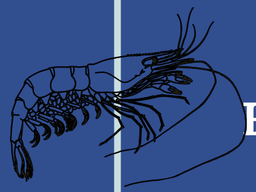
Pondguard as an Essential Oil Blend Supplement to Reduce the Disease Risk and Increase the Productivity of Aquatic Animals

OUTLINE

PONDGUARD INTRODUCTION



FIELD OBSERVATION – Shrimp

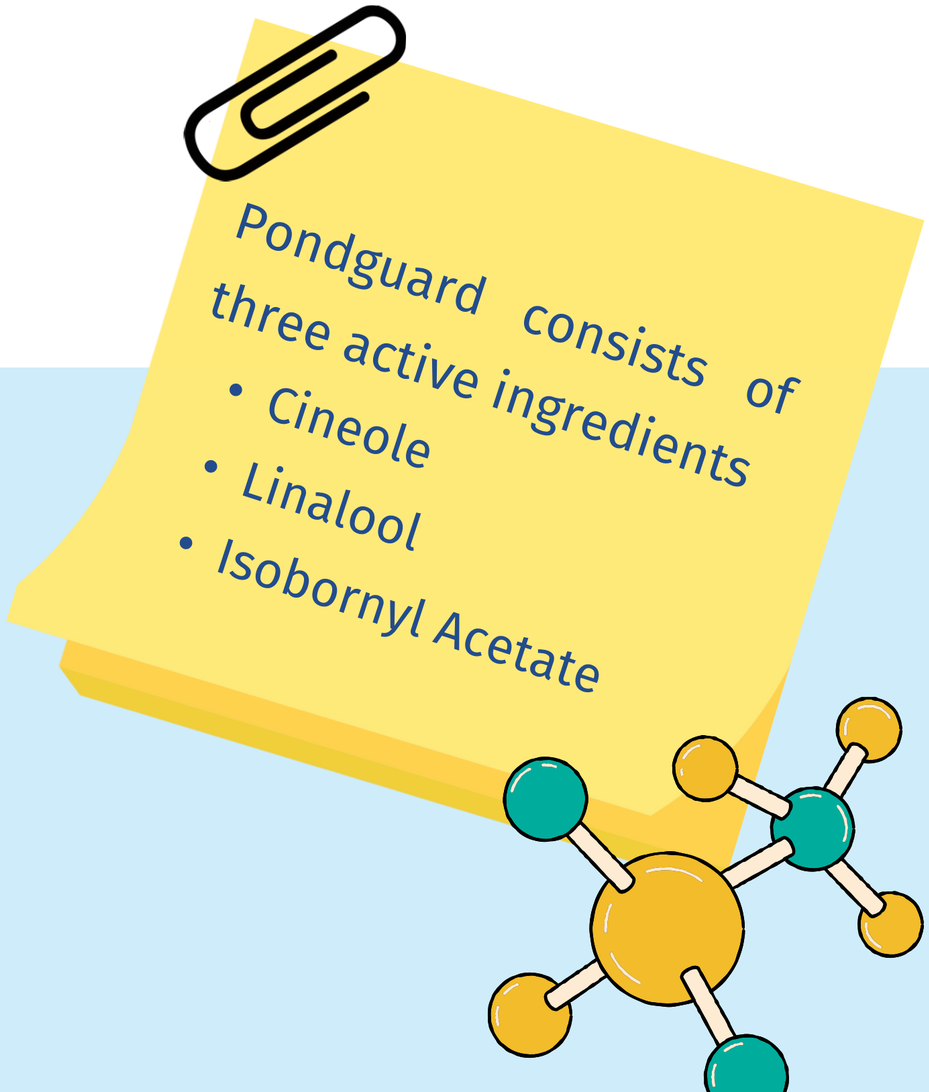
FIELD OBSERVATION – Fish

LABORATORY REPORT

CONCLUSION

INTRODUCTION

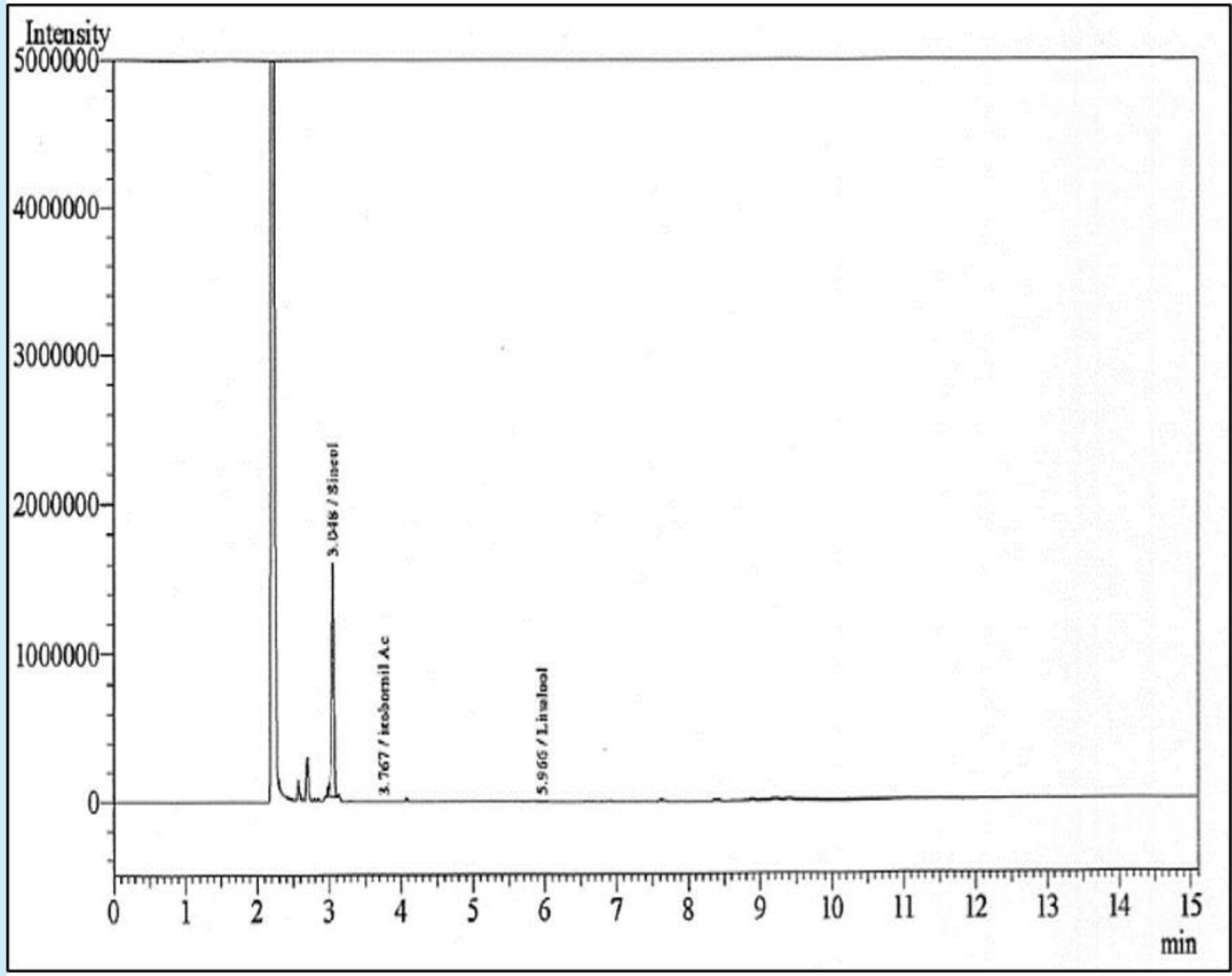
- Pondguard helps in overall improvement in the quality and productivity.
- It maintains the general health of shrimp and fish by improving the immune system.
- It works directly against specific viral pathogens like WSSV,IMNV, TiLV, Iridovirus and KHV.
- It works directly against specific bacterial and other pathogens like *Vibrio harveyi, V. campelii, V. parahaemolyticus*-AHPND-EMS, *Aeromonas, Streptococcus*, and EHP



