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PERSIDANGAN TAHUNAN MANCID KE 16 (16TH MANCO)

Droughts, Floods, Environment: Managing Consumptive Water Needs

(Malaysian National Committee On Irrigation and Drainage)

Intensive Shrimp Culture Water Management:

Biofloc Technology and Waste Water Treatment System

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Pulau Pinang

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Biofloc Technology
(Zero Water Exchange)

BFT (Biofloc) system is at present highly sought technology for Pacific white shrimp culture due to high efficiency, productivity, sustainability and with lower FCR. In addition the concept is base of the ability for the biofloc to recycle the water within culture ponds.

The basic system of bio-floc technology was given by Avnimelech (2000, 2005a&b). The system was successfully applied in commercial culture of shrimps by McIntosh (2000a,b & c, 2001), McNeil (2000), Nyan Taw (2005, 2006, 2009), Nyan Taw & Saenphon Ch. (2005); Saenphon Ch. et.al. (2005). BFT in combination with partial harvest was presented at WA 2009 in Veracruz, Mexico and on Potential of BTF at Asia Pacific Aquaculture 2009 in KL by Nyan Taw (2009). Recently the technology has been presented in ICSA/WAS 2010 in Indonesia and Asian Pacific 2011/WAS in Kochi, India by Nyan Taw (2010, 2011). Avnimelech (2009) published a book entitled "Biofloc Technology: A Practical Guide Book". Expansion of biofloc technology in white shrimp farms was provided by Nyan Taw (2010). The system has already applied in Malaysia at Blue Archipelago shrimp farm at Kerpan (Nyan Taw 2011).

The 'Biofloc (Floc)

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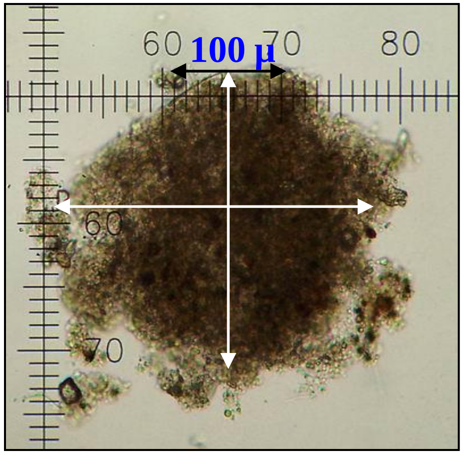
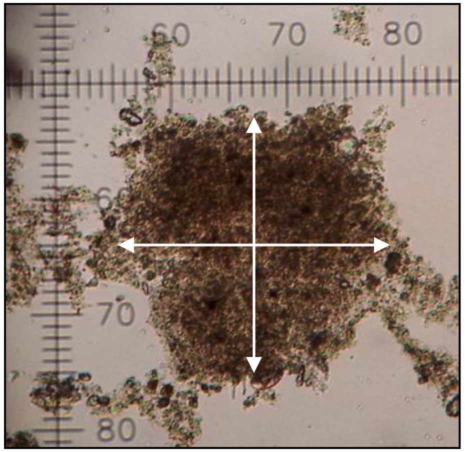
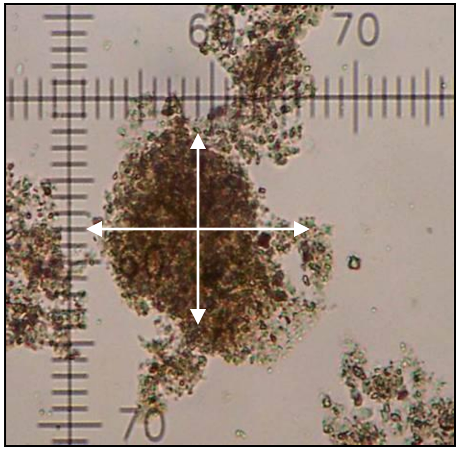
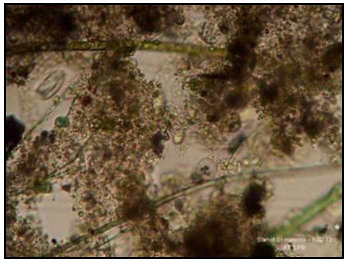
FLOC COMMUNITIES AND SIZE

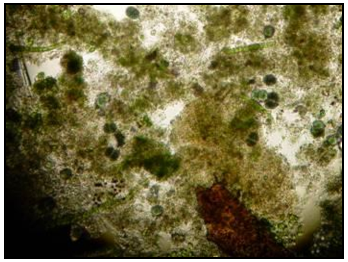








Brown



Green

The biofloc

Defined as macroaggregates – diatoms, macroalgae, fecal pellets, exoskeleton, remains of dead organisms, bacteria, protest and invertebrates.

