VETIVER PHYTOREMEDIATION TECHNOLOGY

An Effective, Simple and Low Cost Method of Treating Contaminated Water to Control Diseases

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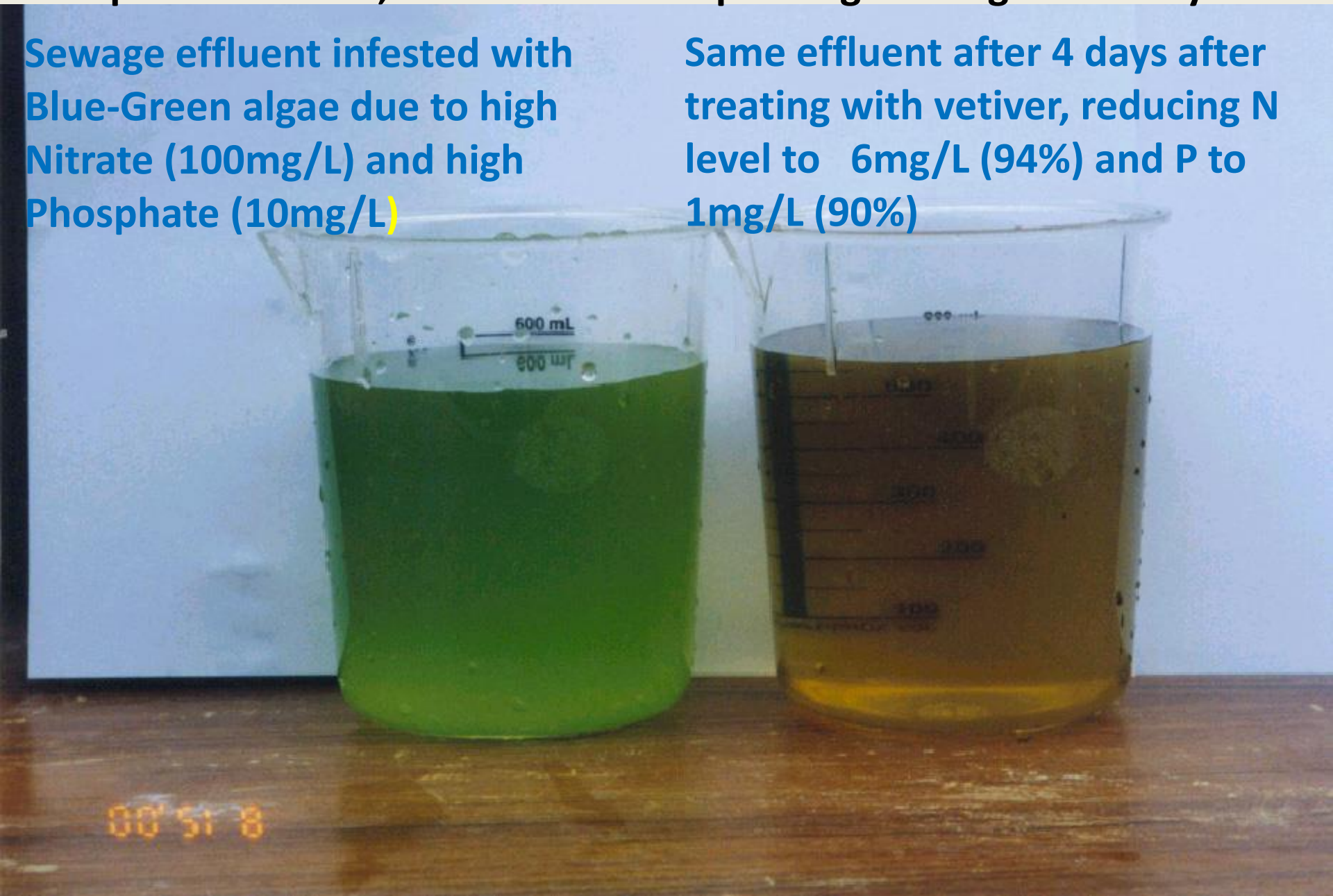
INTRODUCTION

According to WHO/UNICEF's 2010 Joint Monitoring Program untreated sewage from 4.3 billion people and effluent by industry and agriculture are being discharged, resulting in contamination of public water supplies.

