

Organic matter removal from landfill leachate in shallow waste stabilization ponds

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Introduction

- About 240 thousand tons of urban solid wastes are collected in Brazil daily, of which most is disposed off in open dumps and only 13% goes to properly constructed sanitary landfills.
- Most of the urban solid waste content is organic matter and its decomposition produces sub products that must be adequately treated.
- Among these sub products are leachate and biogas which warrant attention because of their hazardous effects on the environment

In terms of leachate strength, high COD, volatile acids and nitrogen concentrations are frequently cited in the literature as shown in the table below (Leite *et al*, 2002)

Time (days)	pH	Total alkalinity (mgCaCO ₃ . L ⁻¹)	Volatile fat acids (mgHAc. L ⁻¹)	COD (mg. L ⁻¹)	TKN (mg. L ⁻¹)	VTS (mg. L ⁻¹)
30	4.2	2,875	13,500	36,169	829	34,892
90	4.2	2,000	16,500	37,382	941	41,134
150	4.0	0	14,040	47,995	1,155	32,730
210	4.3	2,408	17,570	47,692	2,038	22,152
270	4.7	5,500	10,650	31,621	1,994	30,108
330	4.6	3,625	7,138	34,090	1,557	12,892

Aims

This paper investigated organic matter removal from leachate treated in a series of shallow waste stabilization pond.

Methods

The experimental pond system was built at EXTRABES in Campina Grande, Northeast Brazil.

Pond depths varying from 0.45 to 0.60 m and all had the same theoretical dispersion number of 0.18.

The leachate used in the study was tankered periodically from the sanitary landfill in João Pessoa, 130 km from Campina Grande.

It was stored in PVC tanks for a maximum period of 30 days.

The leachate was used to feed the series of ponds which had a total HRT of 50 days.