(Decamp, O., et al 2002)

As Natural Feed (filter feeders – *L. vannamie* & Tilapia) : *It is possible that microbial protein has a higher availability than feed protein (Yoram, 2005)***

Water Re-cycling Concept
Biofloc Technology (Zero water exchange)

(Yoram Avnimelech, 2000, 2005)

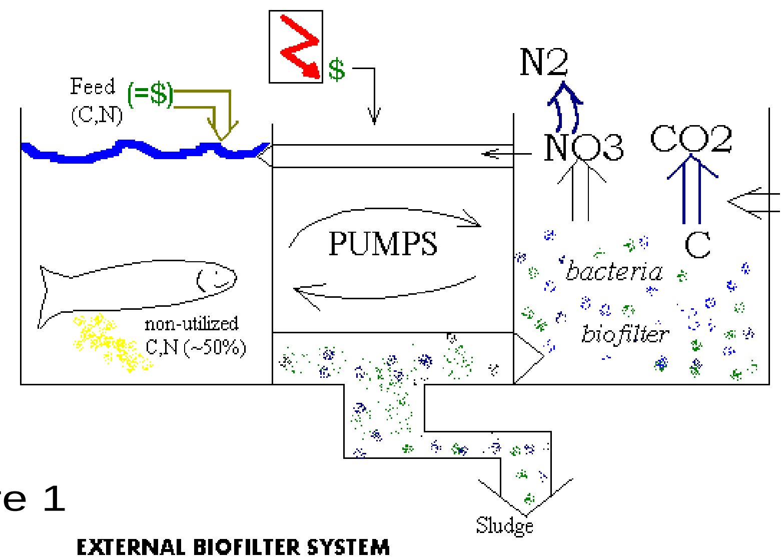


Figure 1

External Biofilter System

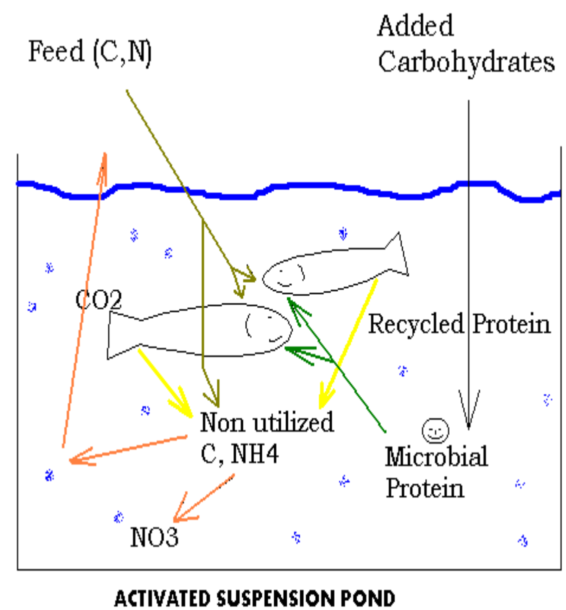
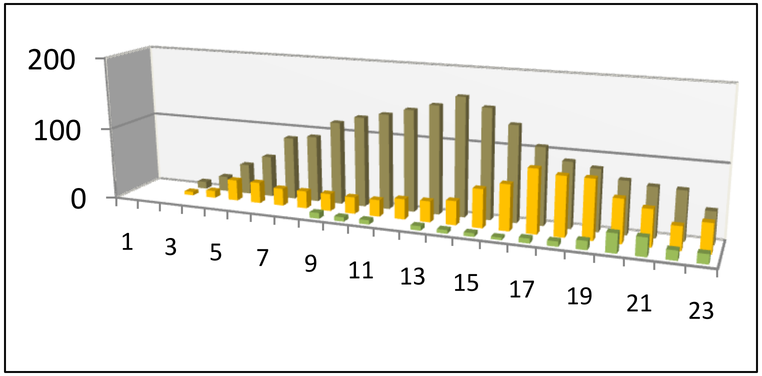


