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SELECTIVE REMOVAL AND RECOVERY OF GOLD AND COPPER IONS FROM AQUEOUS SOLUTION BY PKFAD-IMPREGNATED CHITOSAN

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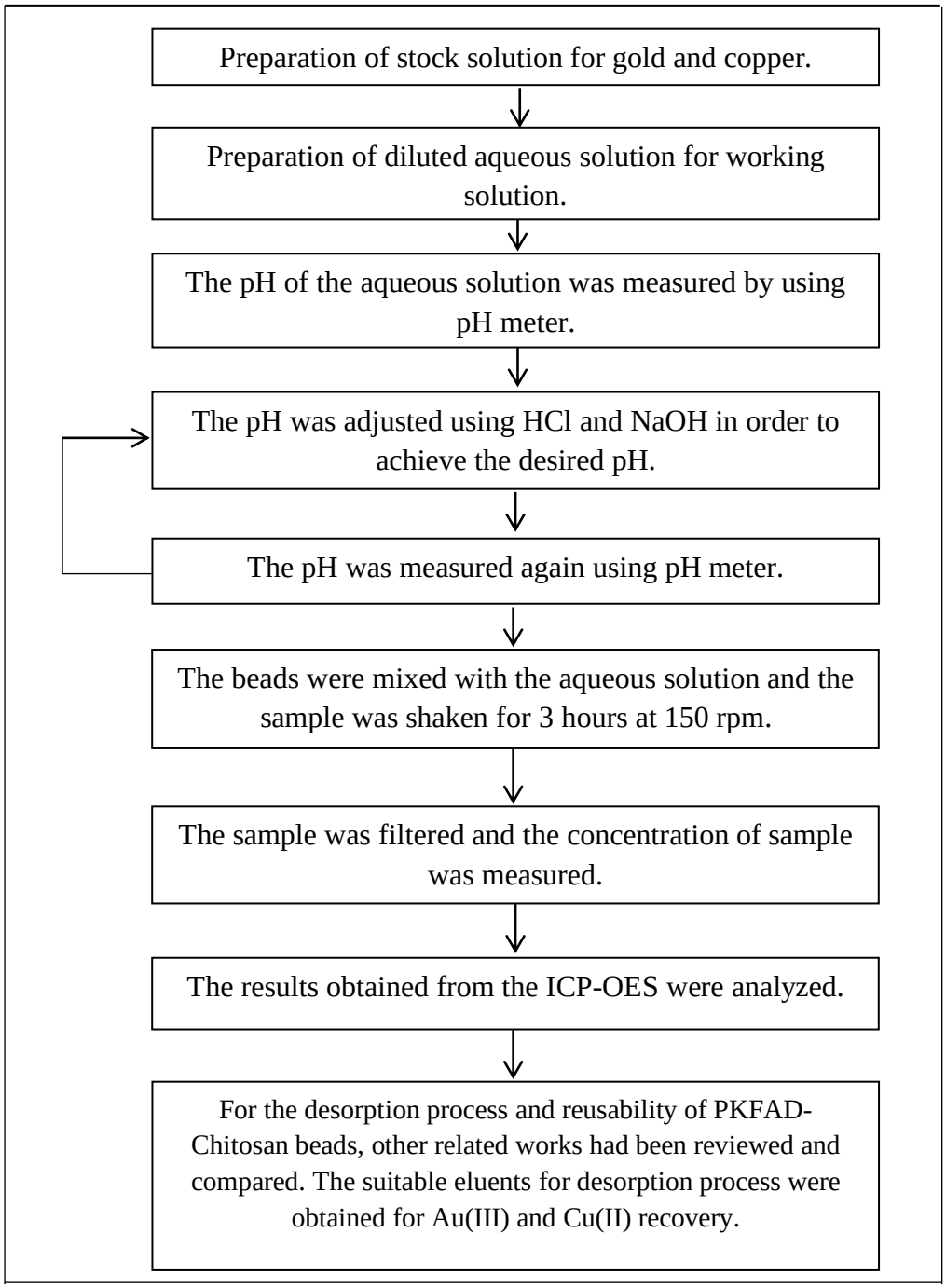
Abstract:
Chitosan is one of the developing biosorbent that becomes main interest among the researchers since it can be used to recover various types of heavy metals in the aqueous solution. A lot of physical and chemical modification had been done toward the chitosan in order to increase its effectiveness for heavy metals recovery. This is because the conventional method like solvent extraction bring more negative impact to the environment In this research, the recovery of gold and copper ions from the aqueous solution has been investigated by using PKFAD-impregnated chitosan as biosorbent. The objectives are to investigate the effects of different parameters on the selective sorption of gold and copper from aqueous solution by PKFAD-impregnated chitosan and to propose suitable desorbing agents for gold and copper recovery from PKFAD-impregnated chitosan by literature review. To synthesis the PKFAD-Chitosan beads, it can be done through the impregnation method by which the viscous solution of chitosan is mixed with PKFAD. The investigated parameters for gold and copper ions recovery are pH of the aqueous solution, initial ratio concentration of aqueous solution and biosorbent dosage. Based on the result obtained, the highest percentage adsorption of Au(III) and Cu(II) can be achieved at pH = 3.24 (96.9%) and pH = 5.53 (71.1%) respectively. When the pH is increasing, the selectivity of Au(III) over Cu(II) reduced from 28.772 to 0.328. When the initial ratio concentration increasing, the adsorption capacity of gold increasing from 6.66 mg/g to 30.719 mg/g. However, the selectivity of Au(III)/Cu(II) is much lower compared to Cu(II)/Au(III) even though the concentration of Au(III) is five times higher than Cu(II). For the adsorbent dosage, the adsorption capacity were decreased for both Au(III) (13.29 mg/g to 3.94 mg/g) and Cu(II) (12.59 mg/g to 2.53 mg/g). The selectivity of gold over copper start to surpass at the adsorbent dosage 0.16 g. For the desorption process, the combination of eluents, thiourea and HCl is highly potential to recover Au(III) from PKFAD-Chitosan beads. Meanwhile, the recovery of copper can be done by using HCl, HNO_3 and EDTA that act as the eluents.

