Ferrocenyl based Polyvinylbenzyl Chloride Nanofiber for Decyanidation

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Introduction

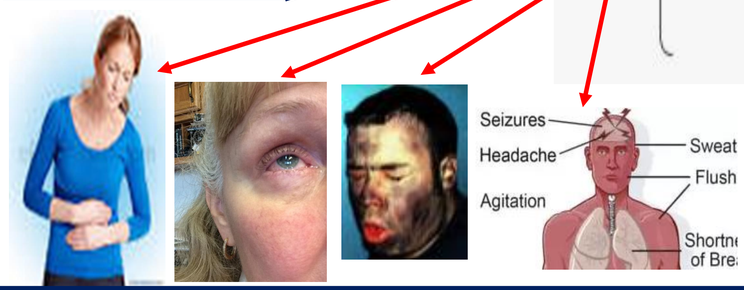
Human activities

ground, atmospheric and aquatic **ecosystem**

ecological and human-health **threats**

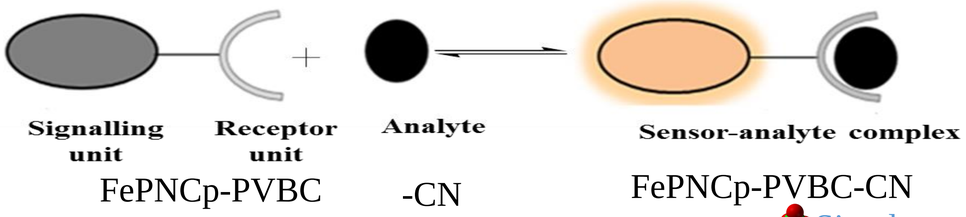
Contaminants (cations, **anions**)

Toxic **CYANIDE**



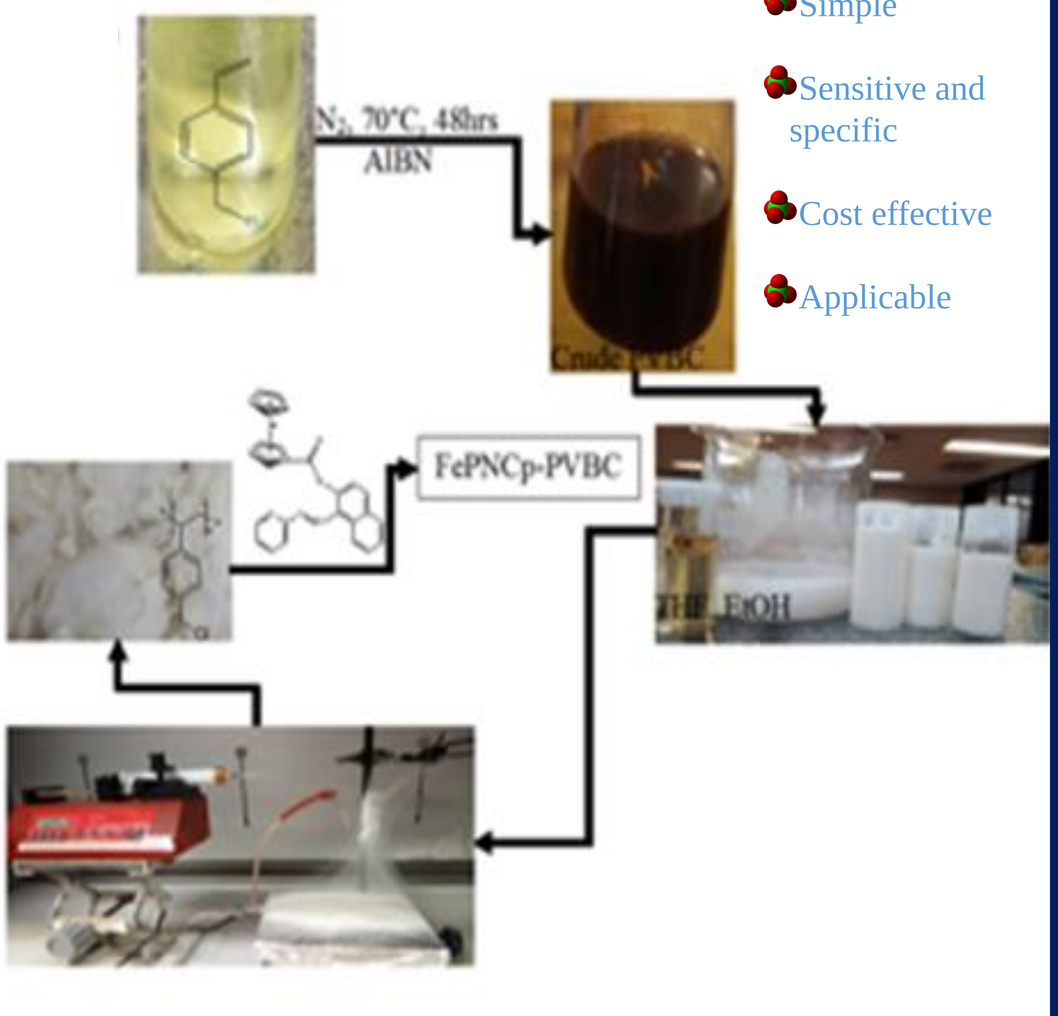
Total Cyanide
- Strong Metal-Cyanide Complexes of Fe
- WAD Cyanide: Weak and Moderately Strong Metal-Cyanide Complexes of Ag, Cd, Cu, Hg, Ni and Zn
- Free Cyanide: CN^-, HCN