Figure 1: Scheme of the experimental waste stabilization ponds

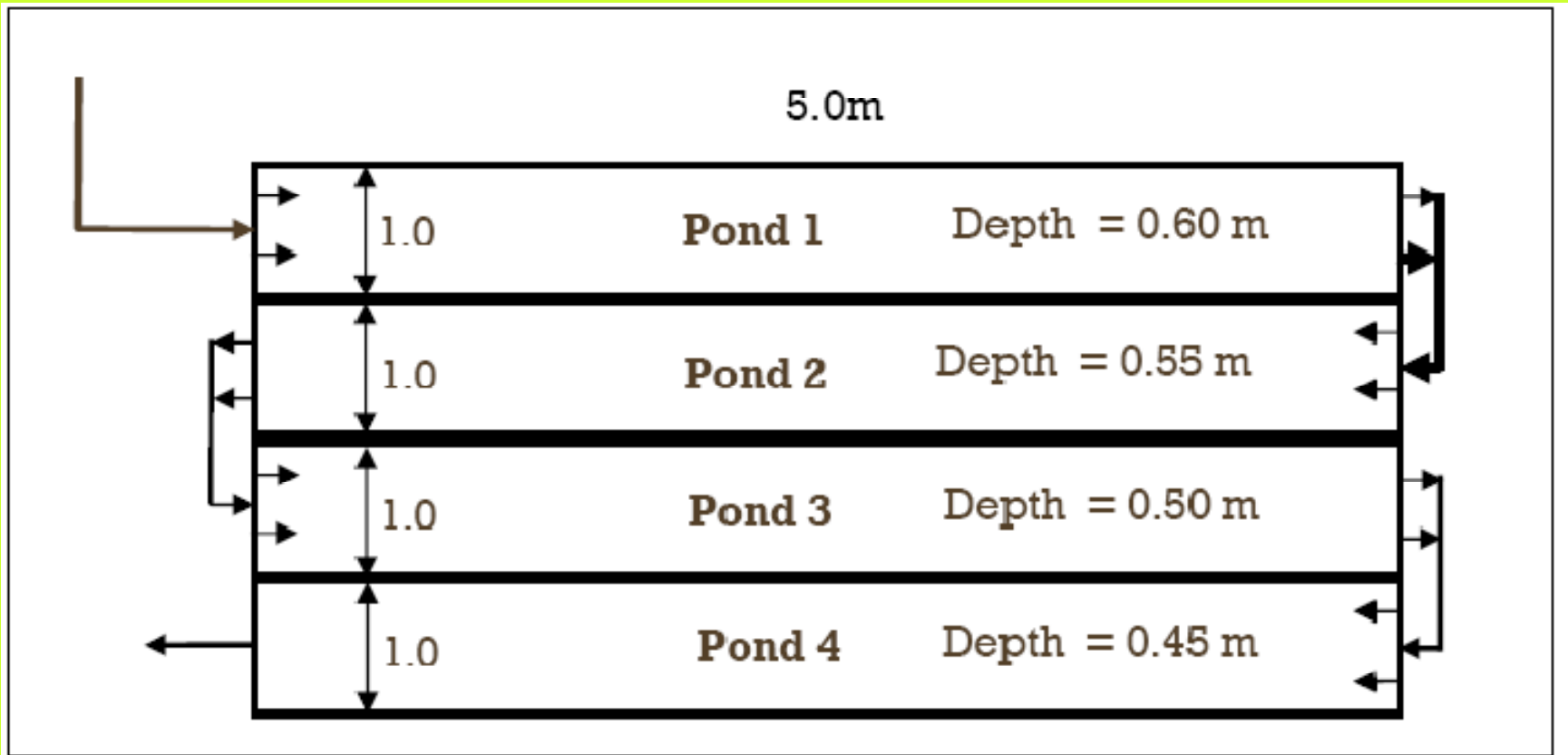


Table 2. physical and operational features of the pond system

	<i>Length (m)</i>	<i>width (m)</i>	<i>depth (m)</i>	<i>Volume (m³)</i>	<i>HRT (days)</i>	<i>d</i>
Pond 1	5	1	0.60	3.00	14.3	0.18
Pond 2	5	1	0.55	2.75	13.1	0.18
Pond 3	5	1	0.50	2.50	12.1	0.18
Pond 4	5	1	0.45	2.25	10.5	0.18

d: theoretical dispersion number

Total HRT of 50 days.

Leachate characteristics from cell 1, cell 2 and cell 3

Parameters	Cell 1	Cell 2	Cell 3
pH	8.2	8.5	7.6
Total alkalinity (mg CaCO ₃ /L)	10,500	10,710	12,558
Volatile fat acids (mg/L)	422	576	8140
COD (mg/L)	3,244	3,920	26,373
Soluble COD (mg/L)	3,189	3,818	16,619
Sulphide (mg/L)	44.8	11.2	100.8
Total phosphorus (mg/L)	22.2	25.8	32.2
Soluble phosphorus (mg/L)	12.5	13.8	3.5
TKN (mg/L)	2,490	2,340	2,520
Ammonia (mg/L)	2,250	2,290	2,282
Total solids (mg/L)	11,852	13,734	28,682
Fixed total solids (mg/L)	1,484	1,626	10,806
Volatile total solids (mg/L)	10,368	12,108	17,876
Suspended solids (mg/L)	254	378	4,620
Volatile suspended solids (mg/L)	132	190	2,928

Variation in Total COD along the pond series.

