

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

Violet Oloibiri^{a,b,c}, Sam Deconinck^a, Stijn DeWandel^a, Michael Chys^a, Kristof Demeestere^b, Stijn Van Hulle^a

^a LIWET, Department of industrial biological sciences, Ghent university — campus Kortrijk, Graaf Karel De Goedelaan 5 8500 Kortrijk Belgium

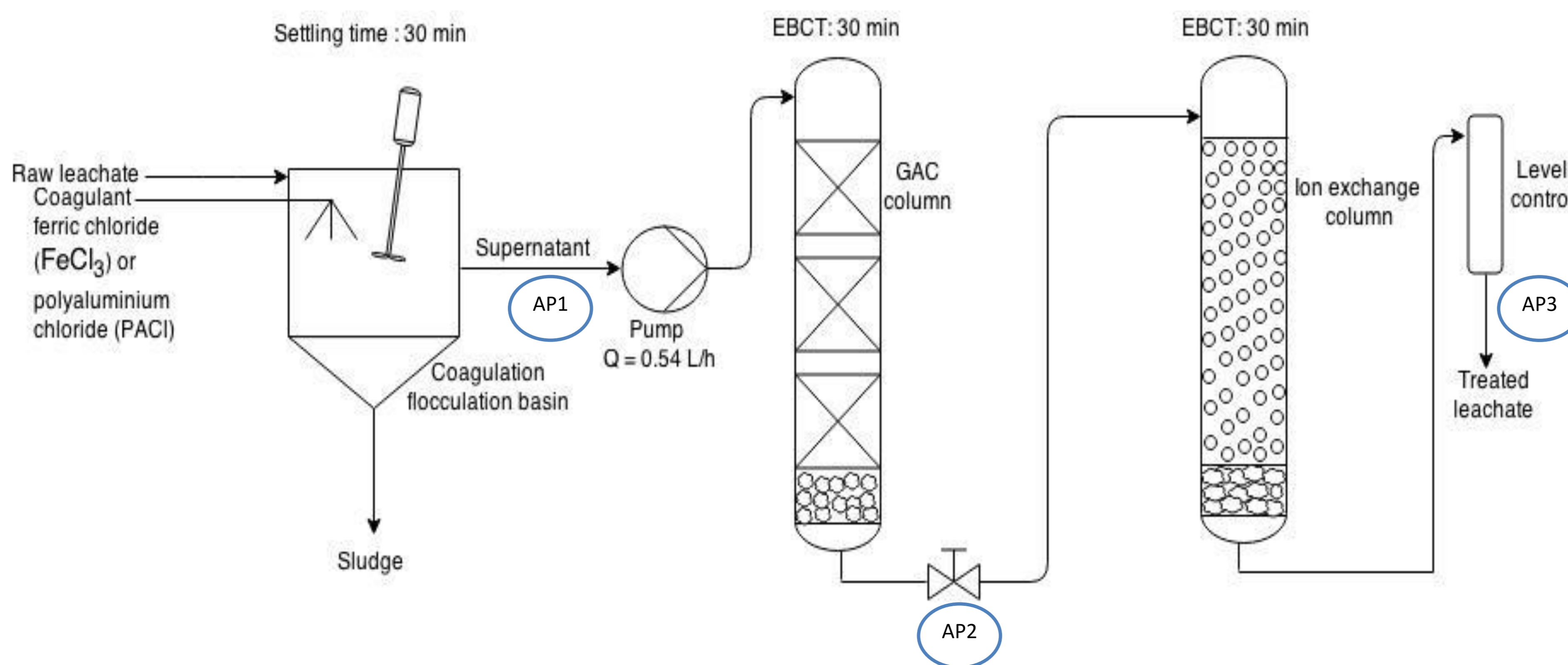
^b ENVOC, Department of sustainable organic chemistry and technology, Ghent University, coupure links 653, Ghent Belgium

^c Kenya industrial research and development institute P.O. Box 30650—00100 Nairobi Kenya

Introduction

- Current landfill leachate treatment facilities focus on the removal but not on 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, $\text{NH}_4^+ - \text{N}$
- Initial concentration (mg/L) of pollutants in raw leachate – COD: 3152, Ni: 3.65, $\text{NH}_4^+ - \text{N}$: 1885 and α_{254} : 18.41 cm^{-1}