Figure 2

Biofloc System

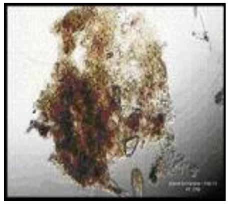
Basic of BFT in Shrimp Farming

1. High stocking density - over 130 – 150 PL10/m2
2. High aeration – 28 to 32 HP/ha PWAs
3. Paddle wheel position in ponds
4. HDPE / Concrete lined ponds
5. Grain (pellet)
6 Molasses
7 Water exchange – ZERO (topping ups only – 1:1)
8 Expected production 20–25 MT/ha/crop
9. FCR – 1.0 to 1.3



Feed & grain application and biofloc


Grain pellet


Bioflocs


Dark Vannamei


Red Vannamei

Blue Archipelago, Malaysia

Arca Biru Sdn Bhd Shrimp Farm

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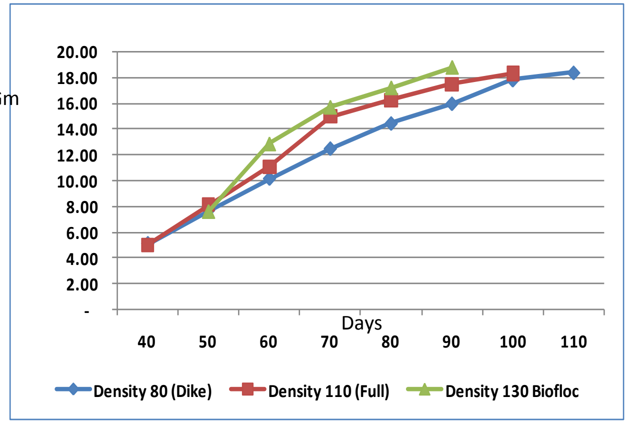
PRODUCTION PERFORMANCE OF ARCA BIRU FARM

Production Parameter	System/size/type		
	Biofloc 0.4 ha HDPE	Semi-Biofloc 0.8 ha HDPE	Conven 0.8 ha HDPE Dyke
No of Ponds	2	19	119
PWA Energy (Hp)	14	24	20
Stocking Density	130	110	83
DOC (days)	90	101	111
SR (%)	89.16	81.35	83.19
MBW (gr)	18.78	18.31	17.80
FCR (x)	1.39	1.58	1.77
ADG (gr/day)	0.21	0.18	0.16
Avg Harvest tonnage (kg)	9,006	12,950	9,616
Production (Kg/Ha)	22,514	16,188	12,019
Prod per power input (Kg/Hp)	**643**	**540**	**481**



Waste Water Treatment System

One of the most important aquaculture resources is water, and its effective management is becoming an increasingly central issue in development and on environmental friendliness.

Nutrient and organic wastes produced by intensive shrimp pond culture consist of solid matter (mainly uneaten feed, feces & phytoplamkton) and dissolved metabolics (mainly ,urea, NH_3 & CO_2). The dissolved and solid fraction will also be supplemented by fertilizers when these are applied. The discharge of untreated effluent rich in nutrients and organic matter together with chemotherapeutants and other chemicals can have several consequences for receiving waters. There is growing evidence that environmental impacts related to shrimp culture play a significant role in outbreaks of disease now affecting shrimp ponds in Asia. There were few attempts so far to treat effluent from intensive shrimp ponds on a commercial scale (Phillips et al., 1993).

Malaysia and Thailand experiments have been conducted using seaweed to remove nutrients and molluscs to remove solid matter from effluent water (Enander & Hasselstrom, 1994; Briggs, 1994; & Chaiyakam, 1995). At present finfishes such as milkfish and tilapia are being used in reservoirs, exit canal or production ponds in shrimp culture systems to reduce the nutrient load.

Biological Treatment for water re-circulation in Aquaculture

Biological treatment is used for higher levels of recycles and may be through one or more of the following:

Lagoons, sometimes operating as semi-intensive fish ponds; simple substrate (rock or gravel) filter beds; molluscs culture; macro-algal beds; seaweeds or designed wetland systems. The choice of these depends primarily on local environmental practice. Water is then pumped back to the main aquaculture system, whether on a continuous or an intermittent, partial replacement basis.