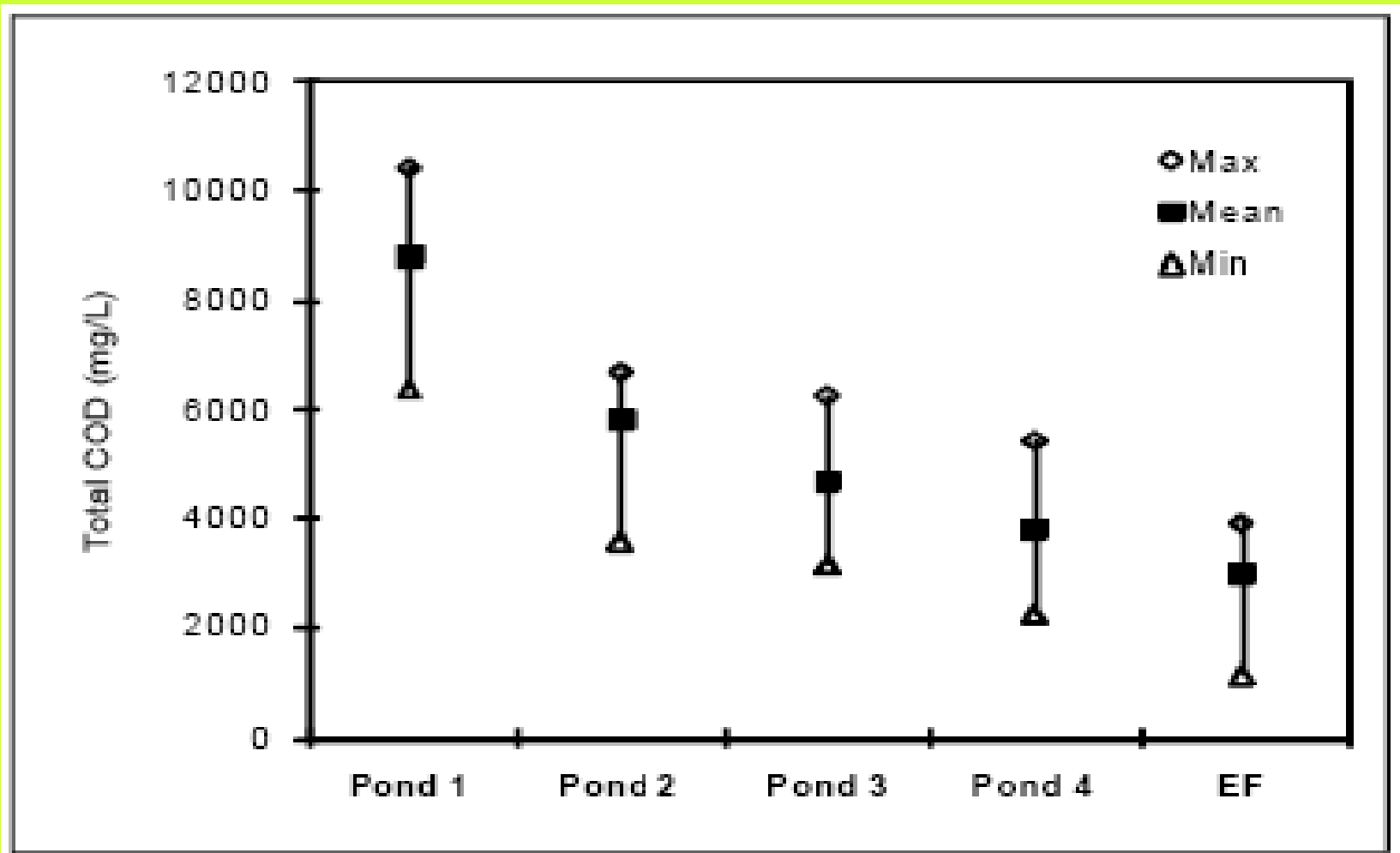


Figure 3: Variation in Soluble COD along the pond series.

