Abstract

The research work is based on the detailed study of the structural and electrical property of polyaniline with effects in the variation of its polymerization reaction conditions. We then tried to optimize the process conditions in order to obtain maximum electrical and ammonia gas sensing properties of the synthesized polyaniline. This endeavor has inflicted an understanding of the chemistry of polyaniline and further development of the polymer for application like ammonia gas sensor. It was found that there is a significant change in the yield and conjugation length of polyaniline emeraldine salt by changing the hydrochloric acid (HCl) concentration of the polymerization medium which finally led us to optimize the synthesis process to get polyaniline salt having better ammonia sensing properties. We have also optimized the incorporation of metal cations like Li^{+} and Mg^{2+} in the polyaniline structure during *in situ* polymerization of aniline to increase the conductivity of polyaniline. We have worked on some novel aspects of processabilty of polyaniline, which is a demanding aspect of conducting polymers. Processabilty of polyaniline was improved by using functionalized protonic acid like para-toluene sulphonic acid (PTSA). The dopant PTSA helps to solubilizing the polyaniline in organic solvent like tetrahydrofuran (THF). However, the bulky PTSA group as dopant decreases the conductivity of polyaniline. To balance the processability and conductivity properties of polyaniline emeraldine salt we used HCl and PTSA as co dopants and at certain mole ratio of the dopants, the polyaniline salt was found to be soluble in THF and also shows better conductivity. Another aspect we investigated to incur processability of polyaniline was by changing the dielectric constant of the polymerization solvent medium used during synthesis by conventional methods. The dielectric constant of the solvent medium is directly related to molecular association and has direct influence on the assemblage of growing polyaniline chains and processability. We used a binary solvent mixture of water and dimethyl formamide (DMF), the former a high and latter a low dielectric constant solvent medium respectively. We were able to optimize a

volume ratio of the binary solvent medium, which shows optimum polymer growth and processability. The processable polyaniline both induced by functional protonic acid and change in solvent property of polymerization medium was deposited on a substrate-insulating polymer like PVA. The latter crosslinked with maleic acid and precoated in glass slide to form a uniform coherent film acts as a substrate on which the soluble polyaniline is deposited by dip coating. This deposited polyaniline was used as a sensor device to respond to ammonia gas environment. The result we obtained was promising, and the result showed good reproducibility and stability than freestanding polyaniline films exposed under similar conditions of ammonia gas exposure.