

J.J. Salas and R. Bouza

TWENTY YEARS OF SLUDGE ACCUMULATION IN CARRIÓN DE LOS CÉSPEDES (SPAIN) STABILIZATION PONDS SYSTEM

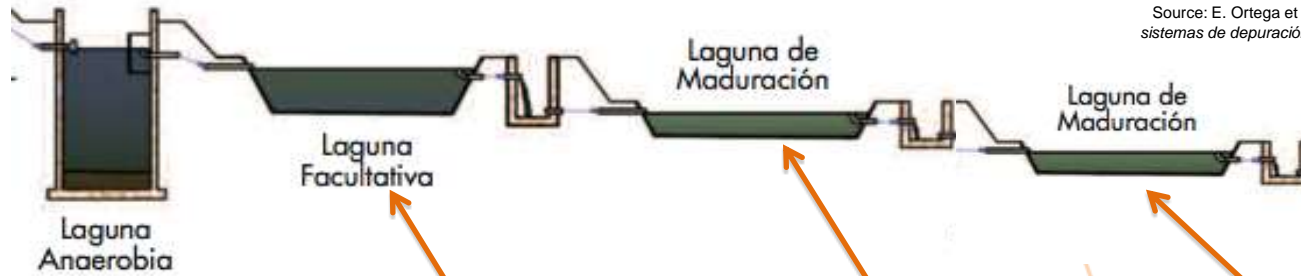
PECC 1990 -2010



Stabilization Ponds System

STABILIZATION PONDS SYSTEM

Source: E. Ortega et al. *Manual para la implantación de sistemas de depuración en pequeñas poblaciones*. MARM.



ANAEROBIC POND
 Volume (m³): 75
 Surface area (m²): 25
 Pond depth (m): 3
 HRT (days): 2,1

FACULTATIVE POND
 Volume (m³): 1220
 Surface area (m²): 982
 Pond depth (m): 1,5
 HRT (days): 34,3

MADURATION POND I
 Volume (m³): 295
 Surface area (m²): 400
 Pond depth (m): 0,9
 HRT (days): 8,4

MADURATION POND II
 Volume (m³): 201
 Surface area (m²): 291
 Pond depth (m): 0,9
 HRT (days): 5,7

AFLUENT
 Carrión de los Céspedes (Spain)
 urban non-separative wastewater
 2500 people
 35 m³/day



2010 STABILIZATION PONDS SYSTEM SHUTDOWN



ACCUMULATED SLUDGES STUDY

Objetives:

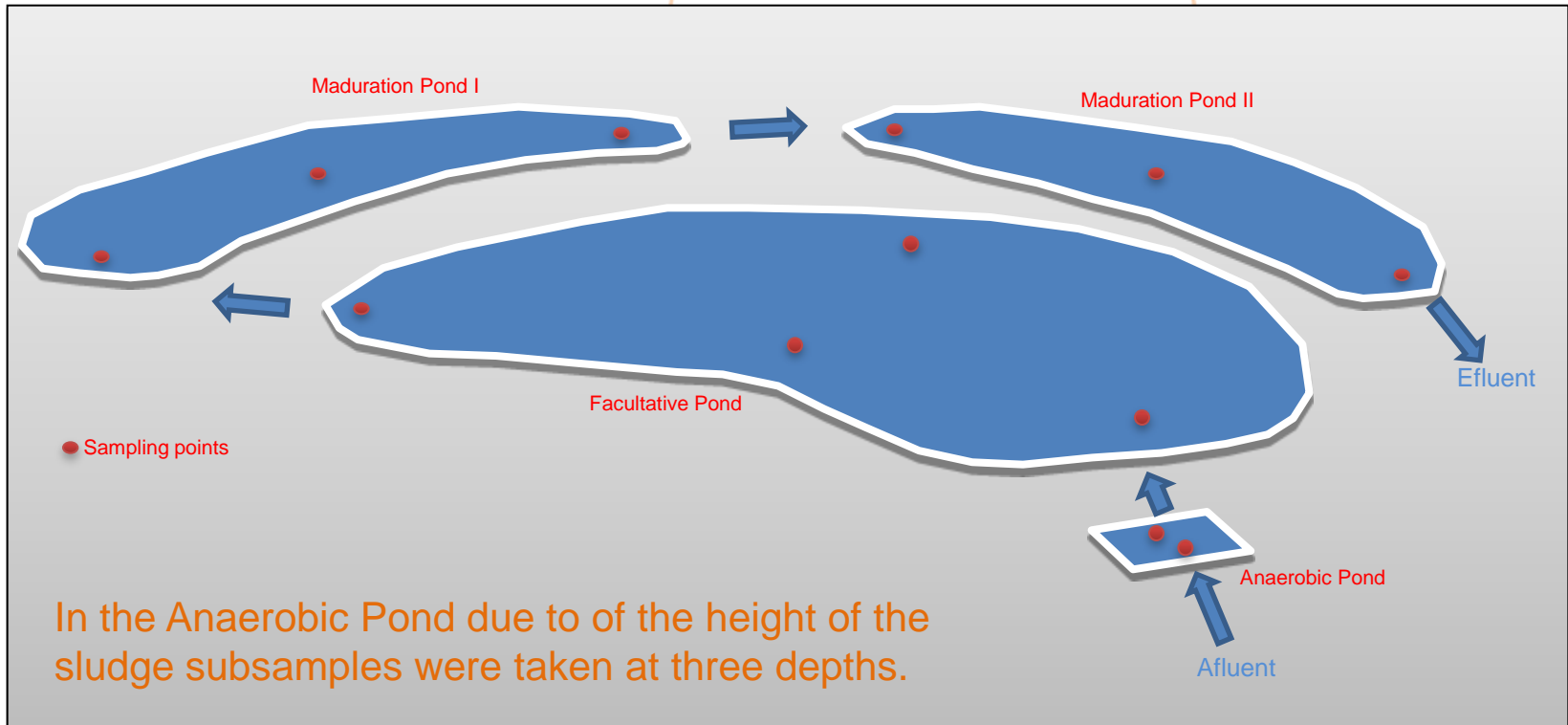
1. Get information about quantity and quality of sludge accumulated after 20 years of operation.
2. Compare data with those reported in literature.