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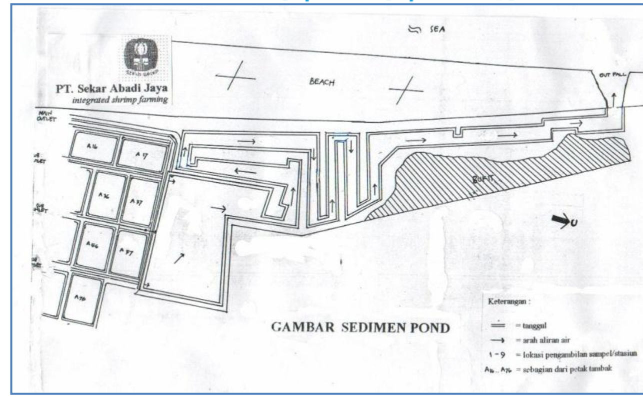
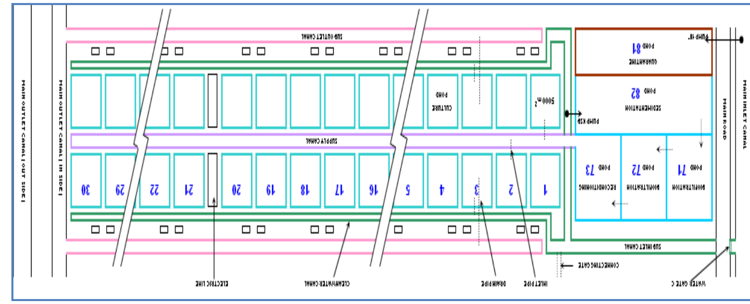
Shrimp Farm in Sumbawa, Indonesia
Waste water treatment (sedimentation system)

The system has three phase treatment system. The system was found to be efficient in meeting the requirements standard (BOD, COD, TSS, etc) set by NACA and DOF, Indonesia for effluence discharge from shrimp farm.



Shrimp Farm, Lampung Indonesia
Water re-circulation system

The system is based on individual modules. Each module has independently waste water treatment system – settling basin, physical, biological and chemical. The system was found to be efficient in meeting the BAP/ACC requirement standards.



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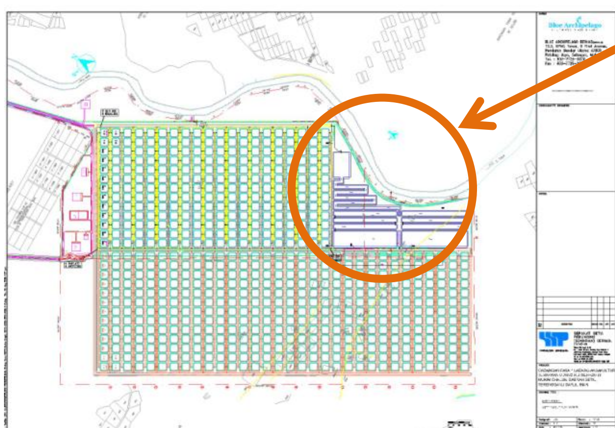
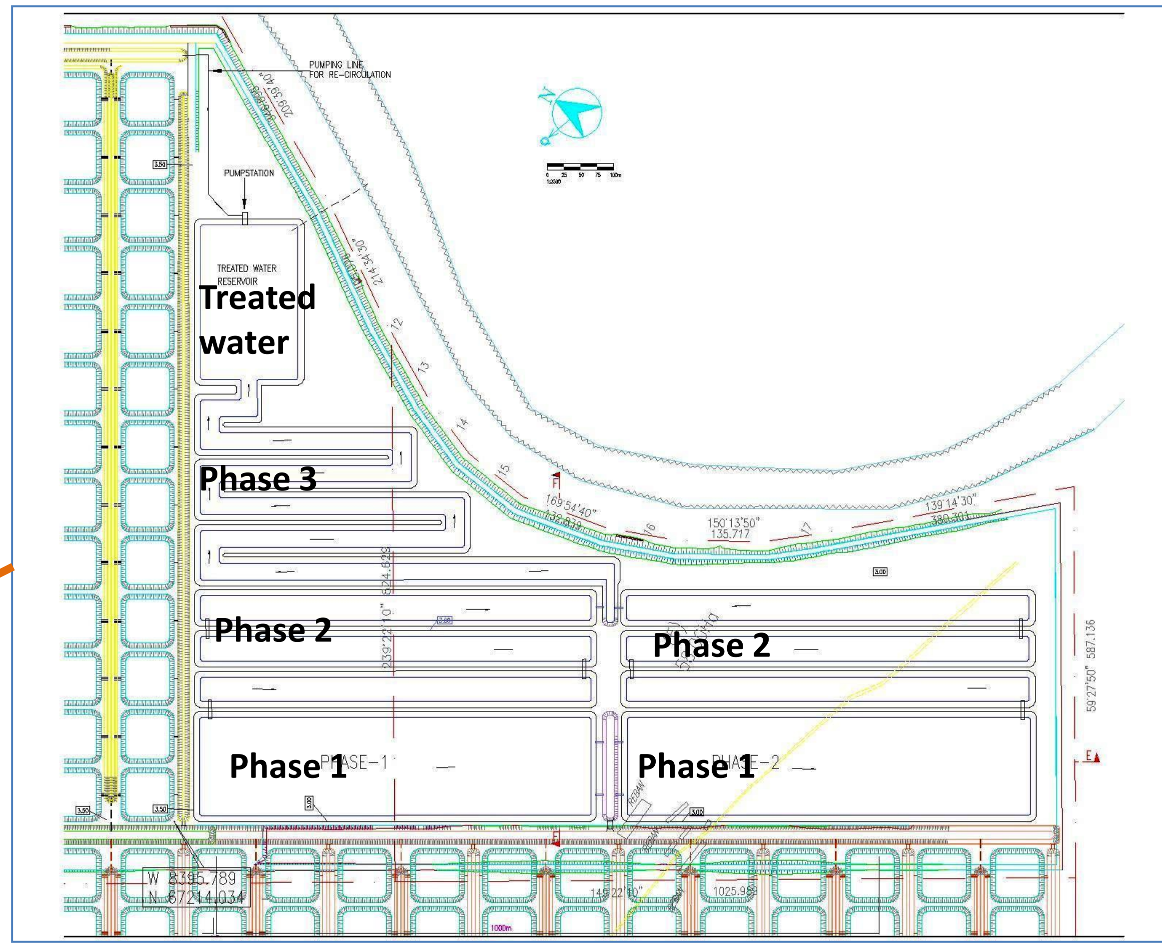
iSHARP Setiu shrimp farm project
Water re-circulation system.