Inadequate sanitation results in an estimated 750,000 childhood deaths annually, most of which occur amongst the rural poor (WHO 2012). If contaminated water was properly treated, the spread of water-borne pathogens and human mortality could be greatly reduced. These clinical pathogens –including bacteria, fungus and algae – require nutrients to multiply so the removal of these (particularly N and P) from sewage effluent, landfill leachate, industrial and agricultural wastewater would greatly reduce or eliminate these water-borne pathogens that severely impact human and environmental health

HIGH N AND P REMOVAL: With high capacity of removing N and P in polluted water, vetiver cleaned up blue green algae in 4 days



CASE STUDY 1: Disposal of domestic sewage effluent

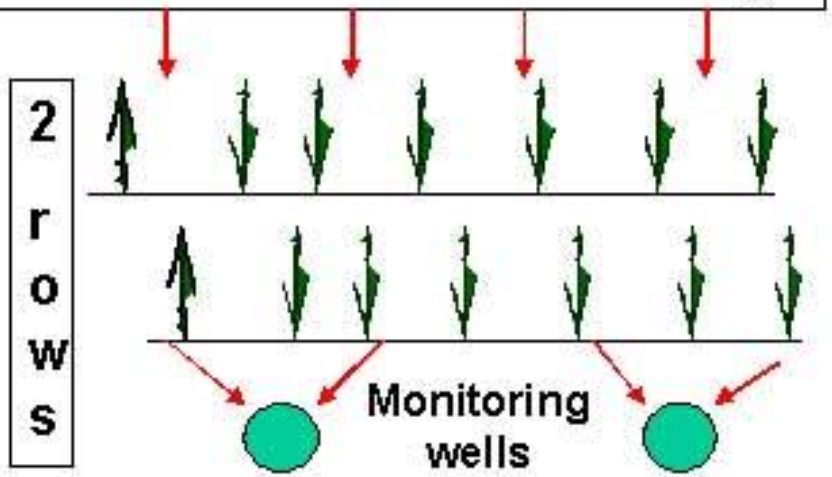
Vetiver planting to absorb effluent discharge from a toilet block in a park in Brisbane.

Six months after planting this stand of 100 plants absorbs all the discharge from the toilet block