EBCT: empty bed contact time

Results and Discussion

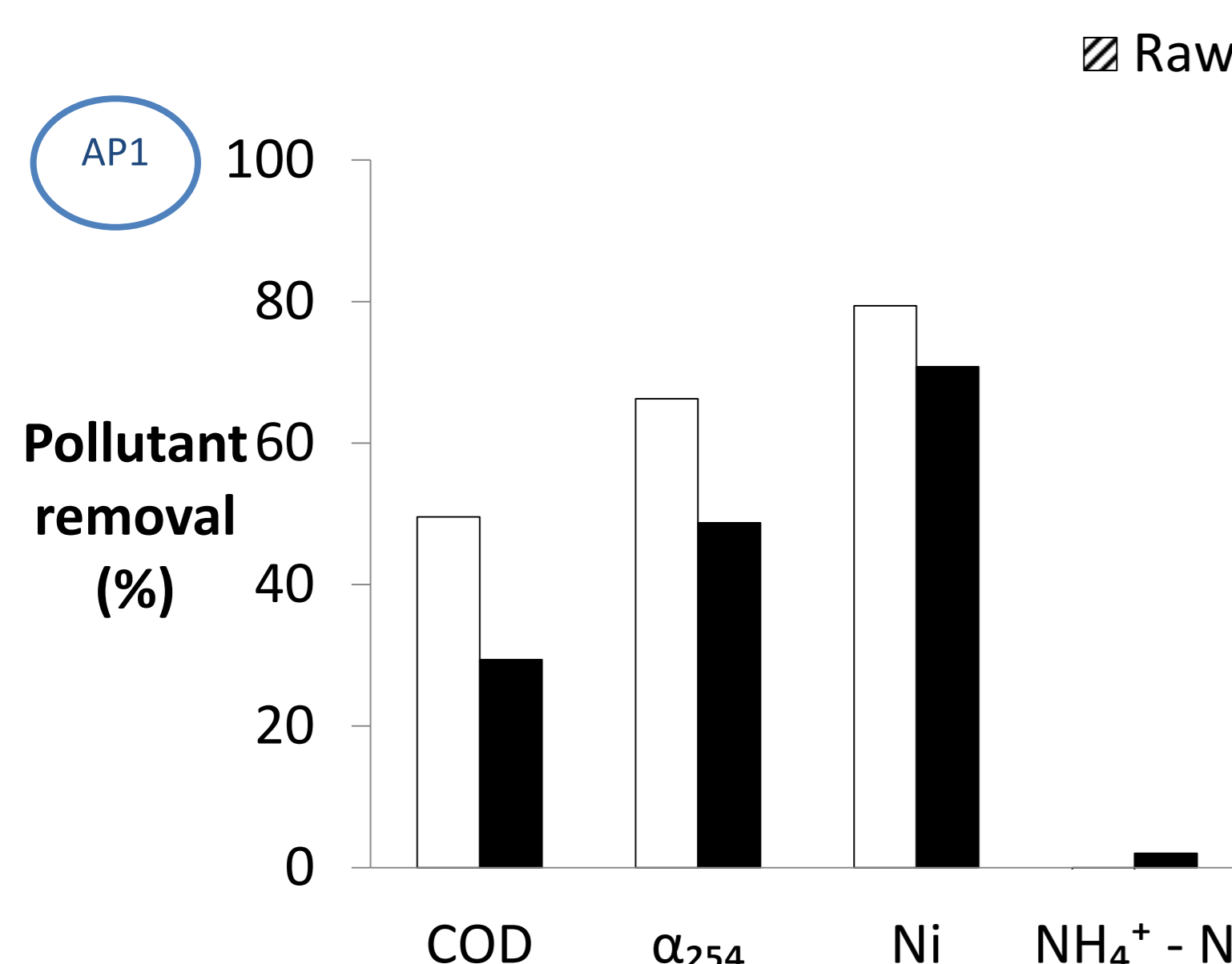


Figure 1: Removal of pollutants from leachate after treatment with Coagulation flocculation at optimum coagulant concentration of 7g/L

