

## Removal of Chlorine and Chlorinated Organic Compounds from Aqueous Media Using Substrate-Anchored Zero-Valent Bimetals

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Chlorine added to drinking water as a disinfectant is a concern of this generation. This is because chlorine reacts with dissolved organic compounds to form polychlorinated complexes that are carcinogenic. Available methods for the removal of chlorine and chlorinated compounds include adsorption, precipitation, electrolysis and ozonation, but some result in the generation of more toxic compounds. This study explored the use of zero-valent bimetal Fe/Zn for the degradation of chlorinated compounds in water which did not generate toxic by-products. The zero-valent bimetallic material was anchored on a polystyrene waste material as a green method of cleaning the environment. It was prepared through nitration, amination, complexation and reduction. The resulting solid material was characterised using Fourier transform infrared (FTIR). The material was also characterised using XPS which confirmed the presence of metals anchored on the material through complexation. The metals were also found to be present upon reduction to zero valence and even after the degradation process of the chlorinated organic compounds. It was then applied for the removal process. Optimization parameters such initial halideconcentration, effect of time and bimetal dosage variation were established using synthetic water samples. It was found that the substrate-anchored ZVB material had a degradation capacity of 4.532, 5.362 and 4.513  $\mu\text{mol l}^{-1}$  for 1,2-dichloroethane, 2-chloro-2- methylpropane and 1-chlorobutane, respectively. The material was then applied on real samples sourced from Nairobi. Quantification of chlorine was done using potentiometric methods and the results confirmed that the degradation was first order. The degradation capacities were found to be  $2.37\pm 0.01$ ,  $3.55\pm 0.01$  and  $3.72\pm 0.01$  in that order.

**Keywords:** Polystyrene. Chlorination. Zero-valent bimetal. Degradation. Reduction

### Biography:

Isaac Mwangi pursued a HND analytical chemistry course in the Kenya Polytechnic and then a master's degree course at Kenyatta University. He later progressed for a PhD course at the University of Johannesburg. Isaac undertook a postdoctoral research fellowship in that University before returning to Kenyatta University to resume his duties. He is now a Lecturer in the department of chemistry.

**Research Summary:** Isaac Mwangi is a dynamic scholar with a wealth of experience in teaching and research and is actively involved in supervision of graduate and postgraduate students in research projects in the field of Physical, Applied and Analytical chemistry. His projects are geared towards improvement of the quality of life for various groups of people. His diverse research interests include among others farming in dry and soilless media plus purification of water and sanitation.