# Development of PANI-PVS Nanoporous Matrix for Tissue Engineering Applications

Pradeep. Gaikwad, Pramod. Rokade, Prashant.Pangrikar, and Balaji D. Rupnar

***Abstract*—**The polyaniline-polyvinyl sulfonate- (PANI-PVS) Matrix has been investigated in the present work. Indium tin oxide (ITO) coated glass electrode was used for the synthesis of polyaniline-polyvinyl sulfonate (PANI-PVS) matrix using potentiometric method. The synthesized PANI-PVS matrix were characterized by electrochemical technique, Fourier transform infrared spectroscopy and scanning electron microscope for tissue engineering Applications.

***Keywords*—** Polaniline matrix; Potentiometric method.

## I. INTRODUCTION

POLYANILINE is compatible can be easily synthesized from aniline monomer in aqueous solution, the polyaniline is more suitable for biosensor applications. because it provides stable and porous matrix for the immobilization of biocomponent and it also facilitate the electron transfer process. The widely used conducting polymers for immobilization of enzyme are polyaniline, polypyrrole, polythiophene etc [1-5]. Since Electrochemically polymerized conducting polymers had received considerable attention over the last two decades [6-10]. The remarkable switching capability of these electroactive materials between the conducting oxidized (doped) and the insulating-reduced (undoped) state is the basis of many applications. The poly-conjugated conducting polymers have recently been proposed because of a number of useful features such as (1) direct and easy deposition on the sensor electrode by electrochemical oxidation of monomer, (2) control of thickness and (3) redox conductivity and polyelectrolyte characteristics of the polymer useful for sensor application [11]. The porosity is an important factor for the facile immobilization of enzyme. Therefore, in the present investigation, we have initially electrochemically synthesized PANI-PVS matrix. We have described the results of our systematic studies relating to the electrochemical synthesis and characterization of the PANI-PVS matrix and development of PANI-PVS-Matrix for tissue engineering applications. The advantage of using the composite PANI-PVS Matrix for the building functional cardiac, cardiovascular and neuronal tissue constructs.

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## II. EXPERIMENTAL

### *A. Preparation of polyaniline-polyvinyl sulphonate (PANI-PVS) matrix*

PANI-PVS matrix were synthesized in an aqueous solution of distilled 0.2 M aniline . and 0.5 M of polyvinyl sulfonate using electrochemical deposition method. It was carried out by potentiometric technique at 27 □C in one compartment, three-electrode glass cell. The ITO coated glass plate was used a working electrode, platinum foil as counter electrode and Ag/AgCl was used as reference electrode. The electrolyte solution was prepared in distilled water. After synthesis the polymer coated electrodes were rinsed thoroughly in distilled water, dried in cold air and then use for subsequent characterization.

### *B. Studies of PANI-PVS matrix*

The potential curves of the potentiometricaly synthesized PANI-PVS matrix is shown in Fig. 1.

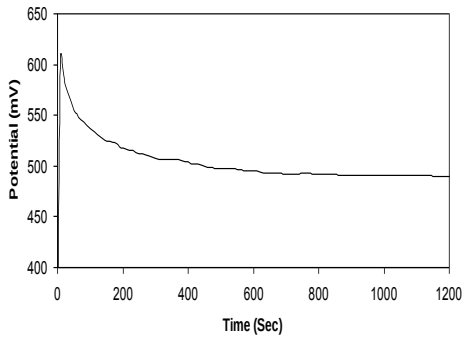


Fig. 1 Chronopotentiogram of PANI-PVS matrix

The behavior of the potentiometric synthesis overshoot during first few second probably indicates difficult formation of dimmers and oligomers. After this, potential remain constant suggesting that building up of the matrix proceeds according to the same reaction along the full thickness of the polymer

### *C. FTIR studies of PANI-PVS matrix*

The FTIR spectra of synthesized PANI-PVS matrix were

recorded by using Testscan Shimadzu FTIR-8400 series, in the region 2000-2100 cm-1 is shown in Fig. 2.

