# THE CLOSURE OPERATION OF ANAEROBIC PONDS WITH SOME IMPORTANT TIPS FOR ROUTINE MAINTENANCE

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***Abstract***

*This present paper presents the closure operations of anaerobic ponds and a few tips what have respect for routine maintenance. In the same time, present the operational problems, the main remedies for these and the toxicity factors that affect pond performance.*

**Key words:** anaerobic, pond, maintenance, toxicity factors, remedies

## INTRODUCTION

An anaerobic pond functions properly if no plants or weeds collect on the wet slope. The surface of the pond is covered by layer of scum which helps to:

- maintain anaerobic condition;
- prevent atmospheric oxygen transfer. Check heat loss. Daily check should be on;
- no seepage though embankment;
- no clogging of inlet particularly when it is submerged;
- no floating scum should pass into facultative pond;
- no fly breeding.

Periodical check must be on sludge layer thickness.

## MATERIAL AND METHOD

The main operational problems and their remedies of anaerobic ponds are the odor problems and mosquitoes and other insects.

The possible reasons of odor problems are:

1. Excessive loading rate;
2. Presence of toxic substances and inhibitors in influent;
3. Sudden drop of temperature;
4. Low influent pH value.

And the possible remedies of these problems are:

- Allow scum (natural floating cover) to form;
- Reduce influent flow by by-passing a portion to facultative ponds;
- Avoid chlorine and other chemicals.

The possible reason like mosquitoes and other insects to appear is:

1. Removed screenings and grits lie at site;
2. Weeds or grass on the wet slope touch or dip into the liquid;
3. No floating scum layer.

But the possible remedies are:

1. Dispose off screenings and grits;
2. Remove all vegetation from wet slopes;

3. Install spray water jets.

To keep the pond clean and for the routine maintenance the operators of this have to do the following periodically:

- Remove screening and grit from pretreatment units; Look for growth of grass and weeds on the wet slope. If found, cut and remove.
- Remove floating scum and floating macrophytes algae patches from the surface of facultative and maturation ponds.
- Spray the scum on anaerobic pond with clean water or plant effluent.
- Remove blocks if any from inlet, outlet and interconnections.
- Check for damage to the embankment by rodents, rabbits and other animals.
- Check the depth of liquid in ponds.

Operators must be instructed on the frequency of performing these tasks and their work must be regularly inspected. It would be of much help, if they are provided with a pond maintenance manual and a log book to record their activities. The operators must also collect samples and carry out some routine measurements.

## RESULTS AND DISCUSSIONS

The natural factors which can disturb the good function and the routine maintenance of ponds are in the first place the wind. Because of these all ponds should be designed to induce churning by wind. We know these results in uniform distribution of biological oxygen demand, necessary demand oxygen, algae and microorganisms all through the depth of water. It also moves oxygen down. This is particularly important when there is nil or insufficient photosynthetic activity. On the flip side, strong winds may produce high waves and erosion to the embankment slopes.

Another factor is temperature that directly influences the physical, chemical and biological activities in a pond system. Rate of photosynthesis and cellular metabolism are directly proportional to the pond temperature. Ponds should be designed for most adverse temperature conditions. At lower temperature, dissolved oxygen present has a tendency to remain in pond longer. As the temperature rises, dissolved oxygen is likely to be liberated to atmosphere, especially under supersaturated conditions. The oxygen production by Algae through photosynthesis is also temperature dependent. All ponds perform well on a sunny, cloudless day at an air temperature above 20°C and mild wind conditions. At a temperature above 35°C, the rate of photosynthesis declines rapidly and at temperatures above 45°C, it all together stops. High temperatures stimulate growth of blue green algae at the expense of more efficient green algae. At the same time, aerobic bacteria consume oxygen at higher rate creating conditions to form anaerobic patches in the pond. Sudden reduction in temperature slows down algae activity and oxygen production. Algae will move to lower layers, the green color will reduce and pond performance will drop.

Rainfall, another factor, influences pond performance. Detention time reduces when it rains. Besides, heavy shower dilutes the contents of shallow ponds reducing the food available to biomass. Rainfall adds oxygen to a pond system by increasing turbulence.

Solar radiation directly relates to photosynthesis by the algae. However, the rate of increase of photosynthesis declines when radiation intensity exceeds certain limits. Oxygen production also reaches a constant level. Actually, light is the factor for oxygen production in low light intensity conditions. And temperature is the guiding factor in areas of high light intensities. Latitude of the location and mean sky clearance factors help in determining the light intensity throughout the year. So, these are important parameters in designing the pond system, particularly the facultative pond. Too much solar radiation has adverse effects on pond performance.

