

# The enhancement of heavy metal removal from polluted river water treatment by integrated carbon-aluminium electrodes using electrochemical method

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**Abstract.** The heavy metal removal enhancement from polluted river water was investigated using two types of electrodes consist of integrated carbon-aluminium and a conventional aluminium plate electrode at laboratory-scale experiments. In the integrated electrode systems, the aluminium electrode surface was coated with carbon using mixed slurry containing carbon black, polyvinyl acetate and methanol. The electrochemical treatment was conducted on the parameter condition of 90V applied voltage, 3cm of electrode distance and 60 minutes of electrolysis operational time. Surface of both electrodes was investigated for pre and post electrolysis treatment by using SEM-EDX analytical technique. Comparison between both of the electrode configuration exhibits that more metals were accumulated on carbon integrated electrode surfaces for both anode and cathode, and more heavy metals were detected on the cathode. The atomic percentage of metals distributed on the cathode conventional electrode surface consist of Al (94.62%), Zn (1.19%), Mn (0.73%), Fe (2.81%) and Cu (0.64%), while on the anode contained O (12.08%), Al (87.63%) and Zn (0.29%). Meanwhile, cathode surface of integrated electrode was accumulated with more metals; O (75.40%), Al (21.06%), Zn (0.45%), Mn (0.22), Fe (0.29%), Cu (0.84%), Pb (0.47%), Na (0.94%), Cr (0.08%), Ni (0.02%) and Ag (0.22%), while on anode contain Al (3.48%), Fe (0.49%), C (95.77%), and Pb (0.26%). According to this experiment, it was found that integrated carbon-aluminium electrodes have a great potential to accumulate more heavy metal species from polluted water compare to the conventional aluminium electrode. Here, heavy metal accumulation process obviously very significant on the cathode surface.

## 1. Introduction

Inorganic pollutants specifically that refer to heavy metals constitute a serious threat for the environment. Most of the metals such as copper, nickel, lead and zinc are harmful when they are discharged without treatment, because they are not biodegradable and tend to accumulate in living organisms, and many heavy metal ions are known to be toxic or carcinogenic [1]. Due to their high toxicity, these contaminated water are strictly concerned to be treated for metals removal. Various

