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LODOred^{-100k}

Surplus sludge reducer in the source

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Presentation

by Violeta Cabello Villarejo

Water scarcity, on quantity and, especially, on quality, is a problem of utmost importance all over the world. This is particularly relevant in developing countries where waterborne diseases take hundred lives away everyday. Wastewater treatment is therefore a core aim and a range of technologies are currently available. Surplus sludge management is still the main unresolved problem of the wastewater treatment process, since its treatment and subsequent disposal inflate considerably the overall wastewater treatment costs as well as its environmental impact. Therefore the reduction of the amount of sludge generated in WWTPs leads to their better performance, supporting the expansion of this necessary industry for ensuring safer water sources and human health.

LODOred^{-100k} is a highly innovative product that enhances biomass purification efficiency in the wastewater treatment process, leading to a substantial reduction of surplus sludge (up to 40%) and stabilization of the biological process.

The use of *LODOred*$^{-100k}$ in a wastewater treatment plant (WWTP) results in an increased efficiency of the overall treatment process and a reduction of its main environmental impact which is sludge generation and its disposal.

LODOred^{-100k} causes no negative environmental impact on soil on land, since it is made of fully biodegradable products. On the contrary, it has a very positive environmental impact, by reducing the quantity of sludge to manage and dispose, since sludge generation is the main impact of the wastewater treatment.

LODOred^{-100k} was created in 2005 by a group of engineers, biologists and chemists from BIOAZUL S.L., an engineering company located in the Technological Park of Andalusia, Malaga (Spain) mainly devoted to R&D on water, energy and environment and development of eco-innovative products. *LODOred*$^{-100k}$ has been implemented in more than 50 WWTPs from different European countries since 2005, being currently used in Spain, Germany, Poland Switzerland and Italy.

How does the innovation solve a particular problem?

Sewage sludge is characterised by a high content of organic matter (40 – 65 % of Dry Matter), high amounts of Phosphorus (P) and Nitrogen (N), but also potential toxic elements (PETs), heavy metals, organic contaminants and pathogens are found. Surplus sludge treatment and subsequent management still accounts for 50% of the operating costs and for 65% of the environmental impact of wastewater treatment process.

Sludge management strategies are very diverse, as well as legislations on the issue in different countries: reuse on land is normally limited to certain amounts and application periods, incineration is a very inefficient process and do not support climate protection, land filling of organic is an almost extinguished practice. Therefore, to reduce as much as possible the quantity of sludge to treat and dispose is claimed as the best solution according to "the waste hierarchy": prevention, minimisation, reuse, recycle, energy recovery and disposal.

Wastewater treatment impacts	Sludge management impacts
Greenhouse gasses emissions along the whole process	Greenhouse gasses emissions from incineration, different treatment technologies, landfills composting, transport
Energy consumption of treatment technologies	Energy consumption of treatment technologies
Direct discharges when storm water surpass plants capacity	Soil pollution due to sludge land reuse
	Groundwater pollution from leaching in landfills, soil, direct discharges.
	Pathogens and other toxic elements transmission to edible crops

Environmental impacts from wastewater treatment and sludge management

Since its development, *LODOred*$^{-100k}$ has been implemented in a wide range of WWTPs by BIOAZUL, supported by the *Technology Transfer Centrum* of Bremerhaven, Germany, which cooperates with BIOAZUL in the development of new applications of *LODOred*$^{-100k}$, and its dissemination and distribution

Besides, the *Centre for New Water Technologies* (CENTA), a reference experimental centre for conventional and non conventional wastewater treatment technologies belonging to the Regional Government of Andalusia, Spain, has supported research on *LODOred*$^{-100k}$ during the last years, designing and developing different tests at their facilities that have led to the product optimization for South Europe wastewater characteristics.

The benefits of the use of *LODOred*$^{-100k}$ in a WWTP can be summarized as:
Reduction of sludge management costs derived from the fewer amount generated (reduction up to 40%).

- Substantial reduction of polymer consumption.
- Improvement of sedimentation abilities (SVI).
- More stable biological treatment process and less sensitive against shock loads.
- Improved effluent quality.
- Improved dewaterability.
- Reduction of the environmental impact caused by wastes of the wastewater treatment.

