Organic matter and nitrogen recovery from landfill leachate using coagulation flocculation followed by granular activated carbon and ion exchange

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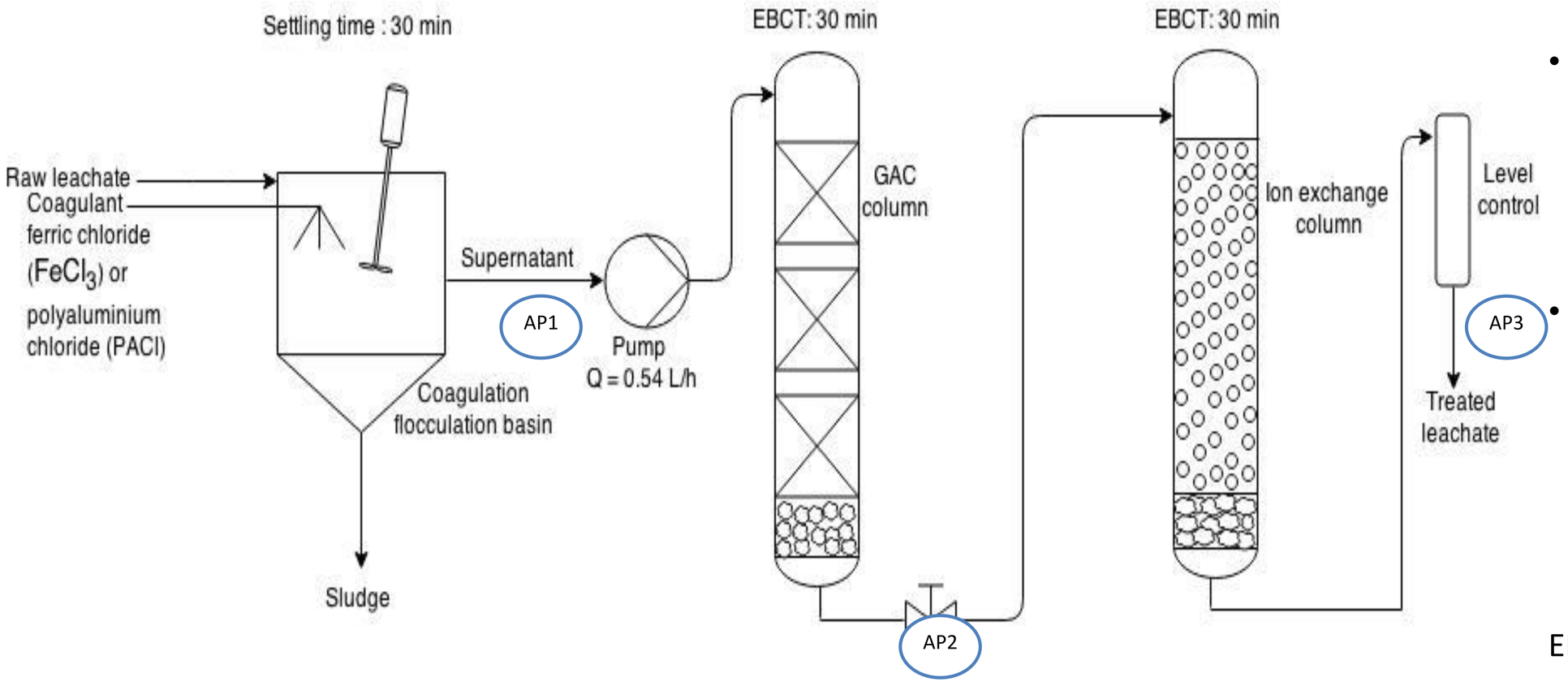
Introduction

- Current leachate treatment technologies focus on the removal and not the potential for recovery of important resources such as organic matter and ammonium nitrogen from landfill leachate.
- Therefore, this study seeks to investigate the **effectiveness of a sequence of coagulation-flocculation (CF), granular activated carbon (GAC) and ion exchange (IE) to recover organic matter and ammonium from landfill leachate** whilst reducing the pollutant load of landfill leachate to the required discharge limits.

Materials and methods



- Performance of the treatment sequence was evaluated at analysis point (AP) 1, 2, 3 by measuring COD , α_{254} , Ni, NH_4^+ - N
- Initial concentration (mg/L) of pollutants in raw leachate – COD: 3152, Ni: 3.65, NH_4^+ - N: 1885 and α_{254} :18.41 cm^{-1}