Methodology



FePNCp-PVBC -CN FePNCp-PVBC-CN

- Simple
- Sensitive and specific
- Cost effective
- Applicable



Result and Discussion

The synthesis of EP was done via diazotization and esterification reaction. Immobilization of electrospun polyvinylbenzyl chloride (PVBC) on EP produced FePNCp-PVBC (PEP) which was further applied for cyanide removal. The ligand, EP and functionalized material, PEP were characterized using analytical techniques.

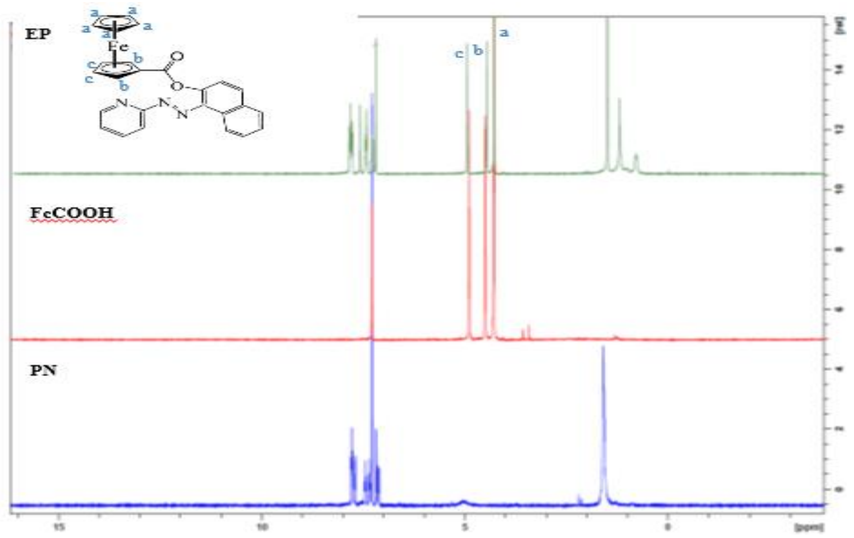


Fig. 1: Proton NMR Spectra of EP and reactants

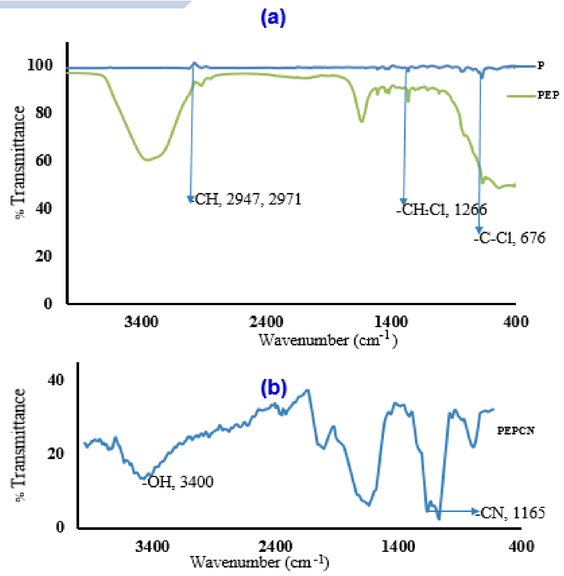


Fig.2: (a) FTIR Spectra of P & PEP (b) PEPCN

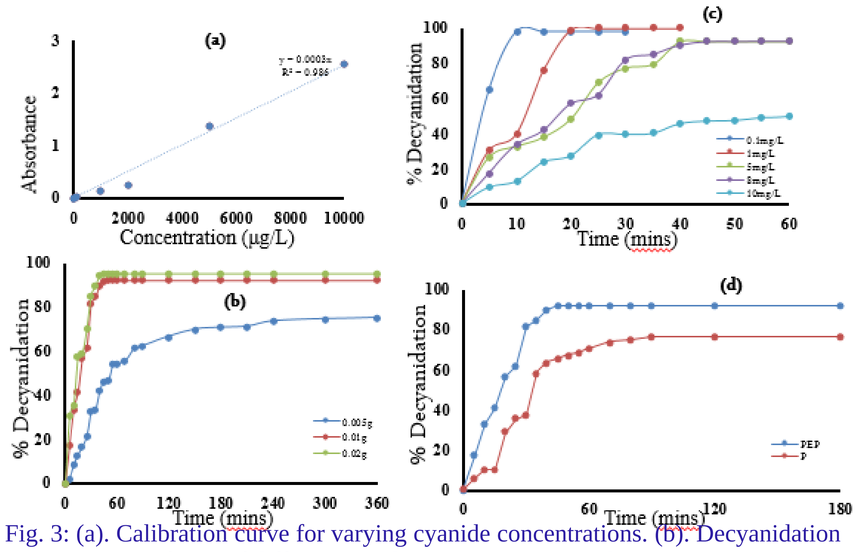


Fig. 3: (a). Calibration curve for varying cyanide concentrations. (b). Decyanidation capacity (DC) of PEP of different weights; 0.005g, 0.01g and 0.02g (room temperature, rotational speed of 250 rpm, initial cyanide concentration of 8mg/L (c) DC of PEP at different initial concentrations. (d) DC of 0.01g P & PEP at 8mg/L CN.

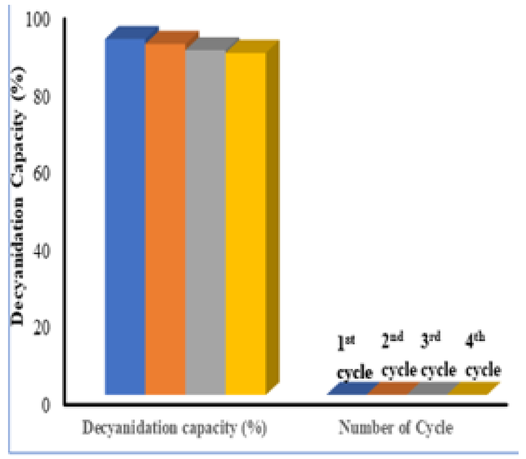


Fig. 4: The bar chart of the 0.01 g FePNCp-PVBC (PEP) showing the cyanide removal at an initial concentration of 8 mg/L CN for four cycles

Conclusion

❖Successful synthesis and characterization of an ester-based ferrocenyl ligand, FePNCp, and its subsequent immobilization on the electrospun polyvinylbenzyl chloride (PVBC) as a functionalized nanofibrous material, FePNCp-PVBC (PEP) was done.

