FACULTATIVE PONDS

AUTHOR

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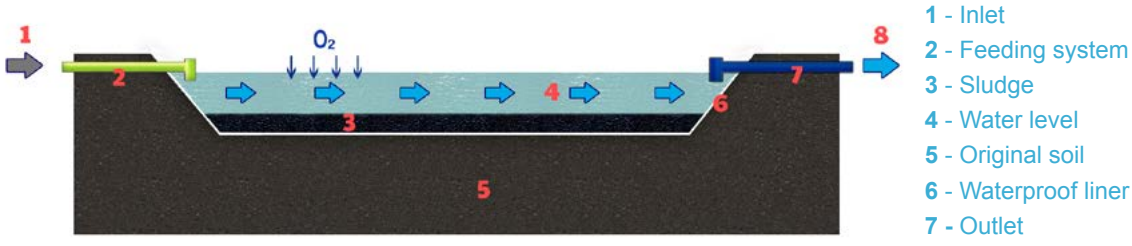

Description

Facultative ponds (FPs) are of two types: primary FPs receive raw wastewater (after screening and grit removal) whereas secondary FPs receive settled wastewater from the primary treatment stage (usually anaerobic pond effluent). FPs are designed for BOD_5 removal based on their surface organic loading. The term refers to the quantity of organic matter applied to each hectare of pond surface area (kilograms of BOD_5 per hectare of FP surface area per day: kg BOD_5/ha/day). A relatively low surface organic loading is used (usually in the range 80–400 kg BOD_5/ha/day, depending on the design temperature) to allow for the development of an active algal population. The depth of FPs is in the range 1–2 m, with 1.5 m being most common.

The maintenance of a healthy algal population is very important as the algae generate the oxygen needed by heterotrophic bacteria to remove the BOD_5. The algae give FPs a dark green colour.

FPs may occasionally appear red or pink, owing to the presence of anaerobic purple sulphide-oxidising photosynthetic bacteria. This change in the FPs' ecology occurs because of slight BOD_5 overloading, so colour changes in FPs are a good qualitative indicator of pond function. The concentration of algae in a well-functioning FP is usually in the range 500–1000 µg chlorophyll-a per litre.

Advantages

- Low energy usage (feeding by gravity)
- Robust against load fluctuations
- No harvest of biomass required
- Lower construction price than subsurface treatment wetlands
- Carbon neutral due to day and night processes (photosynthesis versus respiration)

Disadvantages

- Potential mosquito habitat
- High algae concentrations in the effluent
- Nitrogen is mostly taken up by algae and a small part of it may be stripped to air as ammonia

Co-benefits

Medium	Biodiversity (fauna)				
Low	Biodiversity (flora)	Temperature regulation	Carbon sequestration	Aesthetic value	Recreation
Low	Biosolids	Water reuse			

Compatibilities with Other NBSs

Secondary FPs are mainly used to treat the effluent from anaerobic ponds. Primary FPs receive pretreated wastewater. In small systems with equal or less than 1,000 inhabitants, FPs may be coupled to septic tanks. FPs may be coupled to down water roughing (rock) filtration units for effective algal removal and nitrification of the final effluent.

Case Studies

In publication

- Wastewater pond technology in Mysore, India: a combination of facultative and maturation ponds
- Wastewater pond technology with anaerobic, facultative and maturation ponds in Trichy, India
- Wastewater treatment ponds in El Cerrito, Colombia

Operation and Maintenance

Daily

- Daily inflow and outflow recordings
- Control of floating macrophyte growth
- Monitoring of field parameters

Weekly

- Checking of weirs, valves and piping

Extraordinary

- Repair/replacement of lining if damaged
- Grass trimming, and sampling of influent and effluent
- Delivery of samples for laboratory analyses

Troubleshooting

- Colour changes: due to overloading either by bad functioning of the previous unit or general overloading of the whole system

Literature

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NBS Technical Details

Type of influent

- Raw domestic wastewater
- Primary treated wastewater

Treatment efficiency

• COD	~34%
• BOD_5 (total)	40–56%
• BOD_5 (filtered)	70–80%
• TN	20–39%
• NH_4-N	~44%
• TP	1–25%
• TSS	27%
• Indicator bacteria	Fecal coliforms ≤ 1–2 log_{10}

Requirements

- Net area requirements: 1–3 m^2 per capita
- Electricity needs: FPs are usually operated by gravity flow, otherwise pumping may be required

Design criteria

- Hydraulic retention time: 4 to 8 days, depending on wastewater strength and temperature
- Length:width ratio 1:2 to 1:3

Commonly implemented configurations

- FP – MP
- AP – FP – MP
- Septic tank – FP – TW

Climatic conditions

- Suitable for both warm and cold climates
- Very suitable for tropical climates