Waste water discharge from intensive shrimp culture system can be treated by physical, chemical and biological methods.

The most essential factor is to have a three phase system layout. The sedimentation system can be divided into three phases

Phase 1 (settling basin)
Phase 2 (semi-settling)
Phase 3 (aging canal)





Phase 1 (Settling Basin)

The purpose of the basin in to have the effluence sediments to settle (physical) to the bottom. In the basin filter feeder fishes, seaweed, oysters and nitrifying bacteria can be stocked or placed to filter or convert effluence wastes (biological) into non-toxic forms.

•Effluence sediments to settle to the bottom – settled sludge to be removed physically after every 2 or 3 cycles of culture period.

Phase 2 (Semi-settling Basin):

The purpose of the pond is to convert effluence waste using biological filters and nitrifying bacteria (biological) and also aeration (physical) can be applied to purify the water. Liming can also be applied to again for purification of water (Chemical).

Phase 3 (Aging Canal):

The purpose of the canal is to make sure for biofilters (biological) such as oysters and seaweeds which are stationary animals and plants to be efficient in filtering and taking up effluence nutrients before being discharged into the environment and at the same time aging the water. If required aeration (physical) and liming (chemical) can be applied.

Treated clean water reservoir (water for reuse):

The purpose of this reservoir is to ensure that water treated along the treatment system is the standard acceptable for culture. At this stage strong aeration and circulation by air diffusers and paddle wheels will be provided. If required some liming will also be done. The clean water from the reservoir will be pumped (re-circulated) into the main supply canal to be used within modules.