Compared to other surplus sludge reduction techniques, *LODOred*$^{-100k}$ has the following advantages:

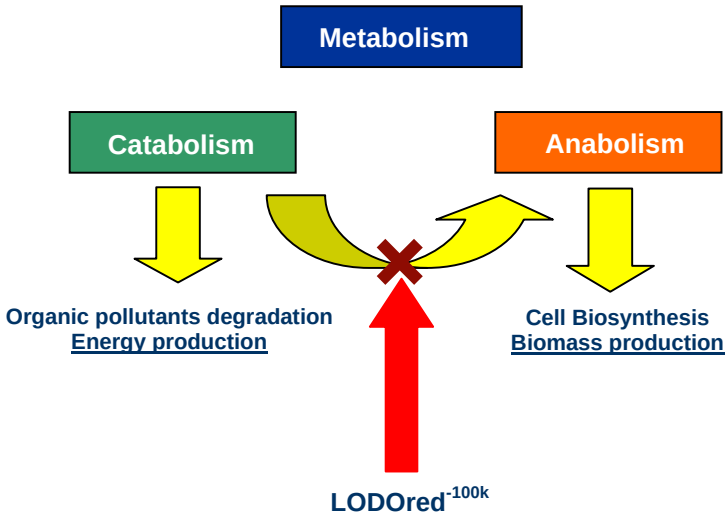
- Reduction of polymer consumption.
- No energy consumption.
- No installation requirements apart from a simple dosing pump.
- Non-hazardous, non-toxic, fully biodegradable product composed of ingredients of food additives grade.

LODOred^{-100k} in practice

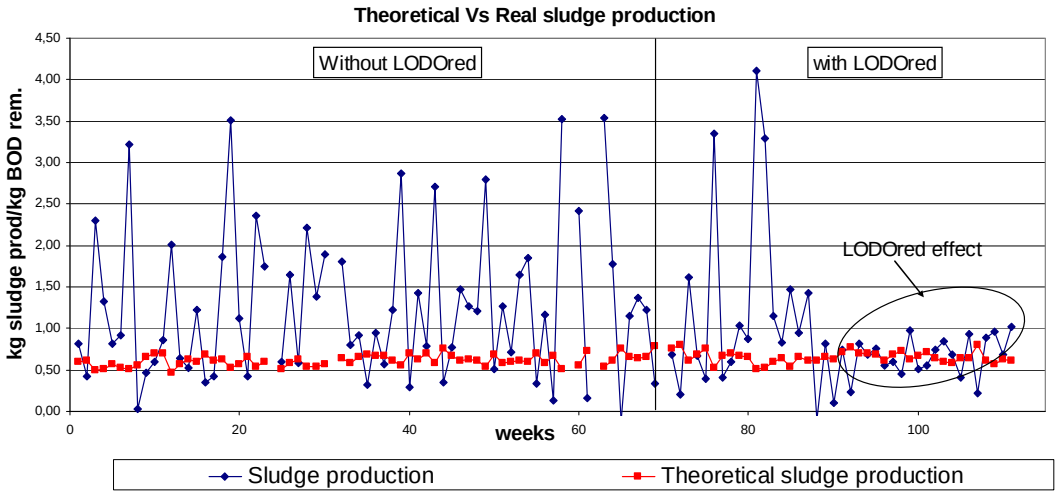
LODOred^{-100k} is designed for activated sludge wastewater treatment plants (WWTPs) without sludge anaerobic digestion, with high sludge generation and high sludge management costs. It is directly and continuously pumped to the activated sludge reactor in a specific dose calculated by BIOAZUL according to the plant characteristics.

Once added, *LODOred*$^{-100k}$ enwraps microorganisms and leads to the formation of compact activated sludge flocks. The main purpose of encapsulating microorganisms is influence their metabolism. By enwrapping microorganisms a “biological”, highly selective membrane coating is created enabling manipulation of metabolism inside as it is otherwise only possible in membrane bioreactor systems. Therefore *LODOred*$^{-100k}$ creates numerous micro membrane bioreactors in a conventional wastewater treatment plant.

Additionally to this important effect, auxiliary substances in *LODOred*$^{-100k}$ on the one hand enable immobilization of enzymes to the flocks and result, in combination with the vitamins, in an intensification metabolism. Other auxiliary substances facilitate or regulate on the other hand mass transfer into and out of the flocks, improving degradation efficiency. The aim of the manipulation of the metabolism is to relocate the equilibrium of the microorganism activities from anabolism, i.e. creation of new cell mass, to catabolism, i.e. generation of additional energy to supply the intensified microbial degradation activity.



Surplus sludge real production in WWTPs does normally far exceed the theoretical value for which plants are dimensioned, as can be observed in the figure. The effect of *LODOred*$^{-100k}$ is an adjustment of the real surplus sludge generation to the theoretical one, thus improving the plant efficiency and performance.



LODOred^{-100k} dosing is a very simple process that can be applied at any municipal WWTP and some industrial like food and paper industries WWTPs, in any case without anaerobic digestion. BIOAZUL can carry out a specific assessment for technical and economical viability in each plant.