High capacity for N absorption in domestic sewage in Australia

Effectiveness of Vetiver in Reducing N in domestic sewage

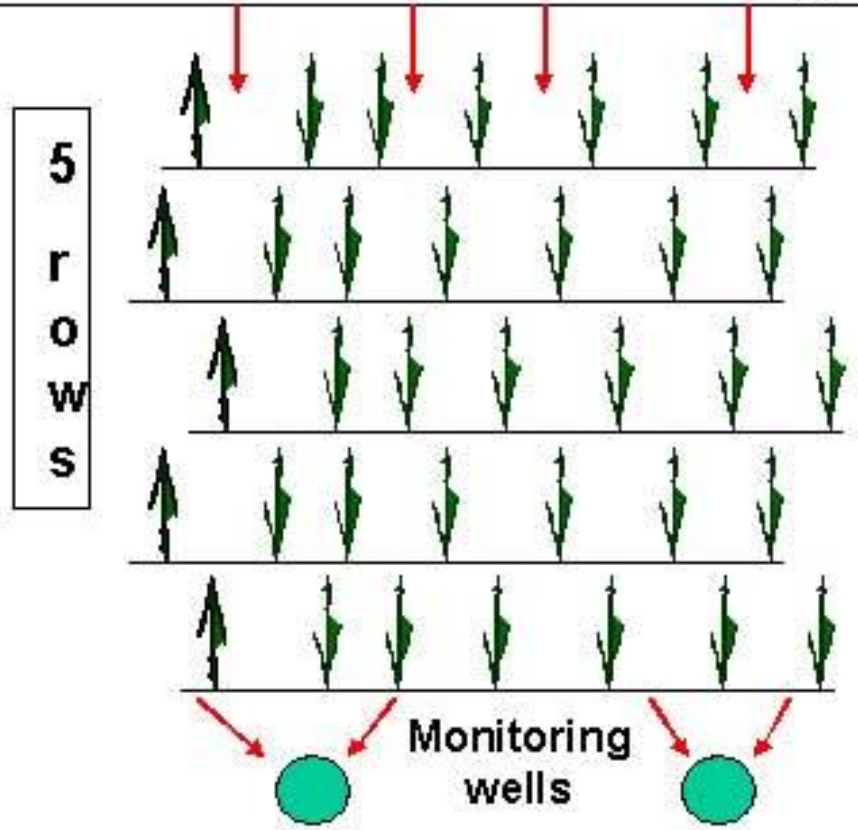
ENTRY: Total N level at 95.2mg/L



EXIT: Total N level at 16mg/L

or a reduction of 83%

ENTRY: Total N level at 95.2mg/L



EXIT Total N level at 1.2mg/L

or a reduction of 99%

CASE STUDY 2: Disposal of sewage effluent a small community

RESULTS

IN FLOW

Average daily flow: 1 670L

Average total N: 68mg/L

Average total P: 10.6mg/L

Average Faecal Coliform:>8 000

OUT FLOW

Average daily flow: Almost Nil*

Average total N: 0.13mg/L

Average total P: 0.152mg/L

Average Faecal Coliform:<10

* Only flow after heavy rain

CASE STUDY 3: Toogoolawah Municipal sewage effluent treatment

Ephemeral constructed wetland

Effluent quality before and after the vetiver treatment

Tests * (license requirements)	Effluent Input	Effluent Output
PH (6.5 to 8.5)8*	7.3 to 8.0	7.6 to 9.2
Dissolved Oxygen (2.0 minimum) *	0 to 2 mg/l	8.1 to 9.2 mg/l
5 Day BOD (20 - 40 mg/l max) *	130 to 300 mg/l	7 to 11 mg/l
Suspended Solids (30 - 60 mg/l max) *	200 to 500 mg/l	11 to 16 mg/l
Total Nitrogen (6.0 mg/l max) *	30 to 80 mg/l	4.1 to 5.7 mg/l
Total Phosphorous (3.0 mg/l max) *	10 to 20 mg/l	1.4 to 3.3 mg/l

CASE STUDY 4: Disposal of industrial wastewater in Australia

Wastewater from a beef abattoir in Australia

Effectiveness of vetiver planting on quality of effluent seepage

Analytes	Nutrient levels		
	Inlet	Mean levels in monitoring bores	
		20m down slope from inlet	50m down slope from inlet
pH	8.0	6.5	6.3
EC (uS/cm)	2200	1500	1600
Total Kjel. N (mg/L)	170	11.0	10.0
Total N (mg/L)	170	17.5	10.6
Total P (mg/L)	32	3.4	1.5

CASE STUDY 5: Post-tsunami housing settlement in Aceh

The American and Danish Red Crosses built over 3,000 houses to resettle victims of the 2001 tsunami. Each house includes a VPT sewage system. These units were highly successful and very effective.

PC: Vant Hoff

CASE STUDY 6: Citarum River basin, Java, Indonesia

The Citarum River in Western Java is reportedly the most polluted river in Asia. Industrial waste, trash, sewage and landfill leachate pour uncontrolled into this river. VPT was implemented to improve river water quality.

Treatment strategy

1- Reducing/controlling pollutant inputs by treatment/disposal of sewage effluent from communal latrines along the river.

