TREATMENT OF SEWAGE SLUDGES BY TECHNOLOGY ATAD. AN APPROXIMATION TO ITS AGRONOMIC EVALUATION

M. Dios[*1,2], J.M. Seoane[2], A. Rancaño[3], M.A. Martín[1], A.F.Chica[1] and A. Martín[1*]

[1] University of Cordoba (Spain) - Department of Chemical Engineering. Campus de Rabanales. Carretera N-IV, km. 396, Marie Curie Building, 14071 Córdoba
Phone: (+34)957218586; Fax: (+34)957218625 *email: iq1mamaa@uco.es
[2] Emproacsa. Empresa Provincial de Aguas de Córdoba. Avda. del Mediterraneo s/n. Córdoba
[3]Acciona Agua. Avda. De Europa, 22. Parque empresarial La Moraleja. Alcobendas. Madrid

7.3. Water and Wastewater Treatments. Advanced Technologyes.

The challenges posed by the European Council Directive 1999/31/EC on the landfill of waste and hardering of the conditions for land application of sludge from sewage treatment plant in Spain (RD 1310/1990) defines a current situation in the discharge of sludge in landfills and its direct application in field are forbidden.
The third draft of the European Directive on spreading of sludge on land try that its application on land does not have any risk for the soil and crops. In this context it is necessary an advanced process capable of producing the simultaneous decrease in moisture and waste stabilization in terms of reduction of organic matter including microbial inactivation. Among the processes set out in the European working paper, thermophilic aerobic digestion (> 55º C) could get these standards for a continuous period of at least 4 hours between recharges. The advantages of ATAD technology against others tecnologies are: the elimination of pathogens, minimizes the volume of sludge (between 40 and 60%), small volume of the reactor, suitable for small plants, simple in operation and stable against sudden changes in load (Riley, 2002).

Therefore, the aim of this paper is to asses the adequacy agronomic of sludges from a pilot scale reaction system ATAD (autoheated thermophilic aerobic digestion) compared to the traditional stabilization and sanitation of sludge mixed from the wastewater treatment plant of Cordoba province (Spain) to allow its incorporation into ground as consider future European Directive. Experiments were conducted in a 0.4 m^3 reactor (working volume), equipped with an air injection system reaching temperatures between 55 and 71º C. The critical variables for thermophilic aerobic digestion has been the organic matter concentration in the influent (>25 g/L volatile solid), hydraulic retention time (HRT between 7 and 14 days) and the oxygen concentration (minimum of 0,6 mg O_2/L). Under these conditions have been achieved elimination at the approach yields a semi-steady state of 30% for VS.

The resulting product shows improved stability as it was assessed by respirometry (Figure 1), with accumulated oxygen consumption <48 mg O_2 /g VS·day (WERF/WEF, 2002), in comparison to 60 mg O_2/g VS·day in the influent sludge, and a reduced

microbial contamination (<1000 cfu of *E. coli*/g d.m. and 4 log - reduction, <3000 spores *Clostridium perfringens*/g d.m., well absence of Salmonella in 50 g d.m.).

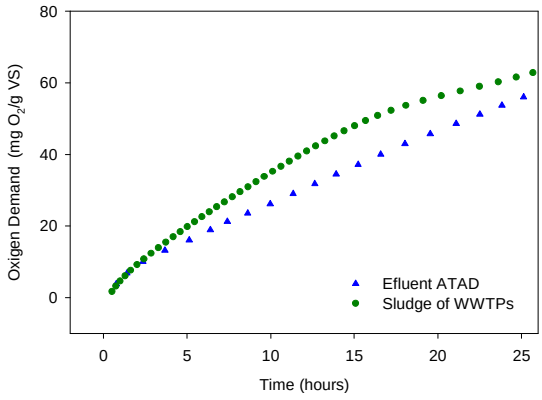

Figure 1. Oxigen demand by repirometry (SOUR-method) for both sewage sludge.

The characterization of metals (Table 1), revealed that dewatered sludge complies with the limit values set by the Spanish Royal Decree 1310/1990. The low metal concentration is typical of waste water without industrial effluent. The metal concentration increases during the process of digestion, a natural fact, by eliminating organic matter. The increase of chromium is not considered to respond to this trend and high value may result from a industrial discharge point. During the dehydration process decreases the metal content in the mud since many of these are found in the soluble phase which is rejected.

Parameter	WWTP Sludge	ATAD Sludge	Limit Value Soil pH<7	Limit Value Soil pH>7
Cadmium	2	13	20	40
Cooper	122	157	1000	1750
Nickel	108	326	300	400
Lead	58	78	750	1200
Zinc	254	383	2500	4000
Chromium	216	1246	1000	1500
***E.Coli* (CFU/g d.m.)**	$2.04 \cdot 10^6$	0	<1000 CFU E.coli /g.d.m.	
***E.Coli* (% reduction)**	-	(100%) >6log	Reduction of 4log	
***Clostridium perfringens* (CFU/g d.m.)**	$6.2 \cdot 10^8$	$7.39 \cdot 10^2$	<3000 spores /g. d.m.	
Salmonella spp.	Presence	Absence	Absence / 50 g.	

Table 1. Metal content and microbiological content for sewage sludge of WWTPs and sludge treated by ATAD technology. Limit value for metal is according with Spanish RD 1310/1990 and microbiological limits in accordance with the proposal of European Directive.

As conclusion, this technology allows a significant dry matter reduction, with the consequent economic benefit. Additionally, this stabilized sludge can be used as high quality agricultural amendment, making it a suitable system for the integrated management of sludge in the plant less than 60,000 eq-hab.

Acknowledgements

The authors are very grateful to Provincial Water Company EMPROACSA for funding this research.

References

Riley, D.W., Forster, C.F. 2002. An evaluation of an autothermal aerobic digestion system. Process Safety and Environmental Protection: Transactions of the Institution of Chemical Engineers, Part B, 80(2), pp. 100-104.

WERF/WEF (2002). Developing Protocols for Measuring Biosolids Stability. IWA Publishing.