Assessing the Effectiveness of Groundnut Shell & Water Hyacinth Bio-adsorbent in Cadmium Removal from Steel Rolling Mills Wastewater

Sengendo James Jimron, BU/UP/2017/1542

Department of Water Resources Engineering, Faculty of Engineering
Busitema University P.O Box 236 Tororo, Uganda
Uganda Industrial Research Institute P.O Box 7086 Kampala Uganda

ABSTRACT

In the current study, the capacity and efficacy of water hyacinth, ground nut shell and their blended composite to remove cadmium ions from steel rolling mills wastewater was investigated. Bio-adsorbent were burnt under extreme temperatures to formulate biochar materials by thermal decomposition. Material A, WHA was prepared by using water hyacinth ash, while for material B, GNS by using Ground nut shell ash, BMA a mixture of equal amounts of the two ashes of WHA & GNS were used. Batch experiments was carried out to determine the effect of initial PH, contact time (t) and adsorbent dose on percentage removal of Cd2+ by bio-adsorbent biochar.

The optimum conditions were determined using Taguchi statistical approach. The maximum removal efficiency values (93.18% Cd2+) were obtained at pH 6.5 in 60 min with 2 g of GNS and initial metal concentration of 1.92 mg L–1 forCd2+. The most influential factor on biosorption is adsorbent dose with a percentage contribution of 93.18%, 91.88% and 90.94% for GNS, WHA, BMA respectively.

Amongst the low cost bio-sorbents, GNS presents the lowest cost per gram of heavy metal removed, 4.8 Ugx/g, while WHA is the second less expensive biosorbent with a cost of 5.2 Ugx/g. BMA presents a slightly high cost (5.4Ugx) per gram of Cd (II) removed

Key Words: Water Hyacinth, Biosorption, Ground Nut Shell, Taguchi method, Heavy Metal

INTRODUCTION

Over 21 million people in Uganda who constitute about 46 percent of the population are living without basic access to safe clean water amidst navigating the COVID-19 pandemic. The major factors contributing to this water crisis include rapid population growth, droughts, forest degradation, poor management of water supply and water contamination. This water crisis may worsen as industrial development and population grows as projected if drastic measures are not taken immediately.

There has been remarkable growth in steel rolling industries in the past years. These industries discharge large quantities of heavy metals and toxic wastes. Recent studies in