Biofilters

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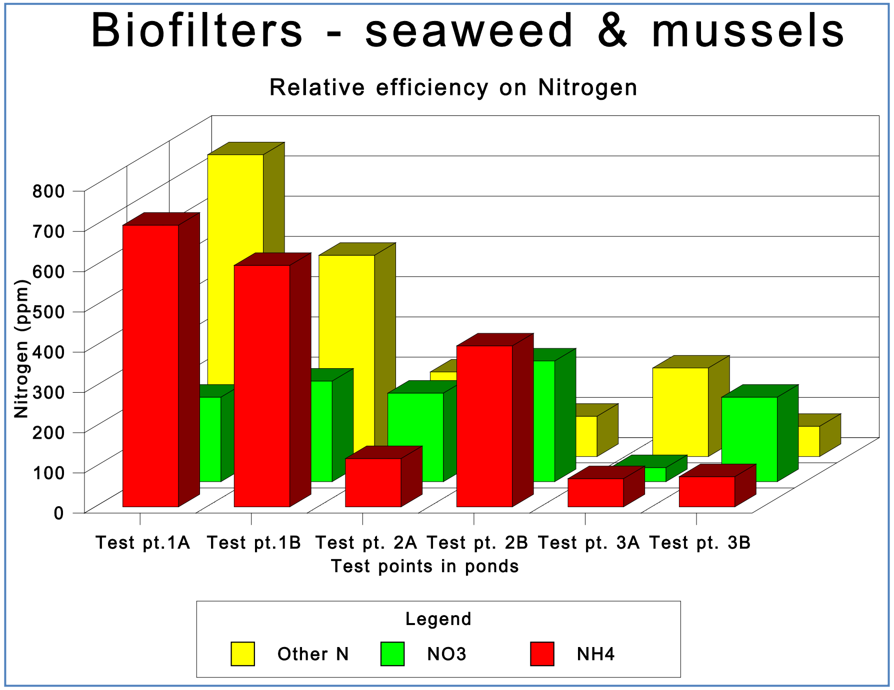
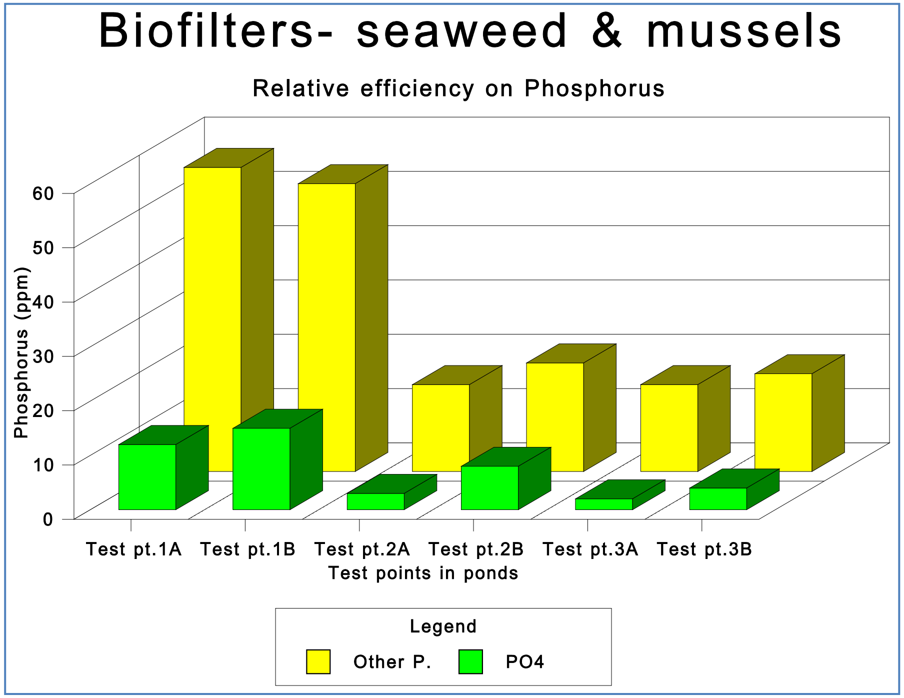
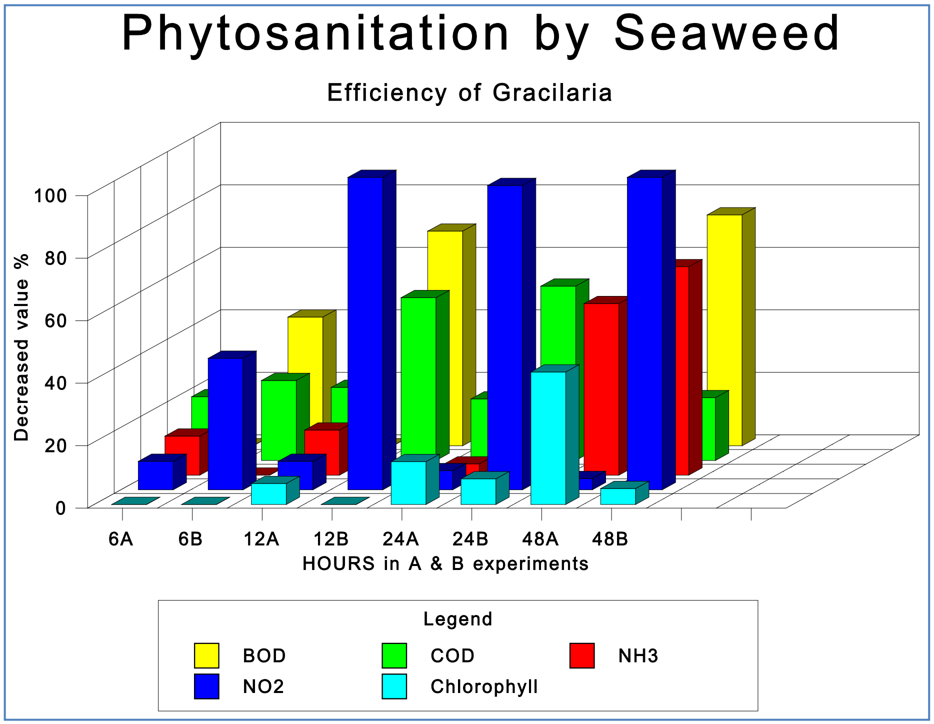