What are the results?

Although developing countries are still at the beginning of a long way in investment of wastewater treatment, in big cities WWTPs are already being installed. The application of *LODOred*$^{-100k}$ is in addition of great interest for the incipient industry in order to gain in efficiency and avoid greater environmental and economical impacts of sludge disposal. Therefore, local water enterprises and administration will be encouraged to invest in the construction of new plants and research on adequate technologies. This will support the prevention greater discharges of untreated wastewater, triggering an enhancement in water bodies' quality.

The following table shows results achieved in several WWTPs of different sizes for a 4 month period where **LODOred**$^{-100k}$ is normally applied:

WWTP	pe	Reduction in sludge specific production (%)	Reduction in polymer consumption (%)
1	35000	21.5	13
2	13000	30	8
3	16000	24	n/a
4	220000	11.27	43.3

The benefits/costs analysis corresponding to the previous WWTPs in Europe is presented:

WWTP	Sludge management costs savings	Polymer costs savings	LODOred costs	Economic balance
1	6384	450	- 2700	4134
2	2257	240	-762	1135
3	3742	n/a	-1762	1980
4	7304	34576	-20683	21198

In the economical balance presented, the profitability, thus the sustainability, of the application of *LODOred*$^{-100k}$ can be observed. As its application does not need any further equipment besides a pump, it is a rather simple to operate and maintain.

Most of the strategies for surplus sludge reduction are focused on sludge degradation after its generation and not in its prevention, with energy consuming technologies that have to be added as an extra step to the treatment chain. Sludge production prevention has been achieved with metals like Zn under laboratory conditions, although they are too expensive and no market implementation has been undertaken yet.

International interest

LODOred^{-100k} was awarded with the third position in the EBN – UNDP/IDEASS International Contest for Innovation 2009/2010, a competition in which more than 200 European environmental companies participated. The ECO-INNOVATION Programme from the Executive Agency for Competitiveness and Innovation has recently co-funded WASTEred, a new R&D project in which *LODOred*$^{-100k}$ is being tested in dairy and meat industries WWTPs from Spain, Germany and Poland. BIOAZUL is the project coordinator and other six international institutions participate in the mentioned project.

BIOAZUL was invited to present the project in the CIP Eco-innovation European Information Day the 13th April 2010. BIOAZUL presented *LODOred*$^{-100k}$ at the 2nd International Conference SMALLWAT07: Wastewater treatment in small communities, which took place in Seville in November 2007. Besides, several local workshops have been arranged by BIOAZUL in Spain with relevant stakeholders of the wastewater treatment industry and administration.

The product is currently used in municipal WWTPs in Spain, Germany, Poland, Switzerland and Italy. The main collaborator of BIOAZUL is the Technology Transfer Center of Bremerhaven, a market oriented and independent provider of research services at international level, which cooperates with BIOAZUL in the development of new applications of *LODOred*$^{-100k}$, and its dissemination and distribution.

To use LODOred^{-100k} in other countries

National and international validations of *LODOred*$^{-100k}$ have been carried out from 2005 with very good results, as showed in the previous section.

LODOred^{-100k} is currently being used in different countries. The institutional conditions and needed authorizations mainly depend on those restrictions fixed by legislations of the countries. In general, as the product is fully biodegradable, non toxic and non hazardous, no problems have

been found for its application so far. The participation of institutions is linked to how the water competences are organized in the countries.

Technically speaking, the requirements are very few. It is needed a dosing station with minor maintenance demand which could be run by a WWTP operator. Main condition is that the WWTP is based on activated sludge and without anaerobic digestion. If this is the case, the steps to follow in order to implement *LODOred*$^{-100k}$ in a WWTP are:

- BIOAZUL will evaluate the technical and economical feasibility of the *LODOred*$^{-100k}$ for the plant.
- Calculation of the optimal dosing of the product for the plant.
- To find the most adequate dosing point at the plant.
- Installation of the dosing station.
- Continuous evaluation of the process in order to adjust the dosing to current conditions.

LODOred^{-100k} was developed and is currently distributed by BIOAZUL S.L, with the support of the Technology Transfer Centrum of Bremerhaven (Germany). Both organizations are continuously working together in the optimization of the product and in the development of new applications. In order to implement *LODOred*$^{-100k}$ in new countries, BIOAZUL would need the cooperation of local water administrations and the wastewater treatment companies. As already explained, the steps to follow for its implementation would not need of new infrastructure neither high qualify staff.

BIOAZUL will support any South-South project attempting to implement *LODOred*$^{-100k}$ in order to reduce the surplus sludge production of developing countries WWTPs with the necessary technical assistance and training of WWTPs operators.

To find out more

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