SAMPLING CAMPAIGN

Batimetric studie was carried in all ponds.

12 sampling points were located throughout the system, two in Anaerobic Pond (influent and effluent), four in the Facultative Pond (influent, effluent, center right, center left) and three in each Maturation Pond (influent, center and effluent).

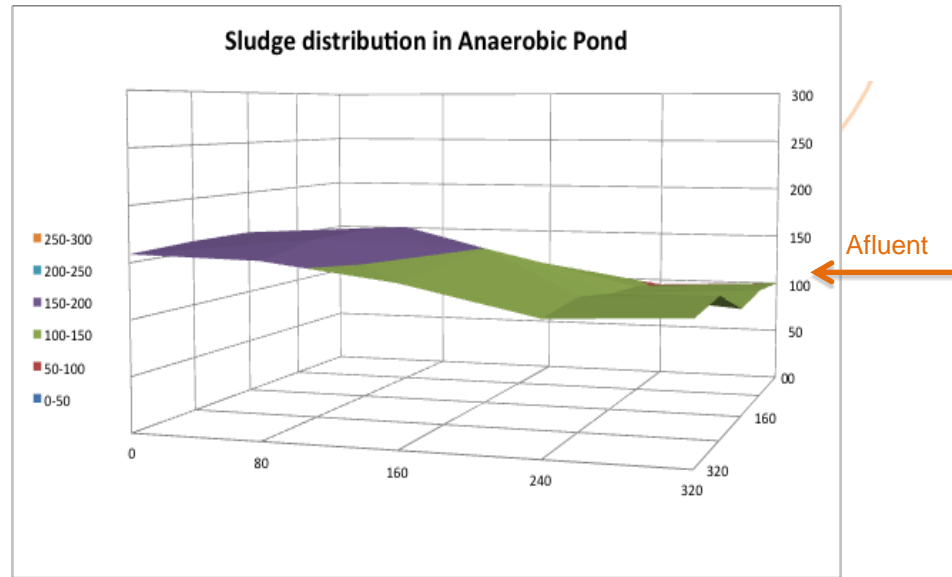


SLUDGE ACCUMULATION

Organic load equivalent to 250 PE

Sludge accumulation data:

	Anaerobic	Facultative	Maduration I	Maduration II
Operation time (years)	15	20	20	20
Sludge volume (%)	55.8	11.1	25,7	21,3
Sludge accumulation rate (m³/capita year)	0.011	0.027	0.015	0.009



Mara (2004) recommended desludging level (1/3 volume) for anaerobic ponds

SLUDGE ACCUMULATION

Organic load equivalent to 250 PE

Sludge accumulation data:

	Anaerobic	Facultative	Maduration I	Maduration II
Operation time (years)	15	20	20	20
Sludge volume (%)	55.8	11.1	25,7	21,3
Sludge accumulation rate (m³/capita year)	0.011	0.027	0.015	0.009

