

Treatment of American Farm School lagoons using a novel system

By David Willis and Nikolas Nikolaidis

Background

Two decades ago in 1984 Roland Plocher from Germany introduced a new environmental management system. He could start up and maintain the aerobic process in a polluted water body or a liquid manure tank without introducing air or oxygen. Instead he used his specifically prepared "catalysts" which could be for example quartz or calcium carbonate powders in minimal amounts. This new approach to environmental problems became known as the Plocher Energy System, in short PES. It sounded like "homeopathy on the environment". R.Plocher worked for almost a decade in Germany, Austria and Switzerland treating a good number of lakes but also manure tanks in animal farms. His system got wide publicity in 1993 through a documentary broadcast by the German national TV channel ZDF.

The aerobic process established by the PES could be confirmed through ordinary observation but also through scientific tests. For example Dipl.-Phys. Carlo Grunow found that the oxygen uptake rate (OUR) of an activated sludge sample treated with the PES could be as high as 17 mg/L*min compared to 0.6 mg/L*min in the untreated ⁽¹⁾. Responding to the unprecedented market demand to the PES the European Union funded a three year testing programme in pig manure farms in Belgium ⁽²⁾. The results confirmed once more R. Plocher's unusual claims. The PES effects on the liquid pig manure were:

- reduction of the anaerobic and increase of the aerobic microflora
- significant reduction of smells
- elimination of surface crusts and homogenization of the liquid
- suppression of pathogens through microbial antagonism.

AFS application

The American Farm School of Thessaloniki operates a sizeable educational farm with 120 cows, 100 calves, 85 pigs and 16000 chicken. Animal waste is produced in both solid and liquid form. The liquid animal waste treatment line includes mixing, solids separation, a 20.000 m³ concrete treatment lagoon and a final 40.000 m³ earth lagoon. Treated effluent mixed with surface runoff is stored during the wet season in the earth lagoon and used in the summer for crop irrigation. Crops from the Farm School fields are used as food for its animals. In 1996 the Plocher Energy System was selected for the aerobic treatment of the AFS lagoons based on its simplicity, environmental compatibility, material safety, zero energy consumption and lower overall costs.

Main problems of the concrete lagoon were odours and sludge accumulation in the bottom. In the earth lagoon a surface growth of duckweed (*Lemna* sp.) created problems in the pumping equipment and odours in late summer. Unless harvested dead plants sink to the bottom and decompose anaerobically.

Concrete lagoon

The lagoon has a round shape, an average surface area of 3500 m² and a depth of 6 m (Photo 1). This lagoon besides the liquid animal waste accepts:

- the secondary treated effluent of the AFS campus sewage
- waste sludge from the AFS sewage treatment plant
- pretreated effluent from the AFS turkey slaughterhouse and
- the surface runoff from the AFS barns and Campus.

BOD₅ levels in the lagoon before introducing the PES were fluctuating around the year reaching occasionally 1200 mg/L. The objectives in applying the PES in this lagoon were:

- a) to keep the pollutant levels as low as possible
- b) to keep the lagoon free of odours
- c) to reduce the sludge accumulation in the lagoon bottom.



Photo 1. AFS Concrete Lagoon

Results were quite satisfactory according to AFS staff and the Government regulating authorities. Neighbor's complaints

regarding odours were reduced from a high level to a negligible level. Bottom sludge levels were reduced from about 3m depth to a desirable 1 m depth. Monitoring of the pollutant levels in the lagoon showed a significant reduction over time. Yearly averages of BOD₅, COD and SS from 1996 to 2001 are presented in Fig. 1 below.

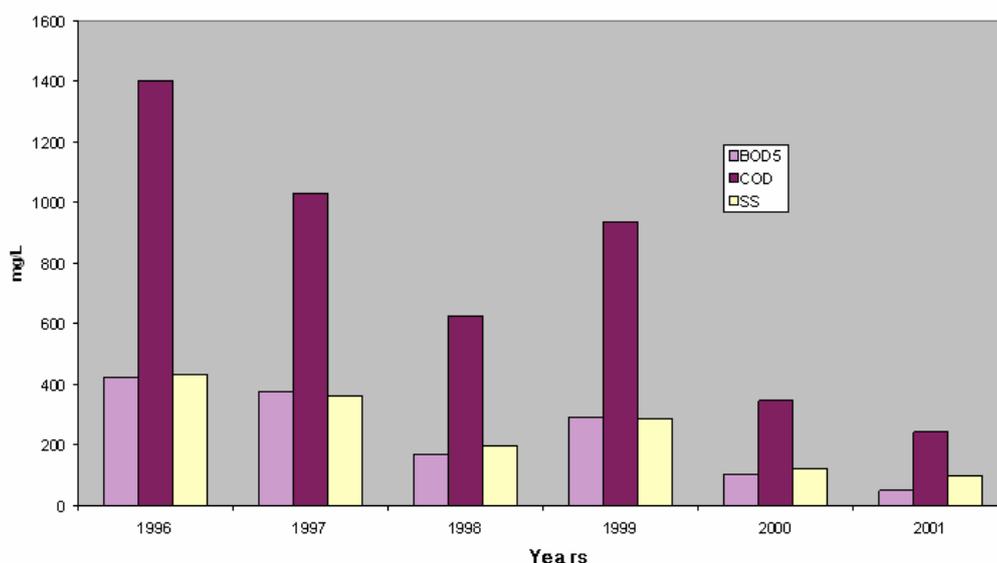


Figure 1. Concrete Lagoon Pollutant levels (Yearly average)

Earth lagoon

The earth lagoon has a rectangular shape, an average surface area of 9.000 m² and a depth of 4.5 m (Photos 2 & 3). This lagoon is the final stage of the liquid waste treatment process which accepts the supernatant from the concrete lagoon plus rainwater runoff. A pumping station is in place taking treated water for farm field irrigation. The thick mat of duckweed on the surface of this lagoon helped greatly in reducing the organic pollutants in the water. On the other hand it created operational problems. The application of PES in the earth lagoon started in 1997 with the following objectives:

a) to keep the lagoon free of any surface growth for undisturbed pumping

b) to keep the nutrients in the water and return them to the soil (surface water plants consume nutrients in the water).

Overall results are shown in Photos 2 & 3. The lagoon remains free of any surface growth up to the present.



Photo 2. Earth lagoon with surface growth (July 1997)



Photo 3. Earth lagoon free of surface growth (May 1998)

Materials and Costs

In average a total of 60 kg of quartz and calcium carbonate in powder form has been applied to the lagoons on a yearly basis. Its cost was 1.800 EUR (2.250 US dollars).

References

1. Grunow C., (1996) "Is it possible to measure the effect of the Plocher System?" In Ernstfried Prade (Ed.) "The Plocher Energy System", Bio Energetic Verlag, Kinsau.

2. Veerle R., (1999) "The effects of the Plocher Energy System on the homogeneity/nuisance from smell of pig manure"., 5b Project with the support of the European Union and the Flemish Region.

Authors

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