CONSTRUCTED WETLANDS FOR TREATMENT OF OLIVE MILL WASTEWATER (OMWW)

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SUMMARY: By combination of solar distillation, wetland treatment of distillate and composting of residues a complete biological degradation of olive mill waste water (OMWW) was achieved. Pilot tests on Crete indicated a removal of COD and phenols > 99 % with waste water from storage pools and also fresh waste water. Uncontrolled evaporation and generation of stale odour was completed prevented.

1. INTRODUCTION

More than 7 Million tons of liquid olive mill residues are produced during the milling process in Europe each year. This OMWW shows a high organic content and a high level of phenols producing a disturbing stale odour in evaporation pools.

2. EXPERIMENTAL STUDY

To improve this situation ARGUS developed a combined process for treatment of these liquids. It comprises the solar distillation (which is similar to the processes in the lagoons) under controlled conditions, treatment of distillate in constructed wetlands and co-composting of residual sludge.

The total process is shown in figure 1.

After comprehensive tests in lab scale on distillation, microbiological treatments in fixed bed bioreactors and constructed wetlands and composting of solid residues (sludge) a pilot plant on Crete at the site of an olive mill was erected.

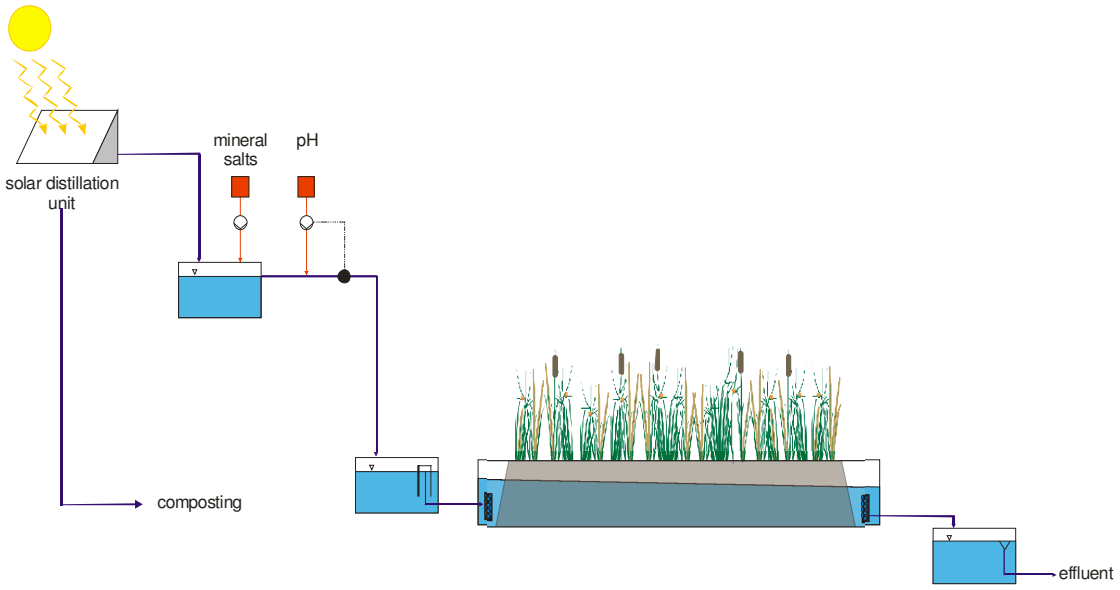

Figure 1: schematic drawing of the pilot plant

3. RESULTS AND DISCUSSION

For solar distillation, 16 solar panels with a total surface of 40 m^2 should distillate around 500 l per day of OMWW.

Under field conditions 78 % of input waste (OMWW) – *condensate* - could be distilled and condensed and only 22 % - *sludge* - is collected for co-composting.

The condensate shows an average COD-level (Chemical Oxygen Demand) of 4.000 – 5.000 mg/l and a phenol content of 50 - 100 mg/l. The reduction of organics compared to original OMWW is about 85 – 90 % of input waste. The pH is lowered (from 5,1 to 3,8) due to increased fatty acid content.

After pH-adjustment and addition of nutrients this distillate is further treated in a wetland system.

This constructed wetland is shown in picture 1 at the site of Greek olive mill on Crete. The size is 3 m x 4 m with a total volume of 7,2 m^3 and was planted with different plants (Phalaris, Juncus, Scirpus). Start-up procedure with adapted biomass was done for 6 weeks before starting the continuous addition of condensate. The mean residence time in the wetland was 9 – 12 days only.

Picture 1: wetland in August 2004

There was only 1 single passing step with no recirculation during continuous running.

The COD was reduced from 4.000 down to 200 mg/l while also the remaining phenols in the distillate were decreased from 100 mg/l to < 0,1 mg/l. The system was running automatically with a throughput of 120 l/day. Accumulation effects of organics on soil could be neglected by start-up procedure. Effluent water could be used for irrigation.

The performance of the wetland system is shown in figure 2 and indicates after a short adaptation period very promising results. The removal of COD is up to 96 %.

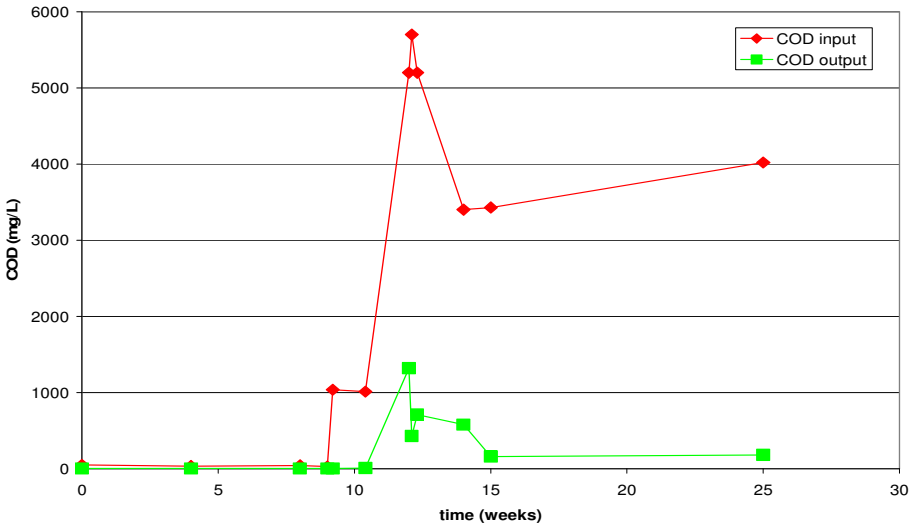

Figure 2: results of the wetland system

During solar distillation process the remaining sludge (22 %) was collected and co-composted with tree cuttings. The sludge shows very high levels of COD (205.000 mg/l) and phenols (2.600 mg/l). The mixture of the biopolders is 60 % of sludge and 40 % of tree cuttings. After 120 days this maturated compost could be used as fertiliser.

4. CONCLUSIONS

This process demonstrates a complete biological treatment of OMWW with no air pollution and odour generation. The overall COD and phenol removal is > 99 %.

The total system is easy to operate and has low energy consumption. It substitutes the disposal of OMWW in open lagoons.

ACKNOWLEDGEMENT

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