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COMPARISON OF THE BEHAVIOUR OF ELECTROCHEMICALLY AND CHEMICALLY SYNTHESIZED POLYANILINE

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It has been reported that polyaniline (PANI) can be synthesized by two principal methods; the direct oxidation of aniline by chemical oxidant (PANI-C) or by anodic oxidation on an inert electrode using electrochemical methods (PANI-E). However, the electrochemical method has an advantage of the resulting polymer does not contain contaminants from oxidative agents which are necessary for chemical synthesis. In addition, PANI can be obtained as a conductive film upon the electrode surface in the electrochemical method. The electrochemistry of PANI is more complex than that of other conducting polymers. Here the redox reaction involves the change of complete reduced state to fully oxidized state. The conducting state varies with applied potential and pH of the medium. Therefore conductivity depends on two variables; the degree of oxidation and the degree of protonation.

The electrochemically prepared PANI films, which are conducting, can be cycled between oxidized and reduced states. Also thicker film can be prepared and peeled off from the electrode surface to get a free-standing, electrically conducting film.

The strong adherence to the inert electrode of PANI has been the basis for detailed electrochemical studies. But the chemically prepared polyaniline doesn't adhere to any of electrode material. Therefore, electrochemical characterization of chemically prepared polyaniline has limitations. In addition, most conductivity measurements reported were made ex-situ with chemically prepared samples. Therefore, it was considered of interest to obtain electrochemical properties and in-situ conductivity of chemically and electrochemically prepared PANI films.

In this study, the electrochemical behaviour of chemically and electrochemically synthesized polyaniline films has been investigated in aqueous functionalized acid solutions. Cyclic voltammograms of both films are almost identical. PANI films obtained by these two processes were compared with respect to their conductivity and stability at electrochemical treatment. A steady loss of electroactivity occurs for PANI in acidic media during continuous cycling, indicating the total charge storage in PANI film is decreasing with the number of cycles. Conductance results of PANI indicate that there are three electrochemical forms; the reduced form which is insulating, the partially oxidized form which is conducting, and the fully oxidized form that is also insulting.