PONDGUARD FORMULATION

The selection of blend oils done based on anti-viral properties, immunomodulating properties and their compatibilities. The targeted active ingredients are as follows :

- Cineole extracted from *Eucalyptus globulus,*
- Isobornyl acetate extracted from *Pinus sylvestris*, and
- Linalool extracted from *Lavandula latifolia*



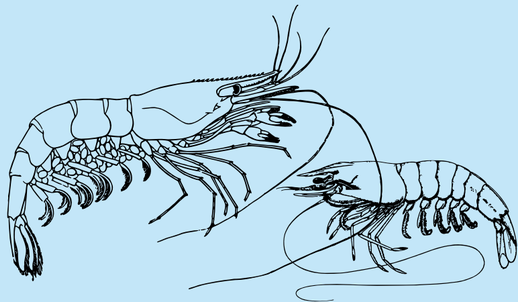
Chromatogram of complete NOBF compound's peak i.e. Cineole, Linalool and Isobornyl acetate

CHARACTERICSTICS OF PONDGUARD

1. Colorless liquid form
2. It has physical properties like potable water
3. pH 6.5 - 7.5
   alkalinity 140-180 ppm
   salinity 0 ppt
4. Non-hazardous, user-friendly and consumable
5. Packed in HDPE plastic bottles 1 L and 5L
6. It efficiently works in both high and low saline water environment

RECOMMENDED DOSE OF PONDGUARD

Parameters of Pondguard Application	PONDGUARD APPLIED IN WATER					PONDGUARD MIXED WITH THE FEED		
	Before PL Stocking		During Culture		Emergency cases	During Culture		Emergency cases
	Day -7	Day -3	DOC 1 - DOC 40	DOC 40 - harvest	High Vibrio load, sudden drop in DO, sudden increase in afternoon pH, and appearance of diseses like, WSSV, EMS, heavy moulting, etc.	DOC 1 - DOC 60	DOC 60 - harvest	High Vibrio load, sudden drop in DO, sudden increase in afternoon pH, and appearance of diseses like, WSSV, EMS, heavy moulting, etc.
Dose	0.4 ppm	0.4 ppm	0.4 ppm	0.4 ppm	0.4 ppm	2 ml/kg feed	4 ml/kg feed	8 - 10 ml/ kg feed
Frequency	Once	Once	Daily	Two times a week	Two times a day for 5 days or till mortality stops.	Two times a day at the higher	Two times a day at the higher feeding rate	Two times a day at the higher feeding rate



- **Dose 0.4 ppm = 4 L for 1 Ha area and 1 m depth of water,**
- **The dose must be adjusted according to depth and area of pond.**