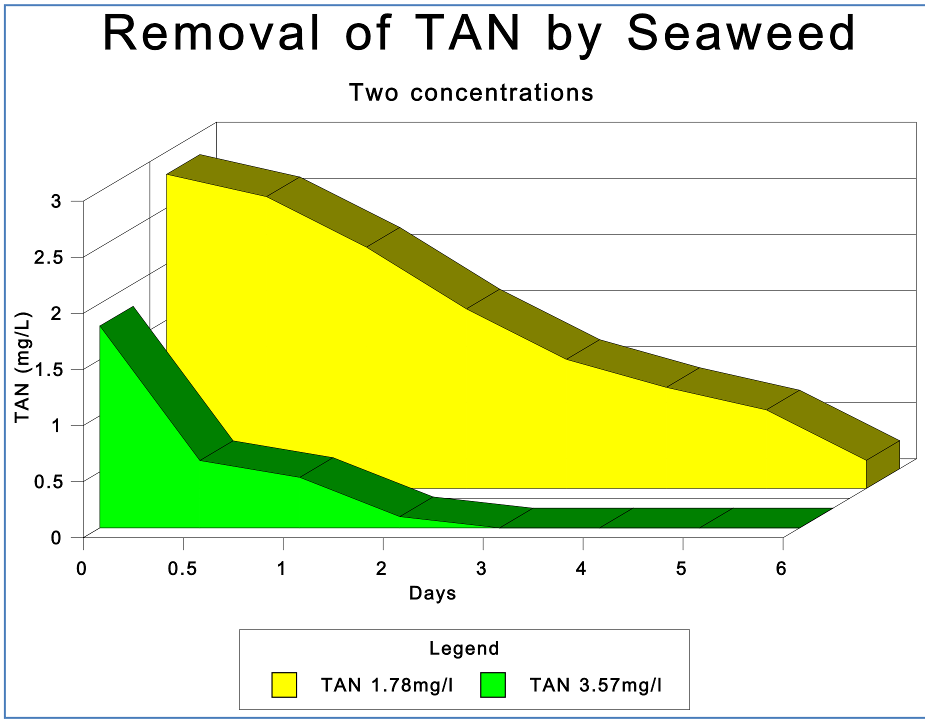


The relative efficiency of the Biofilter for Nitrogen. - Test pt.1 = water from shrimp pond; test pt 2 = water from bivalve pond; test pt 3 = water from seawwed pond. (Enander & Hasseistrom,1994)

The relative efficiency of the biofilter on Phosphorus.(Enander & Hasseistrom,1994)