Another factor also important is evaporation and seepage**.** This causes excessive loss of water resulting in increase of solid concentration which upsets the ecological balance. An evaporation rate in excess of 5 mm/day depth (50 $m^3$/ha/day) water loss is excessive and needs special attention. Soil characteristics along with knowledge of ground water, hydrology is important when selecting the site. If ponds have to be built on permeable soils, they must be lined to minimize seepage.

Principal physical factors, in this case, are:

- **surface area** is a function of organic loading ($CBO_5$) applied 5 per day (especially in case of facultative ponds). In warmer climates, surface loading from 150 - 400 kg $CBO_5$ has been successfully deployed, though exceeding 250 kg $CBO_5$ may cause odor problem.
- **water depth: s**tabilization ponds operate at constant depth as designed. Depths, less than 0.9 m cause growth of aquatic plants, surface weeds and mosquitoes. Depths exceeding 2 m in facultative ponds may limit sunlight penetration. So, anaerobic condition at the bottom layer may be created. A design depth of 1.5 m in facultative ponds has shown good results.
- **short circulating: i**ncorrect positioning of inlet and outlet and poorly shaped ponds may produce short-circulating (dead or stagnant zones) within the pond. They may also transport the incoming wastewater quickly to the outlets, thus affecting pond performance.

Other factors are the chemical factors:

- **pH value: a**naerobic and facultative ponds work well under slightly alkaline condition. So, industrial wastewater with high pH values should be appropriately controlled at the source before entry to ponds.

Anaerobic ponds situated in warm climates are usually biased to an alkaline pH value. In facultative ponds, if the pond turns deep green, the pH value can be taken to be in the alkaline range. If the pond water is yellowish green or milky it is acidic.

However, facultative ponds display a natural diurnal variation in pH value. In the mornings, the pH value is low, due to excess carbon dioxide while in the late afternoon, the pH value rises due to the consumption of carbon dioxide by algae.

The **toxicity factors** that affect pond performance are:

- **toxic materials: s**tabilization ponds are generally immune to toxic substances and heavy metals. Long detention time allows gradual absorption of the inhibiting substances by the existing biomass, provided there is no shock load. Concentration of 6 mg/l of each of heavy metals like cadmium, chromium, copper, nickel, zinc has not affected the treatment efficiency in facultative ponds;
- **oxygen -** dissolved oxygen (DO) helps to identify the efficiency of operation in a facultative or maturation pond. A normally functioning facultative pond will be supersaturated with free oxygen at the surface and in the sub - surface layers during the afternoon. However, DO concentrations may reduce to below 1.0 mg/l or even zero at dawn? The aerobic (the one that absorbs oxygen) surface layer strips off odor release in well maintained ponds;
- **heavy metals** do not cause a problem with domestic wastewater since ponds can withstand up to 30 mg/l of heavy metal without any reduction in treatment efficiency;
- **algae and bacteria:** the performance of a pond system directly depends on its constituent algae and bacterial population. Presence of any toxic substance that affects their metabolism will reduce their performance. The algae are more easily affected than the bacteria. In ponds treating domestic wastewater, the major toxicants are ammonia and sulfide;

- **effect of ammonia:** if ammonia concentration exceeds 28 mg/l, algae may manage if ponds are within pH range during daylight hours. Ammonia is exponentially more toxic above pH 8, since a larger proportion is then in the unionized state, so can rapidly penetrate the algae cell and inhibit photosynthesis. This can cause the facultative pond to behave like an anaerobic one, even when the BOD surface loading is low. However, this can be reversed in a few hours. Inhibition of photosynthesis also reduces pH and hence toxicity of ammonia;
- **effect of sulfide: s**ulfide is toxic to algae in its $H_2S$ stage. Its toxicity increases when pH decreases. In the normal range of pH in ponds, when sulfide concentration exceeds 8 µg/l, the activities of anaerobic heterotrophic bacteria are inhibited. Concentration of 50 - 150 mg/l inhibits methanogenesis in anaerobic ponds.

## CONCLUSIONS

In our country the tradition of waste elimination, so implicit the land filing of waste in ponds realized with a lot of years ago, in the urban area especially, suppose using of simply management schema of waste, meaning mix collection and final waste disposal in existent irregular ponds. This simplifies things more in case of rural area where the waste are disposed in streams or storage in waste ponds, which are actually natural geographic depressions or dips results from constructions like excavation from constructions. Therefore, European Union gives very clear laws regarding at this ponds which must apply them as soon as possible for not to receive penalty.

We will exemplify two major actions:

- irregular ponds from urban areas follow to stop their activity in conformity with timetable approved through G.D. nr. 349/2005 and the waste territories from rural areas must rehabilitate until 16$^{th}$ July 2009 through sanitation areas and introduction them in natural circuit or through closing.
- should be realized 7 transfer stations, one in every micro-region, which will be signposted the component cities, etc.

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