***Keywords*:**
Adsorption; Modified chitosan; Desorption; Au(III) and Cu(II); Selectivity

Objectives:

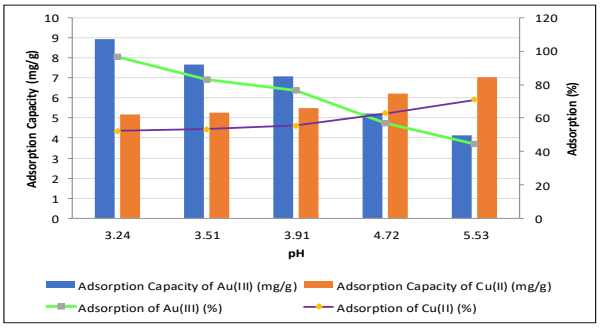
- To investigate the effects of different parameters on the selective sorption of gold and copper from aqueous solution by PKFAD-impregnated chitosan.
- To propose suitable desorbing agents for gold and copper recovery from PKFAD-impregnated chitosan by literature review.

Methodology:

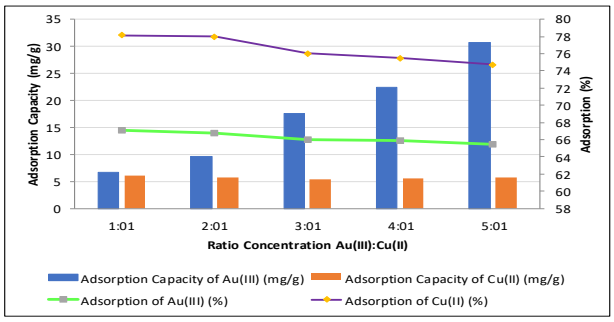


Results:

Effect of pH on Au(III) and Cu(II) sorption



Effect of initial metal concentration ratio on Au(III) and Cu(II) sorption



Conclusion:

This research was successfully conducted the performance of the PKFAD-impregnated chitosan beads for adsorption of Au(III) and Cu(II) from the aqueous solution. The reusability of the PKFAD-Chitosan beads was evaluated by literature review. Firstly, the Au(III) sorption on PKFAD-Chitosan are more selective at the lower pH (pH = 3.24) whereby the percentage adsorption and adsorption capacity were 96.9% and 8.949 mg/g respectively. When the pH is increasing, the graph shows that the declined trend for percentage adsorption and adsorption capacity of Au(III). Moreover, the affinity of heavy metals on PKFAD-Chitosan is changed to Cu(II) (71.1%) compared with Au(III) (44.7%) at pH 5.53. It can be said that the adsorption process need to be done at lower pH, so that high selectivity of Au(III) over Cu(II) can be achieved. For the effect of the initial ratio concentration of Au(III):Cu(II), the percentage adsorption for both Au(III) and Cu(II) were slightly decrease when the ratios were varied from 1:1 to 5:1 in the basis of 10 ppm. However, the adsorption capacity of Au(III) on PKFAD-Chitosan beads were increase from 6.66 mg/g to 30.719 mg/g. The trend of selectivity study for Au(III) over Cu(II) were increasing when the ratios concentration are increase, but the PKFAD-Chitosan beads still have higher affinity on Cu(II) compared to Au(III). For the other parameters likes effect of adsorbent dosage varied from 0.04g to 0.2g, the percentage adsorption of Au(III) was increasing from 53.16% to 78.79%, but it shows a static trend for percentage adsorption of Cu(II) on PKFAD-Chitosan beads. The adsorption capacity for both Au(III) and Cu(II) were decrease when the adsorbent dosage were increasing. The higher selectivity of Au(III) over Cu(II) which is 3 can be achieved at higher adsorbent dosage (0.2g). For the recovery of Au(III), the combination of eluents, thiourea and HCl are proved to be effectively desorbed the Au(III) from the modified chitosan. For the Cu(II) loaded on modified chitosan, the HCl, HNO_3 and EDTA have a great potential for recovery of Cu(II) from adsorbent's surface. It can contribute to reusability of PKFAD-Chitosan beads for the other adsorption process.