❖The response time of FePNCp-PVBC (PEP) proved effective in 45 minutes, even with 0.01g of the adsorbent dosage, and showed a 92.2 % decyanidation capacity.

Selected References

Adesoji, A. O., Shotonwa, I. O., Ejeromedoghene, O., Tshentu, Z. R., & Adewuyi, S. (2023). Ester-Functionalized Ferrocene Based Polyvinylbenzyl Chloride Nanofiber as a Decyanidating Agent. *Chemistry Africa*, 1-11.

Adewuyi, S., Bisiriyu, I. O., Akinremi, C. A., and Amolegbe, S. A. (2017). Synthesis, spectroscopic, surface and catalytic reactivity of chitosan supported Co(II) and its zerovalentcobalt nanobiocomposite. Journal of Inorganic Organometallic Polymer. 27, 114-121.

Khota, W., Kaewpila, C., Suwannasing, R., Srikacha, N., Maensathit, J., Ampaporn, K. & Cherdthong, A. (2023). Ensiling Cyanide Residue and In Vitro Rumen Fermentation of Cassava Root Silage Treated with Cyanide-Utilizing Bacteria and Cellulase. *Fermentation*, *9*(2), 151.

Mudabuka, B., Ogunlaja, A. S., Tshentu, Z. R., & Torto, N. (2016). Electrospun poly (vinylbenzyl chloride) nanofibres functionalised with tris-(2, 2′-pyridylimidazole) iron (III): A test strip for detection of ascorbic acid and dopamine. *Sensors and Actuators B: Chemical*. *222*, 598-604.

Shahedi, A., Darban, A. K., Jamshidi-Zanjani, A., Taghipour, F., & Homaee, M. (2023). Simultaneous Removal of Cyanide and Heavy Metals Using Photoelectrocoagulation. *Water*, *15*(3), 581.