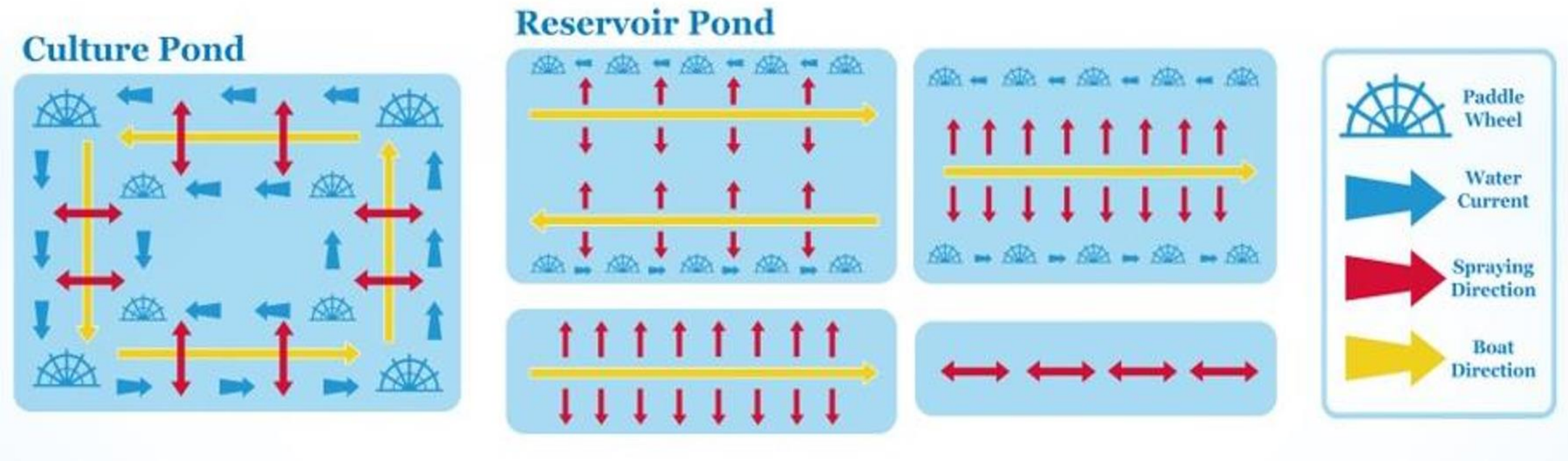
PREPARATION and DILUTION METHOD

Mix recommended dose of Pondguard in 10 liter of clean water.

Mix well for 2 to 3 minutes.

Apply over pond in maximum current area.
Paddle wheel should be kept running for at least 1 hour, for homogenous and rapid mixing.

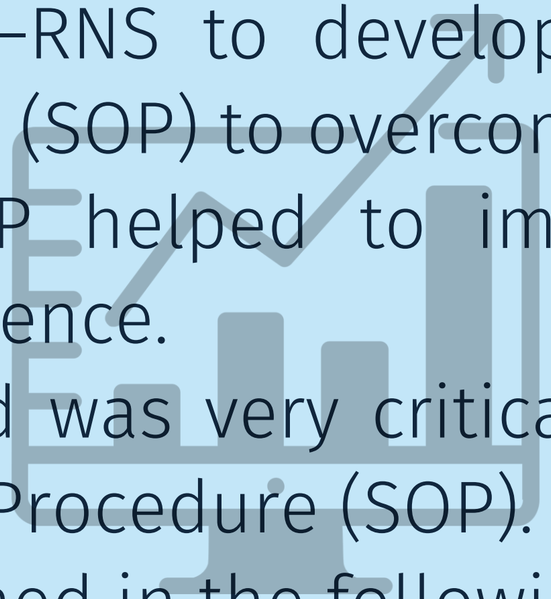
APPLICATION METHOD



Time of application: Suitable time of application 9.00 to 16.00 hrs.
Storage and handling: stored at room temperature (25° - 32 ° C), keep in the shade.

FIELD OBSERVATION

- Multiple pathogens and factors disrupted shrimp farming in Indonesia.
- That encouraged CPP–RNS to develop the new normal Standard Operational Procedure (SOP) to overcome them.
- The New Normal SOP helped to improve the productivity and decrease disease incidence.
- The role of Pondguard was very critical in the success of the New Standard Operational Procedure (SOP).
- The outcome is explained in the following slides