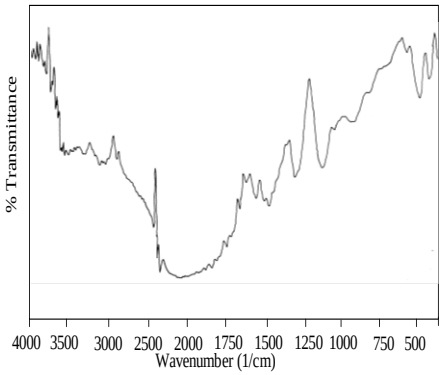


Fig. 2 FTIR spectra of PANI-PVS Matrix

The peak at 1533 $cm^{-1}$ and 1497 $cm^{-1}$ corresponds to the quinine and benzene ring stretching deformation respectively. The C-N stretching in the quinoid ring is observed at 1378 $cm^{-1}$, while C-N stretching of a secondary aromatic amine is observed at peak 1038 $cm^{-1}$. The peak at 1093 and 1099 $cm^{-1}$ corresponds to the C-H in plane bending mode. C=N stretching of quinine di-imine unit is observed at 1565 $cm^{-1}$. The peak observed at 1035 $cm^{-1}$ and 694.3 $cm^{-1}$ are due to the symmetric stretching of $SO_3^-$ group. Thus, the FTIR spectral results confirm the formation of polyaniline matrix with PVS medium

### *D. SEM studies of PANI-PVS matrix*

The scanning electron micrograph of synthesized PANI-PVS matrix is as shown in Fig 3. The scanning electron micrograph was recorded using JEOL, JSM-6360A SEM machine.

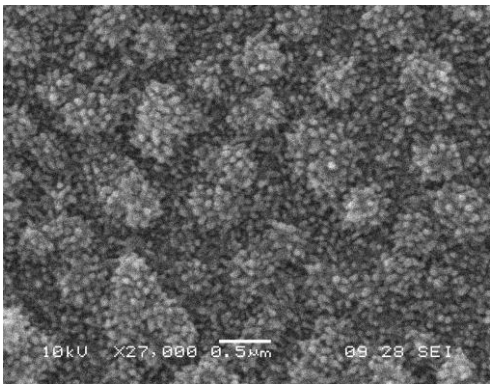


Fig 3 SEM micrograph of PANI-PVS matrix

It can be seen that the surface morphology is nanoporous structure, which is suitable for immobilization of biocomponent

## III. CONCLUSION

We have successfully developed of PANI-PVS nanoporous matrix. It was found that the conducting PANI-PVS nanoporous matrix having amine functional group can be utilized as a suitable nanoporous matrix for building functional cardiac, cardiovascular and neuronal tissue.

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## REFERENCES

[1] Bidan, Sensors and Actuators B 6, (1992) 45
[2] P.D. Gaikwad, P.A. Savale, D.J. Shirale, H.J. Kharat, K.P. Kakde, V.K. Gade, M.D. Shirsat, in: M.D. Shirsat (Ed), Microwaves and Optoelectronics, Anshan Tunbridge Wells, UK, 2005, p. 450.
[3] P.N. Barlett, J.M. Cooper, J. Electroanal. Chem 362 (1993) 1
[4] D.J. Shirale, A.S. Bhalerao, H.J. Kharat, P.D. Gaikwad, K.P. Kakde, P.A. Savale, V.K. Gade, M.D. Shirsat, in: M.D. Shirsat (Ed), Microwaves and Optoelectronics, Anshan Tunbridge Wells, UK, 2005, p. 455.
[5] S. Cosiner Biosens. Bioelectron.14 (1999) 443
[6] P.A. Savale, D.J. Shirale, P.D. Gaikwad, H.J. Kharat, K.P. Kakde, V.K. Gade, M.D. Shirsat, in: M.D. Shirsat (Ed), Microwaves and Optoelectronics, Anshan Tunbridge Wells, UK, 2005, p. 409.
[7] A.Eftekhari synthetic Metals 145 (2004) 211.
[8] V.K. Gade, D.J. Shirale, P.D. Gaikwad, H.J. Kharat, K.P. Kakde, P.A. Savale, M.D. Shirsat, in: M.D. Shirsat (Ed), Microwaves and Optoelectronics, Anshan Tunbridge Wells, UK, 2005, p. 459.
[9] P D Gaikwad, D J Shirale, V K Gade, P A Savale, H J Kharat, K P Kakde, S S Hussaini, N R Dhumane and Shirsat M D Bulletin of Materials Science 29(2006)1.
[10] D.J. Shirale, V.K. Gade, P.D. Gaikwad, H.J. Kharat, K.P. Kakde, P.A. Savale, S.S. Hussaini, N.R. Dhumane, M.D.Shirsat, Mat. Lett. 60(2006)1407.
[11] A.F Diaz J I Castillo J A Logan W y Lee. J Electroanal Chem. 129 (1981) 115 -32.