List of Figures

Fig. No.	Figure Caption	Page No.
Fig. 4.1:	FTIR spectra of the MKAC (a) Before adsorption (b) After Cr (VI) loading	60
Fig. 4.2(a):	SEM micrograph of MKAC beefore adsorption	61
Fig. 4.2(b):	SEM micrograph of MKAC after Cr (VI) adsorption	62
Fig. 4.3:	Effect of solution pH on Cr (VI) adsorption by MKAC (Initial concentration: 20 mg/l; Agitation speed: 150 rpm; Dose: 0.25g/100mL; Temperature: 35°C; time: 190 minute)	63
Fig. 4.4:	Effect of contact time on Cr (VI) adsorption by MKAC (Initial concentration: 20 mg/l, Solution pH: 2, Agitation speed: 150 rpm, Dose 0.25g/100mL, Temperature: 35°C)	64
Fig. 4.5:	Effect of adsorbent dose on metal uptake and percentage metal removal by MKAC (Initial conc.: 20 mg/l; Solution pH: 2; Agitation speed: 150 rpm; Temperature: 35°C; Contact time : 150 min.)	65
Fig. 4.6:	Effect of initial Cr (VI) concentration on metal uptake (mg g-1) by MKAC (Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.75g/100ml; Temperature 35°C; Contact time: 150 min.)	66
Fig. 4.7:	Langmuir isotherm model for the Cr (VI) adsorption onto MKAC (Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.25g/100mL; Time: 150 min.)	67
Fig. 4.8:	Freundlich isotherm model for the Cr (VI) adsorption onto	67

MKAC (Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.25g/100mL; Time: 150 min.)

- Fig. 4.9:Tempkin isotherm model for the Cr (VI) adsorption onto MKAC68(Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.25g/100mL;
Time: 150 min.)
- Fig. 4.10:D-R isotherm model for the Cr (VI) adsorption onto MKAC68(Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.25g/100mL;Time: 150 min.)
- Fig. 4.11:Pseudo-first-order kinetic model for removal of Cr (VI) by70MKAC (Solution pH: 2; Dose: 0.25g/100 ml, Agitation speed:150 rpm; Temperature 35 0C).
- Fig. 4.12:Pseudo-second-order kinetic model for removal of Cr (VI) by71MKAC (Solution pH: 2; Dose: 0..25g/100 ml, Agitation speed:
180 rpm; Temperature 35 °C).180 rpm; Temperature 35 °C).
- Fig. 4.13:Intra particle diffusion model for removal of Cr (VI) by MKAC71(Solution pH: 2; Dose: 0..25g/100 ml, Agitation speed: 150 rpm;Temperature 35 °C).
- **Fig. 4.14:** Determination of thermodynamic properties for adsorption of 73 Cr(VI) on MKAC
- Fig. 4.15:FTIR spectra of the almond shell activated carbon (a) Before75adsorption (b) After Cr (VI) loading
- **Fig. 4.16 (a):** SEM micrograph almond shell activated carbon before adsorption 76 of Cr (VI)
- **Fig. 4.16 (b):** SEM micrograph almond shell activated carbon after adsorption 77 of Cr(VI)