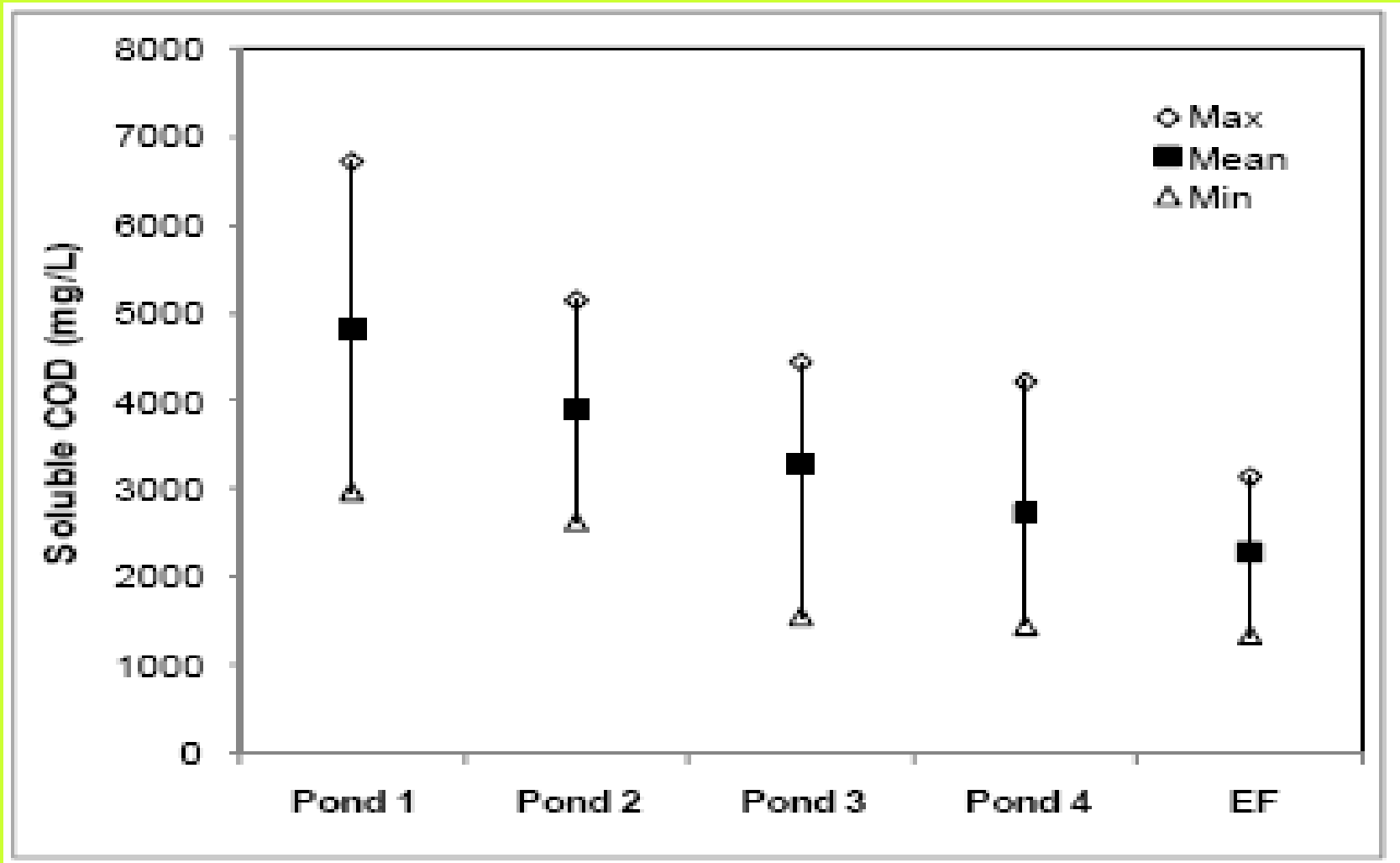


Figure 4. Variation in Suspended Solids along the pond series.