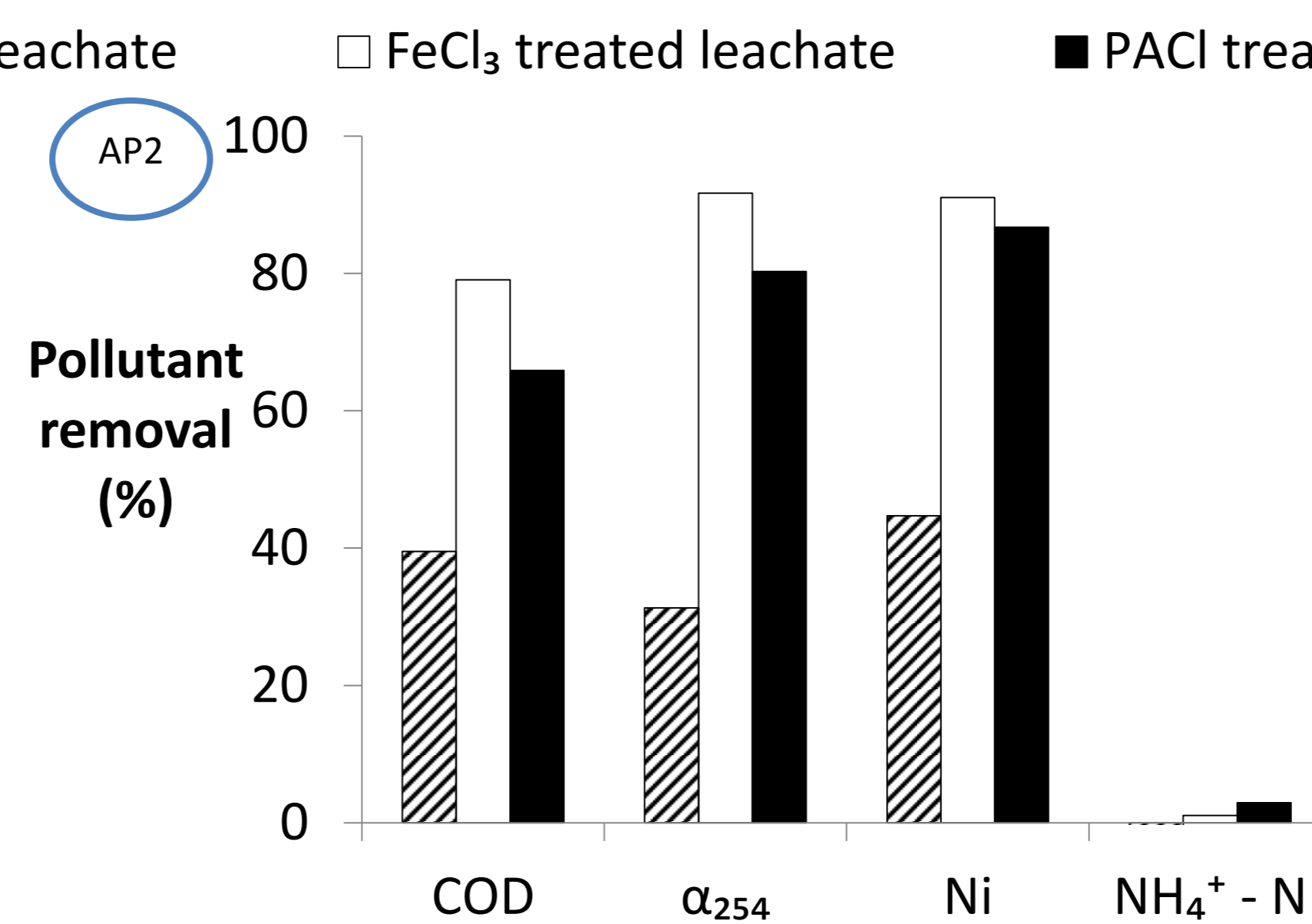


Figure 2: Higher pollutant removal is achieved when landfill leachate is treated with CF and GAC compared to raw leachate treated with GAC only