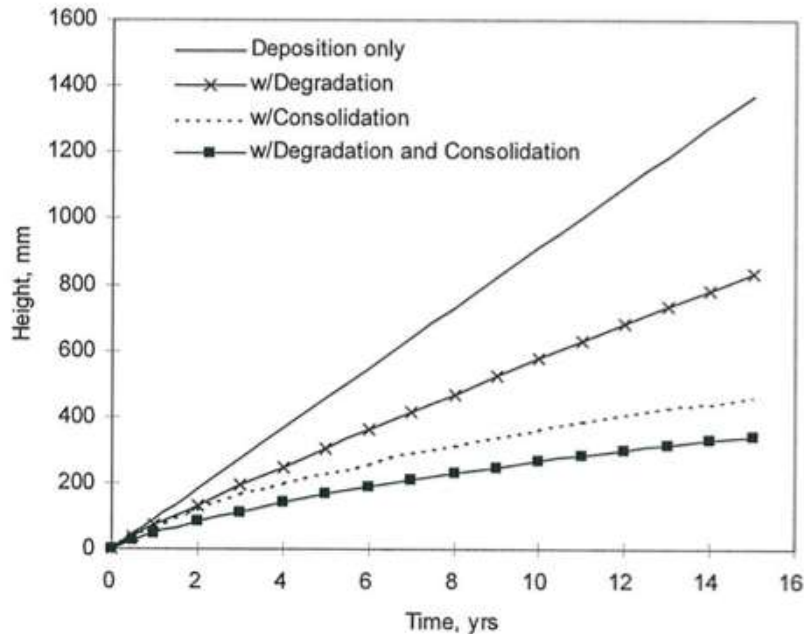
Sludge accumulation rate described in bibliography (Anaerobic Ponds):

- Mara (2004): 0.04 m³/ capita year in warm climates,
- Pena et al. (2000): 0.05 m³/ capita year in Columbia
- Goncalves (2002): 0.052 m³/ capita year reported in Brazil.

SLUDGE ACCUMULATION RATE IS TO LOW

SLUDGE ACCUMULATION

This low rate of sludge generation could be due to a combination between degradation and consolidation as reported Nelson & Yang (2004):



After 15 years:

- **Degradation** would have decreased the sludge height by 39%.
- **Consolidation** would have decreased the sludge height by 66%.
- **Degradation + Consolidation** would have decreased the sludge height by 75%.

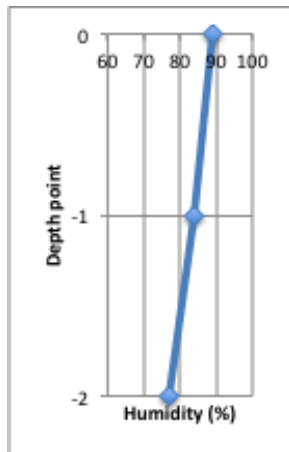
Figure 3 Accumulation of sludge assuming deposition only (no degradation or consolidation), only degradation, only consolidation, or both degradation and consolidation occur over the 15-year operation period.

Nelson, K.L.; Yang, I.J. The effects of degradation and consolidation on sludge accumulation in primary wastewater stabilization ponds. 6th International Conference on Waste Stabilization Ponds. Avignon (France), 28th of september – 1st of October 2004

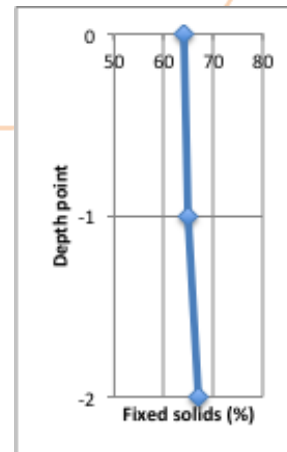
SLUDGE CHARACTERISTICS

	Anaerobic	Facultative	Maduration I	Maduration II
pH	6.6±0.2	6.6 ± 0.0	6.5±0.1	6.6±0.1
ORP (mV)	-335.3±20.5	-317.0±12.1	-360.3±41.7	-334.0±92.5
Water content (%)	83.3±5.6	86.8±1.7	78.7±3.8	82.7±2.5
Total solids TS (%)	16.7±5.6	13.2±1.7	21.3±3.8	17.3±2.5
Fixed solids (% TS)	65.0±1.4	63.2±1.5	81.7±2.1	83.7±3.1

Anaerobic Pond



CONSOLIDATION



DEGRADATION

CONCLUSIONS

- ✓ The sludge quantity measured in Anaerobic Pond was lower than those rates described in bibliography.
- ✓ A long period of operation may be the cause of the low amount of sludge accumulated.
- ✓ The low quantity of sludge accumulated over long periods of operation may be due to the consolidation and degradation phenomena described by Nelson & Yang (2004).
- ✓ Moisture data and the mineralization rates studied in sludge column of the Anaerobic Pond support could support this thesis.
- ✓ Other parameters analyzed are according with those reported in bibliography



J.J. Salas and R. Bouza

TWENTY YEARS OF SLUDGE ACCUMULATION IN CARRIÓN DE LOS CÉSPEDES (SPAIN) STABILIZATION PONDS SYSTEM