

" A STUDY OF THE ELECTROCHEMICAL
CHARACTERISTICS OF A
BENTONITE/POLYANILINE COMPOSITE "

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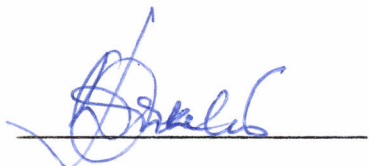
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This is my original work and has not been presented to any other university



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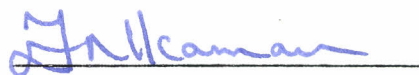
This work has been submitted with our approval as university supervisors.



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ABSTRACT.

Cyclic voltammetry was used to study the electrochemical characteristics of a bentonite/polyaniline composite by the utilization of a carbon graphite working electrode modified with bentonite (a mineral clay). These characteristics were compared with those of polyaniline alone (a conducting polymer) using an unmodified carbon graphite working electrode. Incorporation of polyaniline into bentonite shifted its oxidation potential towards negative potential indicating that polyaniline is easier to oxidize in the composite. Scan rate dependence studies revealed that polyaniline's electrodeposition on bentonite was not diffusion controlled. Oxidation of polyaniline in the composite film revealed pH dependence similar to that of simple polyaniline films.

Bentonite matrix was also seen to trap aniline monomer during electrodeposition of polyaniline and thus at a positive potential of +0.85 V, where the electrochemical response of polyaniline degrades, polyaniline continued to grow on the bentonite modified electrode in the absence of aniline monomer until total consumption of the trapped aniline. The rate of formation of quinone derivatives beyond +0.85 V was also seen to be independent of the potential window for the bentonite modified electrode, the reverse of which is true for the bare electrode. Incorporation of polyaniline into bentonite does not enhance its electrodeposition in non-acidic media but was seen to stabilize polyaniline from the effect of ionic

strength (utilizing various NaCl solutions).

The electrochemical activity of the composite film studied in the presence of positively and negatively charged solution couples ($\text{Fe}^{2+}/\text{Fe}^{3+}$ and $\text{Fe}(\text{CN})_6^{3-}/\text{Fe}(\text{CN})_6^{4-}$) revealed enhanced redox activity of both the solution couples, a result which was attributed to the bentonite matrix acting as a charge transfer media. The electrochemical activity of the composite remained basically the same when the electrolytic anion was changed from sulphate/bisulphate to chloride indicating that it was independent of the anion type, but electrodeposition of polyaniline was seen to be slow when H_3PO_4 acid was used as the supporting electrolyte. An X-ray fluorescence analysis of the composition of bentonite revealed Fe to be the most prevalent ion but was present in such small quantities as to have no effect on the electrochemical characteristics outlined above.