 Fig. 4.18: Effect of pH on metal uptake by almond shell activated carbon (Initial concentration: 50 mg/L, Time: 240 min, Agitation speed: 150 rpm, Temperature: 35°C, Dose: 2.5g/L) Fig. 4.19: Effect of initial concentration of Cr (VI) on metal uptake and % removal by almond shell activated carbon at (pH 2; Time 4 h; Agitation sped: 150 rpm; Temperature: 35°C; Dose: 2.5 g/L). Fig. 4.20: Langmuir isotherm for removal of Cr (VI) (Solution pH 2; Dose 2.5 g/100 ml; Agitation speed 150 rpm; Temperature 35 °C) Fig. 4.21: Freundlich isotherm for removal of Cr (VI) (Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature: 35 °C)
 Fig. 4.19: Effect of initial concentration of Cr (VI) on metal uptake and % removal by almond shell activated carbon at (pH 2; Time 4 h; Agitation sped: 150 rpm; Temperature: 35°C; Dose: 2.5 g/L). Fig. 4.20: Langmuir isotherm for removal of Cr (VI) (Solution pH 2; Dose 2.5 g/100 ml; Agitation speed 150 rpm; Temperature 35 °C) Fig. 4.21: Freundlich isotherm for removal of Cr (VI) (Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature: 35 °C)
 Fig. 4.20: Langmuir isotherm for removal of Cr (VI) (Solution pH 2; Dose 2.5 g/100 ml; Agitation speed 150 rpm; Temperature 35 ^oC) Fig. 4.21: Freundlich isotherm for removal of Cr (VI) (Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature: 35 ^oC)
Fig. 4.21: Freundlich isotherm for removal of Cr (VI) (Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature: 35 ⁰ C)
Fig. 4.22:Tempkin isotherm for removal of Cr (VI) (Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature :35 °C)
Fig. 4.23: Pseudo-first order kinetic model of Cr (VI) removal by ASAC1
(Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature: 35^{0} C)
 (Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature: 35 °C) Fig. 4.24: Pseudo-second order kinetic model for Cr (VI) removal by ASAC1 (Solution pH: 2, Dose 2.5 g/L; Agitation speed: 150 rpm; Temperature: 35 °C)
 (Solution pH: 2; Dose: 2.5 g/100 ml; Agitation speed: 150 rpm; Temperature: 35 °C) Fig. 4.24: Pseudo-second order kinetic model for Cr (VI) removal by ASAC1 (Solution pH: 2, Dose 2.5 g/L; Agitation speed: 150 rpm; Temperature: 35 °C) Fig. 4.25: Determination of thermodynamic properties for adsorption of Cr (VI) on almond shell activated carbon

- **Fig. 4.27:** SEM image of activated carbon before (a) and after adsorption (b) 92 of MB
- Fig. 4.28: Effect of Initial pH of solution on MB removal (Initial conc.: 100 94 mg/l; Contact time: 360 min; Adosrbent dose: 0.25 g/100 ml; Agitation speed: 180 rpm; Temperature: 30°C)
- Fig. 4.29:Effect of adsorbent dose Methylene blue uptake (Initial conc.:95100 mg/L;Solution pH: 7;Agitation speed:150 rpm;Temperature:30°C)
- Fig. 4.30: Effect of initial MB concentration (Solution pH: 2; Agitation 96 speed: 150 rpm; Dose: 0.2g/100ml; Temperature 30°C; Time: 240 min)
- Fig. 4.31:Adsorption isotherms for MB adsorption- Langmuir isotherm98(Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.2g/100mL;Temperature 30°C; Time: 240 min)
- Fig. 4.32:Adsorption isotherms for MB adsorptionFreundlich isotherm98(Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.2g/100mL;Temperature 30°C; Time: 240 min)
- Fig. 4.33: Adsorption isotherms for MB adsorption Tempkin isotherm 99 (Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.2g/100mL; Temperature 30°C; Time: 240 min)
- **Fig. 4.34:** Adsorption isotherms for MB adsorption- Dubinin and 100 Radushkevich isotherm (Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.2g/100mL; Temperature 30°C; Time: 240 min.)
- Fig. 4.35: Adsorption kinetics models for MB adsorption Pseudo first- 102 order(Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.2g/100mL; Temperature 30°C; Time: 240min.; Initial con. of

xv

MB: 100, 200 and 300 mg/L)

- Fig. 4.36: Adsorption kinetics models for MB adsorption Pseudo second- 102 order (Solution pH: 2; Agitation speed: 150 rpm; Dose: 0.2g/100mL; Temperature 30°C; Time: 240min.; Initial con. of MB: 100, 200 and 300 mg/L)
- Fig. 4.37:Determination of thermodynamic parameters for adsorption of104MB on almond shell activated carbon