Polyaniline synthesized in pilot scale: structural and mophological characteristics

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Among various conducting polymers, polyaniline (PAni) has received wide-spread attention because of its outstanding properties including simple and reversible doping–dedoping chemistry, stable electrical conduction mechanisms, high environmental stability and ease of synthesis [1]. Increasing applications require PAni at industrial scale and optimization of manufacturing processes are essential for this purpose. Since pilot scale influences hydrodynamics of the polymerizations system [2], pilot scale is an important instrument for evaluating amendments in the process. In this work, polyaniline was synthetized on pilot scale, with variation of reaction time for every synthesis, keeping the other parameters unchanged. The PAni salt first obtained was dedoped and the PAni-B (PAni in a base form, nonconductive) obtained was redoped with dodecylbenzenesulfonic acid (DBSA), when PAni-DBSA (PAni in a salt form, conductive) is obtained. The effects of synthesis conditions on the structural and morphological characteristics of PAni-B and PAni-DBSA are investigate by Raman Spectroscopy, XRD (X-ray diffractometer) and SEM (Scanning electron microscopy). Electrical conductivity was determined to redoped samples. Results were analyzed and we compare PAni forms to identifying the doping structure to PAni-DBSA by Raman spectroscopy. It was found too that reaction time can give some influence at conductivity. The XRD result showed differences in crystalline peaks of PAni-B and PAni-DBSA and this difference could be attributed mainly to the redoping process. Whereas the formation of crystals on a pilot scale may change because of effects caused by water flow, speed of polymerization could affect the formation of crystals too. The SEM pictures to PAni-B showed tiny coral reefs with globules structure and PAni-DBSA showed multilayer structure.

References:

1 - Fratoddia I. et al. Sensors and Actuators B 220: 534–548 (2015).

2 - Roichman Y et al. Synthetic Metals 98: 201-209 (1999)