

Assessment of Abattoir Wastewater Purification Potential of Chitosan Crosslinked Biopolymer from Shrimp Shell Waste for Domestic and Commercial Use

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South African watercourses are rapidly deteriorating due to the discharges from harmful abattoir wastewater, which is contaminated with toxic and carcinogenic pollutants. Removing these harmful materials from wastewater is important to protect humans and the environment. This study aims to assess the status of poultry and red abattoir effluent and proposes a sustainable green technology (biopolymer) that can remove contaminants (physiochemical parameters and heavy metals from the abattoir wastewater effluents within the Mangaung Metropolitan Municipality in Bloemfontein. Different elements from effluent water were isolated from the red meat and the poultry industry using modified chitosan cross-linked with maleic anhydride and formaldehyde. Parameters analysed: EC, pH, BOD, COD, and TD were within the permissible values of effluent discharge in the (South Africa Meat Safety Act and WHO). Modified products were tested for their ability to adsorb different elements from red meat and poultry effluent wastewater. Results showed the presence of alkali and alkaline earth group metals (Ca, Mg, Na, and K) as major elements. The performance of the modified product was assessed based on the amount (concentration) and the quantity of elements adsorbed. Based on modified products tested, shrimp chitosan cross-linked with formaldehyde was shown to be better adsorbents for Cr and Ni due to the possible influence of the amino, carboxylic, hydroxyl, etc. functional groups in these chitosan products. Results also showed the presence of smaller concentrations of heavy metals (Cr, Ni, Cu, and Pb) in the eluted solution, which suggests the versatility of the adsorbent to different elements. Large-scale use in treating abattoir effluent in South Africa and internationally will be possible using chitosan cross-linking formaldehyde biopolymer. This provides a creative, economical method of treating abattoir wastewater, equipping large and small farms with new information to complement current treatment techniques.