EBCT: empty bed contact time

Results and Discussion

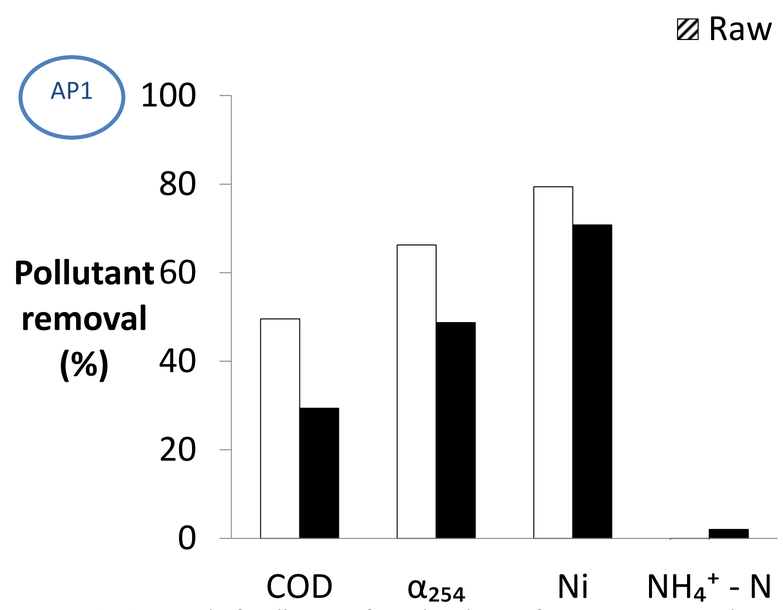


Figure 1 : Removal of pollutants from leachate after treatment with Coagulation flocculation at optimum coagulant concentration of 7g/L

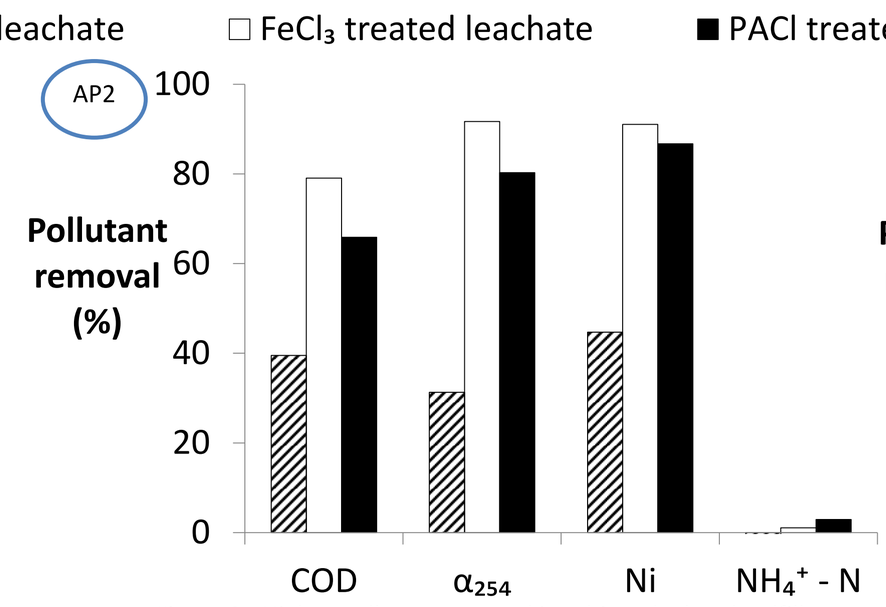


Figure 2 : Higher pollutant removal is achieved when landfill leachate is treated with CF and GAC compared to raw leachate treated with GAC only

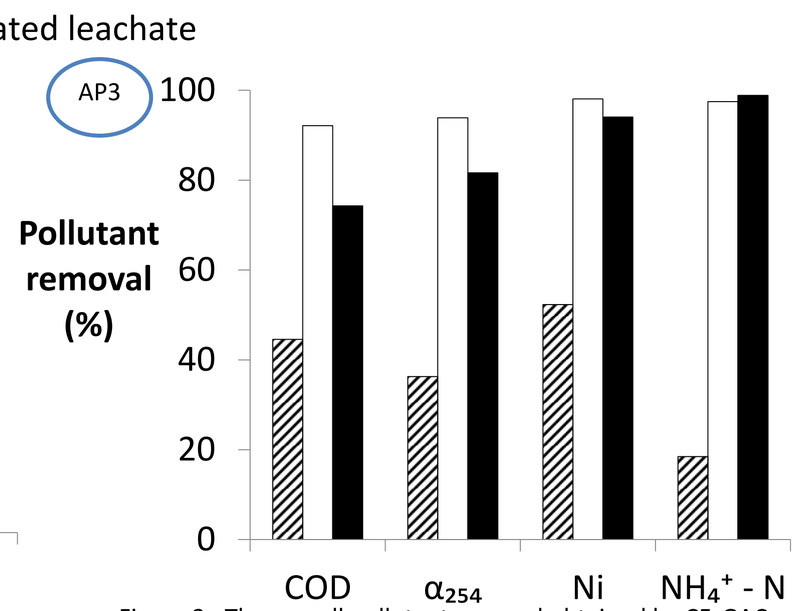


Figure 3 : The overall pollutant removal obtained by CF, GAC and IE is better than the performance of GAC and IE in treatment of raw landfill leachate

Table 1: Number of bed volumes treated by the IE column before passing the Flemish environmental discharge limits

	COD	Ni	NH_4^+ - N
Raw leachate	2	2	6
FeCl3 treated leachate	11	> 12	9
PACl treated leachate	4	> 12	10

Key Findings

- The overall removal efficiency of pollutants increases when CF is combined with GAC and IE.
- IE is effective in removing NH_4^+ - N from landfill leachate. Up to 98% ammonium nitrogen is retained in the column
- Treatment of landfill leachate by CF and GAC before ion exchange improves the capacity of the IE column to retain ammonium nitrogen, COD and Ni
- $FeCl_3$ is the best coagulant to use to pre-treat leachate before AC and IE

Future perspectives

- Regeneration of the ion exchange column with a suitable solution to recover the retained NH_4^+ - N
- Carry out an economic analysis of the entire treatment chain

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