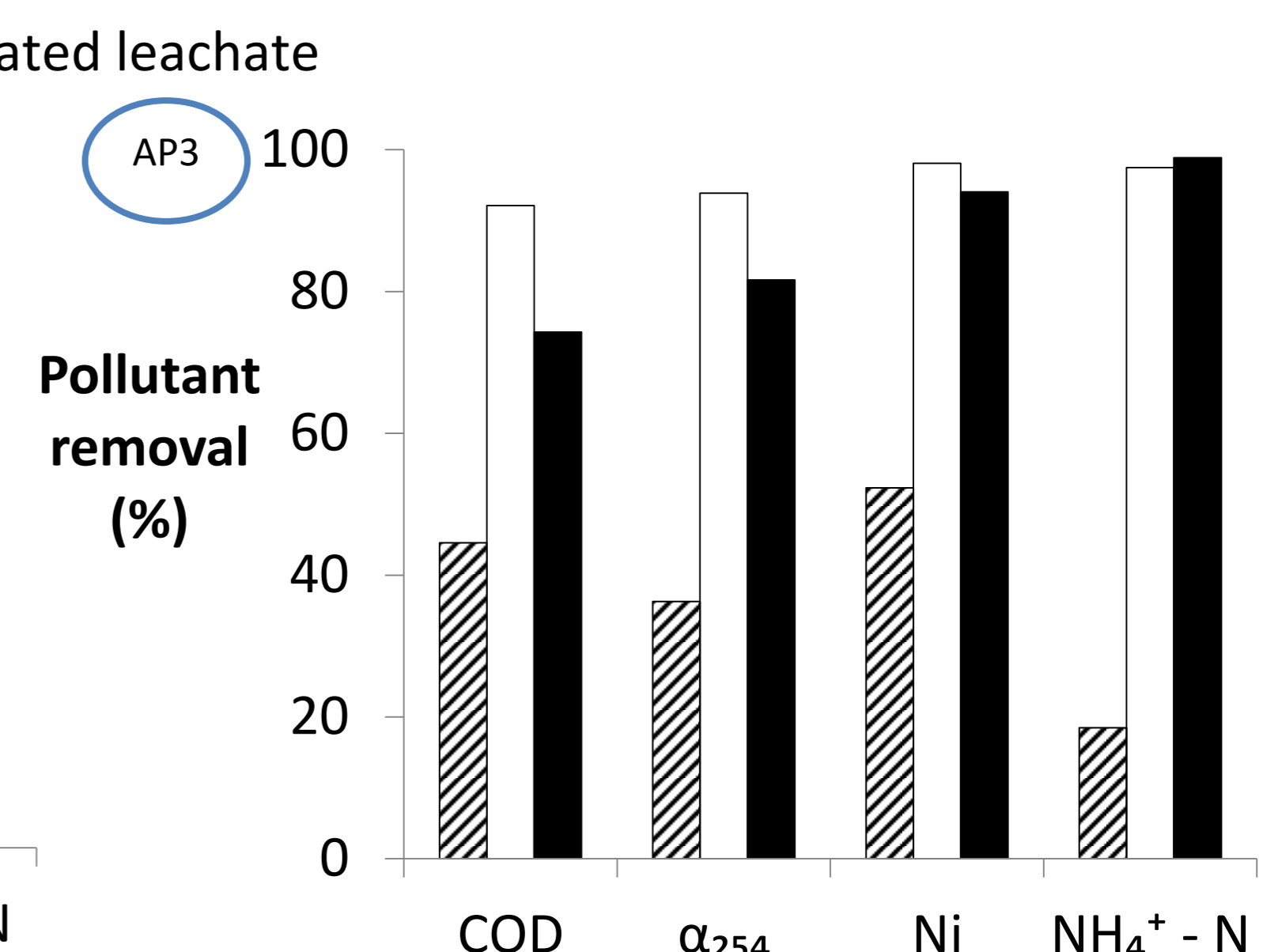


Figure 3: The overall pollutant removal obtained by CF, GAC and IE is better than the performance of GAC and IE in treatment of raw landfill leachate

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

	COD	Ni	$\text{NH}_4^+ - \text{N}$
Raw leachate	2	2	6
FeCl ₃ 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 $\text{NH}_4^+ - \text{N}$ 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
- FeCl₃ 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 $\text{NH}_4^+ - \text{N}$
- Carry out an economic analysis of the entire treatment chain