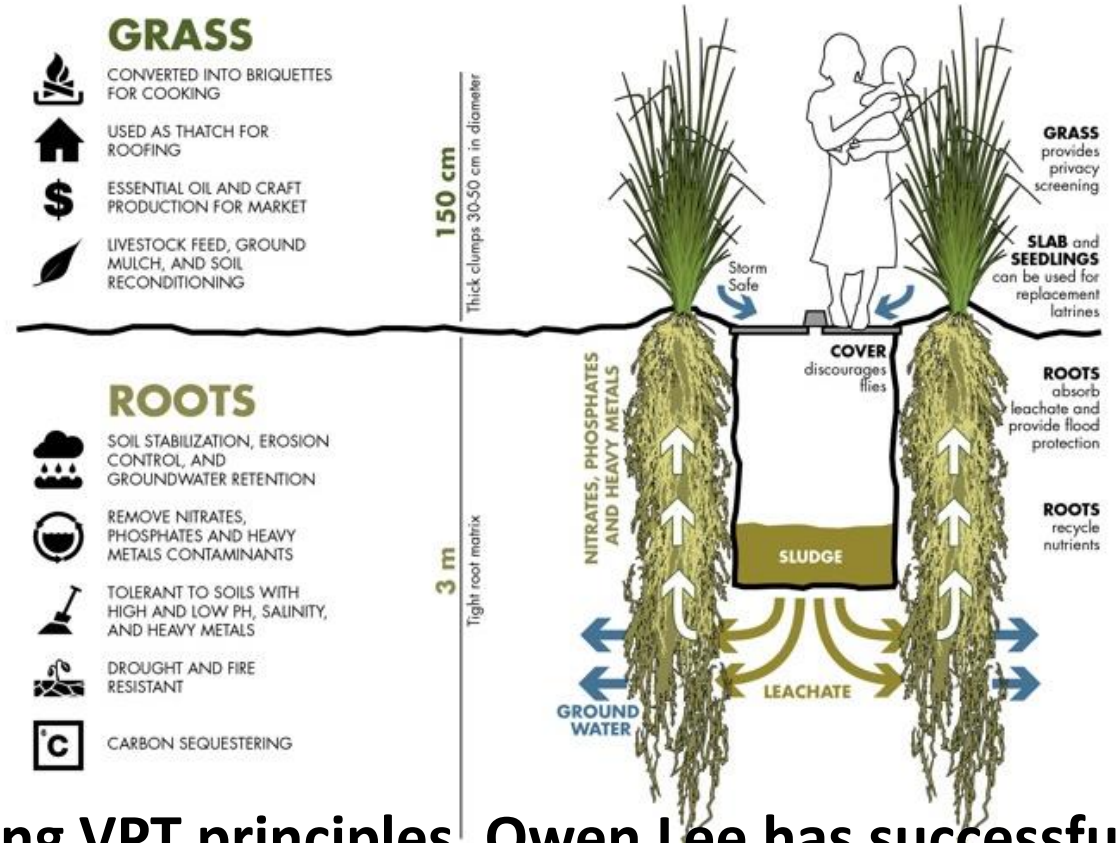
Vetiver planting

Communal septic tank

Treatment strategy

2- Reducing/controlling pollutant levels in the river by planting vetiver on river banks and irrigating it with river water

Results to date appear quite positive. While lacking a quantitative assessment, qualitative observations indicate that water quality has improved. Blue-green algae blooms have substantially reduced and fish have returned to some river sections



CASE STUDY 7:
Vetiver latrine in Haiti

THANK YOU

Using VPT principles, Owen Lee has successfully introduced "Vetiver Latrines" to central Haiti. The Vetiver Latrine is simple. Vetiver is planted around a small concrete slab that covers a slit trench. The long roots of the grass stabilize the pit and uptake the liquid effluent/leachate from sludge in the pit. Above ground, vetiver shoots provide the perfect privacy screen. The design is simple enough for householders to construct themselves. To date, 116 Vetiver Latrines have been built by the community, covering 97% of 3 villages.