocomposite were characterized by scanning electron microscopy, FTIR spectroscopy and X-ray diffraction. Results showed that the synthesized PANI nanoparticles have mean particle size of 45 nm with relatively uniform size distribution. The performance of the designed sensor was tested in a static setup used for production of explosive material vapor. The developed sensor was employed for measurement of various concentration of explosives' vapor (0.1 to 100 ppm) under static air conditions. The fabricated sensor showed good sensitivity toward DNT and had a linear range at the concentration range of 0.5-50 ppm. Also, selectivity tests were carried out in the presence of DNT and vapor of other organic matters and the results indicated that the designed sensor's possess high sensitivity and selectivity toward DNT.