BIOSORPTION OF IRON AND NICKEL IONS FROM WASTEWATER USING ALGAE THAT THRIVE COOLING WATER SYSTEM

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ABSTRACT

The biosorption for heavy metal removal from industrial wastewater is alternative technology that more advantages than other techniques such as low cost, low biological sludge, high efficiency and environmental friendly. The batch biosorption of iron and nickel ions from synthesis wastewater by blue green algae (cyanobacteria) that thrive in the cooling water system of industry was studied as a function of initial metal ion concentrations, biosorbent dosage and pH. The contact time of biosorption from synthesis wastewater was compared with industrial wastewater at the optimum condition. The concentrations of metal ions were measured in the aliquot samples using Inductively Couple Plasma-Optical Emission Spectrometer (ICP-OES). The results showed the heavy metal removal is highly effective at low initial concentrations of heavy metals. The optimum pH and biosorbent dosage are 5 and 3 g/l, respectively. The removal process from industrial wastewater showed reduction of Iron level from 31.16 mg/l to 2.66 mg/l and Nickel level from 2.56 mg/l to below maximum permissible limit (less than 1 mg/l) within 24 hours. The FTIR spectra indicated that the functional groups predominantly involved in the biosorption were –OH, COO-, -CN.

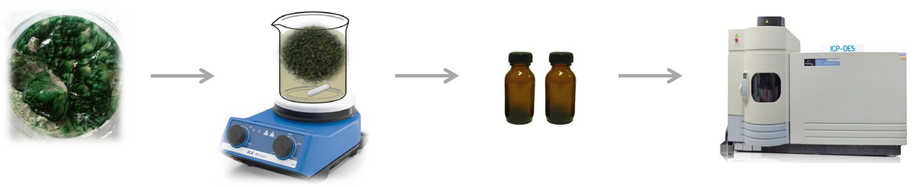
INTRODUCTION

The contaminations of heavy metals from industrial wastewater into natural water resources affect life significantly. Because of heavy metal ions can accumulate in the environment and into the food chain [1]. Therefore, the process of heavy metal removal is very important and the industry should be aware.

The old technologies of heavy metal removal have several disadvantages such as high cost, chemicals used and large volume residual sludge. The biosorption is new alternative method for heavy metal removal process because of low cost, low biological sludge, high efficiency and environmental friendly [2, 3, 4].

The objectives of this research to study the effect of pH, initial condition, biosorbent dosage and contact time on the biosorption process by blue green algae. Moreover, the efficiency of heavy metal removal from synthesis wastewater compared with industrial wastewater by dead algae that thrive in the cooling water system of the industry.

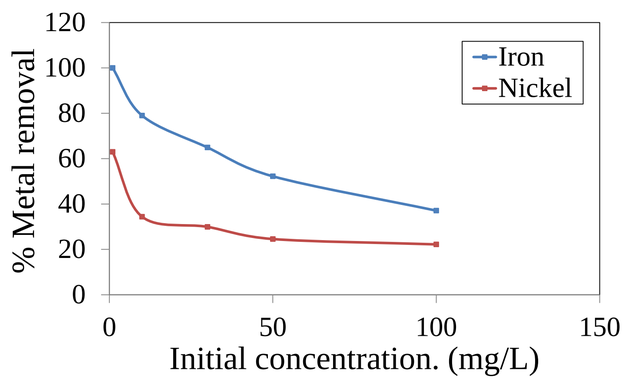
METHODS



The algae washed and dried at 40 ^{o}C for 24 hours (constant weight). The biomass was sieved 0.85 mm. The solid to liquid ratio was 1 g dry wt./L.

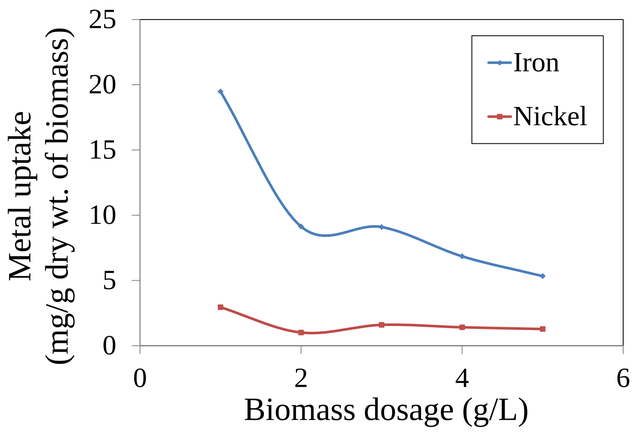
RESULTS

➢ Effect of initial heavy metal concentrations.



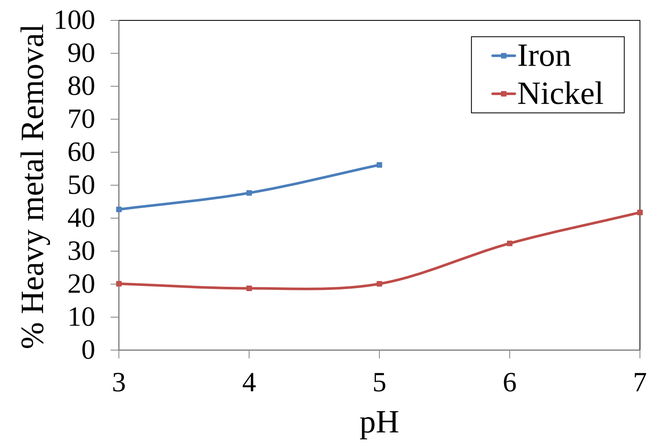
The efficiency of biosorption decreased when the initial concentration increased because the sorption sites on the algae were limited.

➢ Effect of biomass dosage.



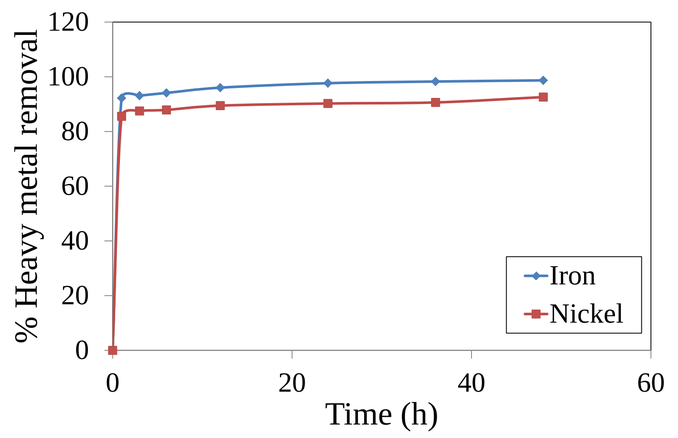
This graph indicate that is possibly due to the enhanced number of binding sites that were available for complexation of metal ions and due to increased electrostatic interactions with large quantities of biomass.

➢ Effect of pH.



The effect of pH can be explain by a competition between proton ions and the metal ions for the binding sites on the adsorbent.

➢ Effect of contact time.



The optimum time of the metal removal from synthesis wastewater was 3 h. But the heavy metal removal rate from industrial wastewater will rise sharply in the first hour. This may be due to the presence of other elements in the industrial wastewater, which affects driving force and mass transfer resistance in the aqueous phase.

Conclusions

- The optimum biomass dosage for heavy metal removal was 3 g/L.
- The FTIR result show that hydroxyl, carboxylic and C-N group were involved in the biosorption .
- that the maximum metal uptake by blue green algae was 37.08 mg/g of iron and 22.20 mg/g of nickel ions.

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