Phytosanitation & Removal of TAN by Seaweeds

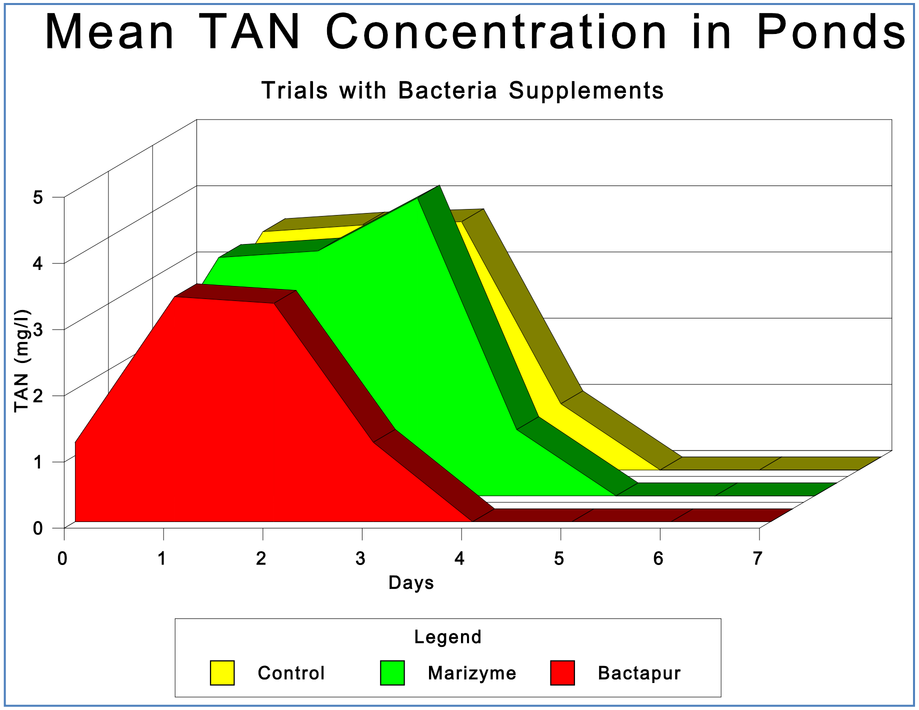


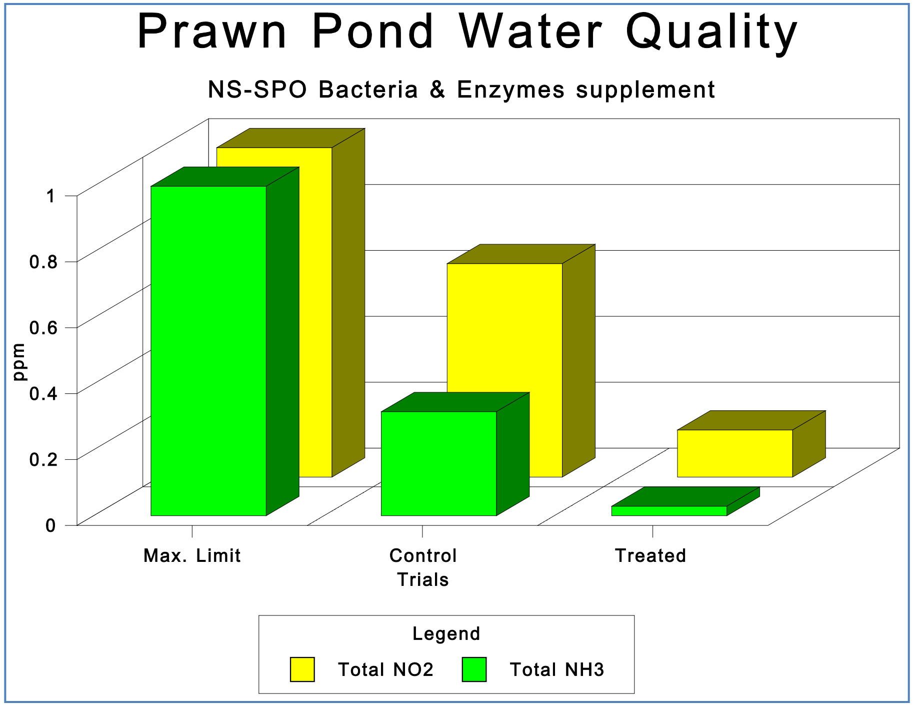


Phytosanitation using seaweed *Gracilaria* in reclamation of shrimp pond effluent. (Chaiyakam,1995)

Removal of TAN by Gracilaria sp. at two concentrations.(Briggs, 1994)

Bacteria & Enzyme Supplement





Water quality of prawn culture pond water treated with Bacteria & Enzymes Supplement at optimum DO & pH (Pantastic & Baldia, 1989)

Thank You

Nyan Taw

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