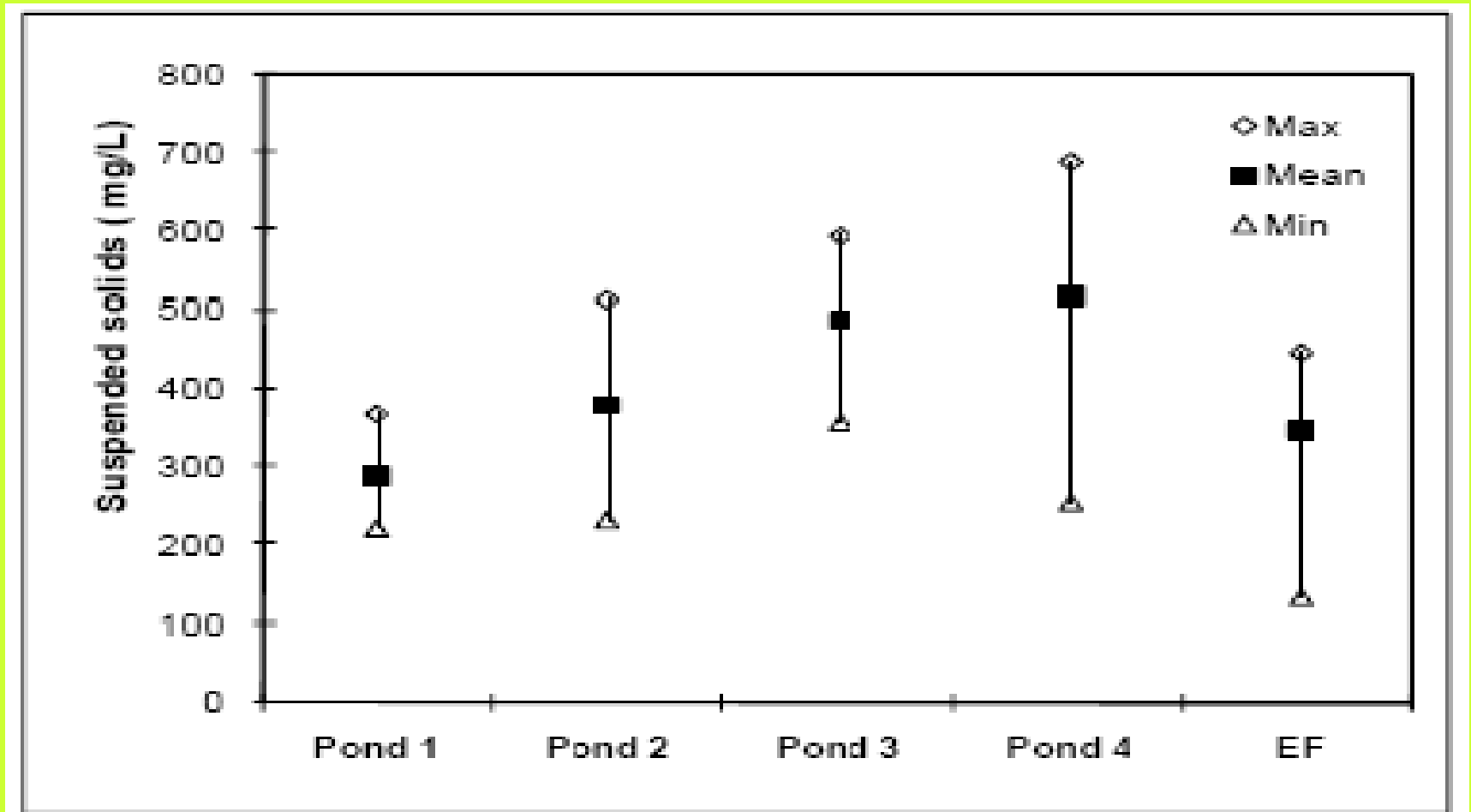
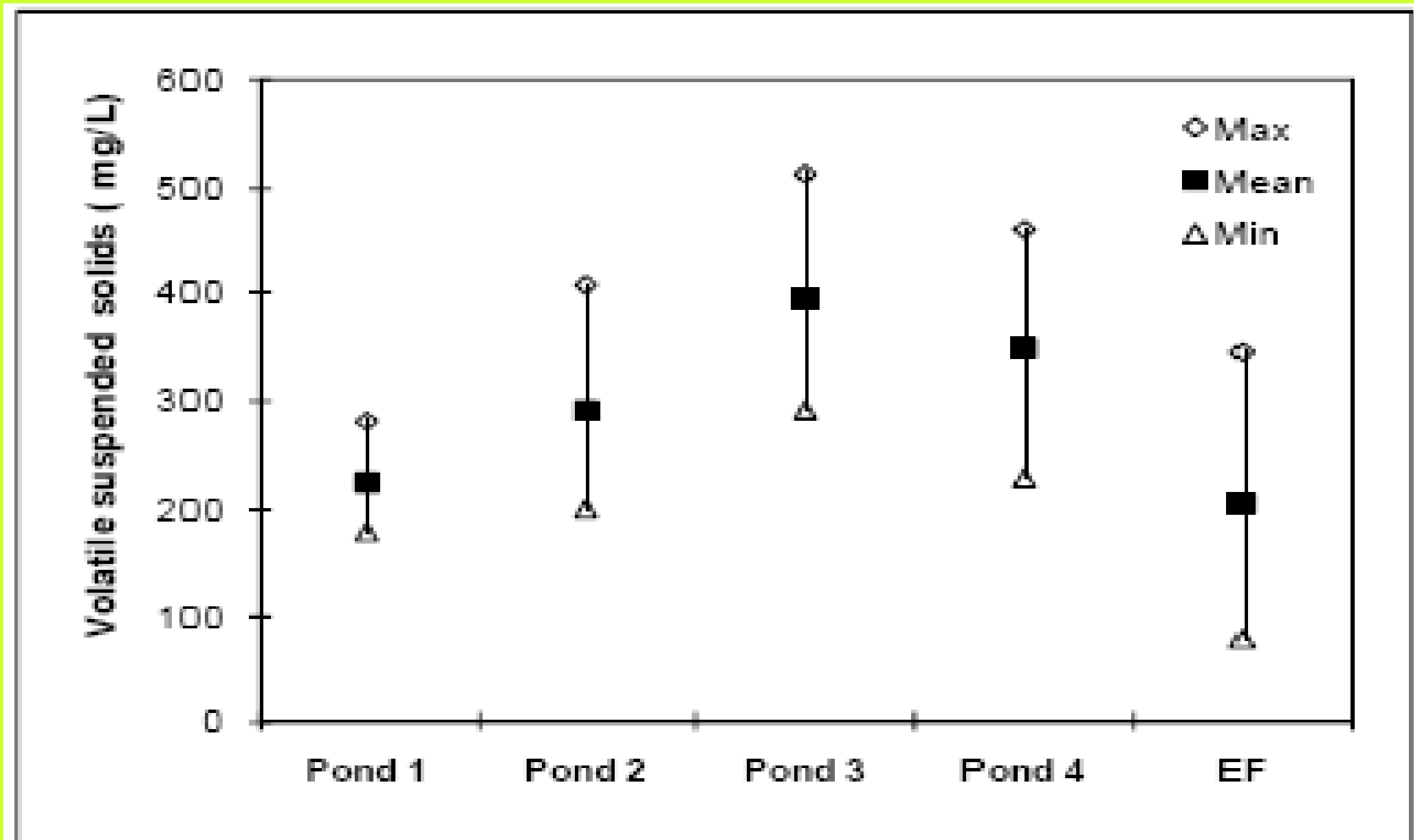


Figure 5: Variation in Volatile Suspended Solids along the series.



Conclusions

- Shallow waste stabilization ponds, fed with landfill leachate in a plug flow regime removed 66% and 52% of total and soluble COD respectively.
- Despite the high carbonaceous and nitrogenous loading rates on the first pond of the series there was good growth of algal biomass in the system which was responsible for the high effluent solids
- A shallow pond series could become an important treatment alternative for landfill leachate treatment in northeast Brazil.

Acknowledgements

The authors would like to thank
FINEP/PROSAB and CNPq for supporting
the research.