

Figure 5: Effect of ferrous sulphate on turbidity removal

f) Effect of ferrous sulphate with lime

From the experimental results it is seen that when dosage of ferrous sulphate was increased from 100 - 800 ppm, the corresponding reduction in turbidity was observed to be 67.53- 64.93%. It was noticed from the fig that the highest turbidity removal for the sample was achieved when the dose was 400 ppm which is shown in table 7 and has been represented graphically in fig 6.

Table 7: Effect of ferrous sulphate with lime on pH, turbidity and suspended solids

Coagulant dose (ppm)	pH	Turbidity removal (%)	Suspended solids (mg/l)
100	8.05	67.53	0.010
200	8.05	74.02	0.009
300	8.30	80.52	0.008
400	8.50	81.81	0.007
500	9.00	72.72	0.020
600	9.50	70.76	0.012
700	9.75	67.11	0.015
800	10.20	64.93	0.008

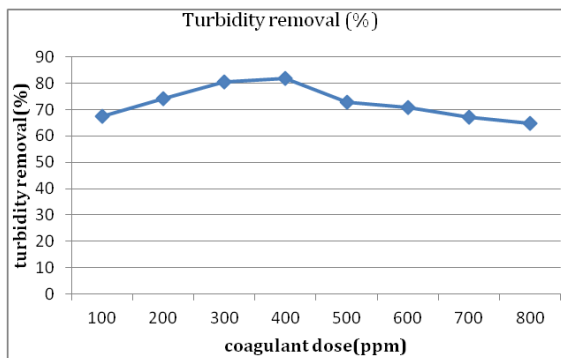


Figure 6: Effect of ferrous sulphate with lime on turbidity removal

3.2 Heavy metal removal

In this work, coagulants were used at different doses, and their performances in the removal of heavy metals. Initial concentration of Lead (Pb) and Iron (Fe) of the coal washery sample are shown in table 8.

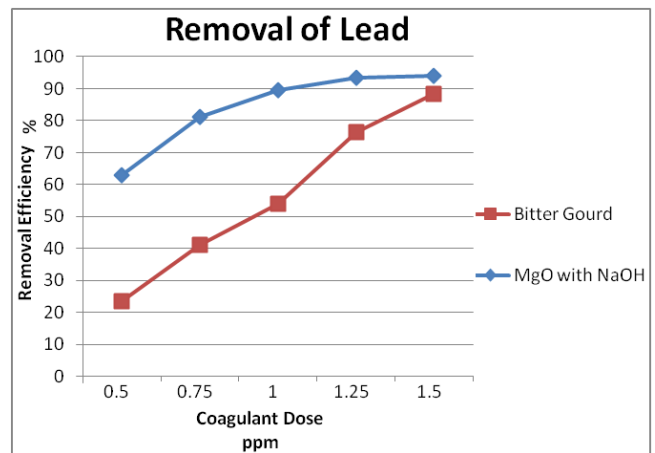
Table 8: Initial concentration of Lead(Pb) and Iron(Fe)

Heavy metals	Initial Concentration (mg/l)	Permissible limit
Iron (Fe)	30.0	3 max
Lead (Pb)	0.17	0.1

a) Effect of bitter gourd and MgO with NaOH on removal of Lead (Pb)

From the experimental results it is seen that when the dosage of Bitter gourd and MgO with NaOH was increased from 500-1500 ppm, the corresponding reduction in Lead removal was observed to be 23.53-88.23% and 63- 94.11% respectively

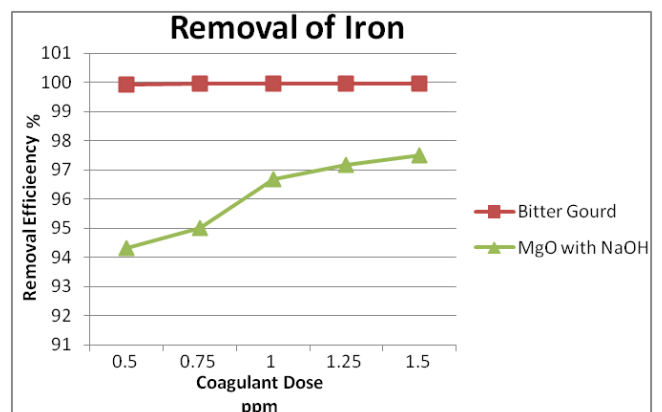
Sr.No	Coagulant Dose ppm	Final Concentration mg/l		Efficiency %	
		Bitter Gourd	MgO with NaOH	Bitter Gourd	MgO with NaOH
1	0.5	0.13	0.063	23.53	63
2	0.75	0.10	0.032	41.17	81.2
3	1	0.08	0.018	54	89.4
4	1.25	0.04	0.013	76.5	93.35
5	1.5	0.02	0.01	88.23	94.11



b) Effect of bitter gourd and MgO with NaOH on removal of Iron (Fe)

From the experimental results it is seen that when the dosage of Bitter gourd and MgO with NaOH was increased from 500-1500 ppm, the corresponding reduction in Iron removal was observed to be 99.93-99.96% and 94.3-97.4% respectively

Sr.No	Coagulant Dose ppm	Final Concentration mg/l		Efficiency %	
		Bitter	MgO with	Bitter	MgO with
1	0.5	0.02	1.72	99.93	94.3
2	0.75	0.10	1.5	99.96	95
3	1	0.01	1.0	99.96	96.66
4	1.25	0.01	0.85	99.96	97.16
5	1.5	0.01	0.74	99.96	97.5



4. Conclusion

In the developing countries treatment plants are expensive, the ability to pay for services is minimal and skills as well as technology are scarce. In order to alleviate the prevailing difficulties, approaches should focus on sustainable water treatment systems that are low cost, robust and require minimal maintenance and operator skills. Therefore, locally available materials can be exploited towards achieving sustainable safe water supply. The study was conducted to obtain okra seeds and bitter gourd seeds as new source of bioremediation for the treatment of coal washery effluent. The effect of seeds on pH, suspended solids, turbidity, is to be compared accordingly. The chemical coagulants ferrous sulphate with lime, ferric chloride with lime was used for comparing the values with natural coagulants. The results obtained from this research revealed that bitter gourd seeds without extraction are more effective than okra seeds with extraction by NaCl in removal of turbidity of coal washery effluent. The efficiency of bitter gourd seeds, okra seeds, ferrous sulphate with lime and ferric chloride with lime was 61.03%, 44.15%, 81.81% and 99.87% respectively for an optimum dosage of 400 ppm. The chemical coagulants were found to be more effective in removing turbidity as well as suspended solids. Also bitter gourd seeds were used for removal of heavy metals like lead and iron and the results were compared with the removal efficiency of the same heavy metals using chemical coagulant magnesium oxide with NaOH. It was found that removal efficiency of lead was greater in chemical coagulant than in natural coagulant and removal efficiency of iron was greater in natural coagulant than in chemical coagulant.

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