

Chapter VII

Column Experiments

The batch results which have furnished information regarding the feasibility and compatibility of the prepared activated carbons in the removal of DB2 is subjected to column operations. This is carried out to quantify the carbons' efficiencies in the continuous column running. Two column operations were set up pertaining to aqueous DB2 solutions and the corresponding effluent sample as noted from chapter V.

7.1 Short Term Analysis

Glass columns with dimensions of 10 cm column depth and 3 cm diameter were filled with 5 gm of respective carbons sandwiched between (layers of both) glass wool and glass beads of appropriate thickness.

An aqueous solution of 100 mg/L initial concentration was poured from the top of the columns. The flow rate was fixed as 5mL/min through trial/error method by collecting volumes sorbate species at different time intervals. PJBAC exhibited a maximum removal of (99.5%) against GDAC (85%), therefore PJBAC was chosen for long term analysis. Figure 7.1 depicts a typical column of PJBAC employed for column studies



Figure 7.1 Short Term Analysis

7.2 Long Term Analyses

This study was conducted as continuous column operation and further analysis of the exhausted column. A cylindrical glass tube with 30 cm/6 cm as column depth/diameter was designed (Figure 7.2) as the fixed bed column. The apparatus was packed as done before in the case of pilot studies but for 40 gm of PJBAC. Column runs were carried out for the same initial concentration with flow rate subsequently being fixed as 100 mL/5 min, where 99.5% dye removal was ensured.



Figure 7.2 Long Term Analysis

7.3 Desorption/ Regeneration Studies

The column got exhausted after a collection of maximum of 13 litres registering 99.5% removal upto 8 litres, followed by gradual decline. The exhausted column was washed initially with doubly distilled water, followed by 0.01 M HCl and finally again with double distilled water. About 75% of DB2 loaded PJBAC was observed to be successfully desorbed emphasizing the reasonable regeneration capacity of PJBAC. This may be due to the physical adsorption as a predominant mechanism substantiated by the DKR isothermal constant value ($2.817 \text{ kJ/mol} < 8 \text{ kJ/mol}$) for DB2 -PJBAC system.

7.4 Column Studies- DB2 Effluent Sample

The viability and effectiveness of adsorption process mainly depends on the properties of the sorbent materials as well as the composition of the wastewater. DB2 effluent sample collected as referred in the subdivision 5.31 was subjected to column studies to quantify the sorption capacity of PJBAC. The removal was established in favour of the system upto 6 litres exhibiting 92%, followed by decreasing in uptake upto 9 litres, when the packed PJBAC got exhausted.