Shrimp Culture Using Pondguard

Vannamei & Monodon

SHRIMP CULTURE SOP in INDONESIA

Description	New Normal SOP	Old SOP
Layout	Sedimentation pond : 8%	Sedimentation pond : 8%
	Treatment pond : 17%	Treatment pond : 22%
	Recondition pond : 8%	Culture pond : 70%
	Culture pond : 67%	
Stocking Density	Density 120 pcs/m2	Density 134 pcs/m2
Water Exchange/cycle	900%	800%
Pond bottom cleaning	Started from the 2nd week of culture	Started from 2nd month of culture
Disease Surveillance	Tighten	Relax
DO level (dissolved oxygen)	> 4.5 ppm	> 4 ppm
Culture system	Balancing on the number of plankton and bacteria (keeping the plankton number stable).	Balancing on the number of plankton and bacteria

SHRIMP CULTURE SOP in INDONESIA

Description	New Normal SOP	Old SOP
Pondguard	Treated with Pondguard	No Pondguard treatment
Pond Preparation	Use lime CaO around 1.5 - 2 Ton/Ha (to deactivate EHP Spore)	Use lime CaO around 1 Ton/Ha (to deactivate EHP Spore).
Biosecurity - PCR Based Monitoring	RT-PCR	Nested PCR
TOM and Vibrio load monitoring	Frequency of monitoring : two times a week	Frequency of monitoring : once a week
	TOM less than 100 ppm	TOM less than 100 ppm
	Green vibrio less than 100 cfu/ml	Green vibrio less than 100 cfu/ml
	Yellow vibrio less than 1000 cfu/ml	Yellow vibrio less than 1000 cfu/ml

SUMMARY OF TRIALS AND OBSERVATION

Beneficial Properties	Test Methodology	Results
Immunomodulatory	*In Vivo* (CPP)	Enhance the hemocyte count and maintain at the optimum level.
Anti-WSSV	*In Vitro* & *In vivo* (CPP)	Effective, 100% deactivation and no infection recorded in Pondguard supplemented shrimp.
Anti-IMNV	*In Vitro* & *In vivo* (CPP)	Effective, 100% deactivation and no infection recorded in Pondguard supplemented shrimp.
Anti-AHPND/EMS	*In Vitro* & *In vivo* (University of Can Tho, Vietnam)	Effective, 100% deactivation and no infection recorded in Pondguard supplemented shrimp.
Anti-Vibrio	*In vivo* (CeRaf, Vietnam)	Pathogenic Vibrio load reduce to 0% in 24 hrs of application.
Growth performance in Vannamei	*In Vitro* (CPP) & *Pond level in Indonesia, India, Saudi, China, Vietnam*	Enhance the survival and productivity and lowers the FCR
Growth performance in Monodon	*Pond trial - India*	
Growth performance in Tilapia	*In Vitro* & *Pond, Cage & Tank level*	Enhance the survival and productivity and lowers the FCR
Biofloc technique in Tilapia	*In vivo* (CPP)	Enhance the survival and productivity
Grass carp growth performance	*In Vitro* & *In vivo* (SOU, China)	Enhance the growth rate, reduce the FCR , higher productivity

VANNAMEI POND PERFOMANCE in INDONESIA

Culture Performance "Technical Partner" CP Prima

Description	2019	2020	2021
			Q1
Number of Pond (pcs)	859	1,054	105
Area (ha)	277	328	31
Stocking Density (pcs/m²)	130	126	115
Avarage Day of Culture (DOC) (days)	82	85	88
Harvesting Size (pieces/kg)	61	58	52
Mean Body Weight (MBW) (gr)	17	17	19
Average Daily Weight Gain (gram/day)	0.201	0.204	0.218
Feed Conversion Ratio (FCR)	1.26	1.29	1.24
Survival Rate (SR) (%)	89	82	89
Productivity (Ton/ha)	19	18	20

- There is an increase in productivity from 18 tons per hectare to 20 tons per ha despite reducing stocking density.
- The day of culture (DOC) increased, which showed better health conditions of shrimp.
- The survival rate of shrimp increased to 89 % as compared to 82 % in 2020.
- The FCR reduced to 1.23 in 2019 as compared to 1.29 in 2020.

PONDGUARD OVERSEAS PERFOMANCE in VANNAMEI PONDS

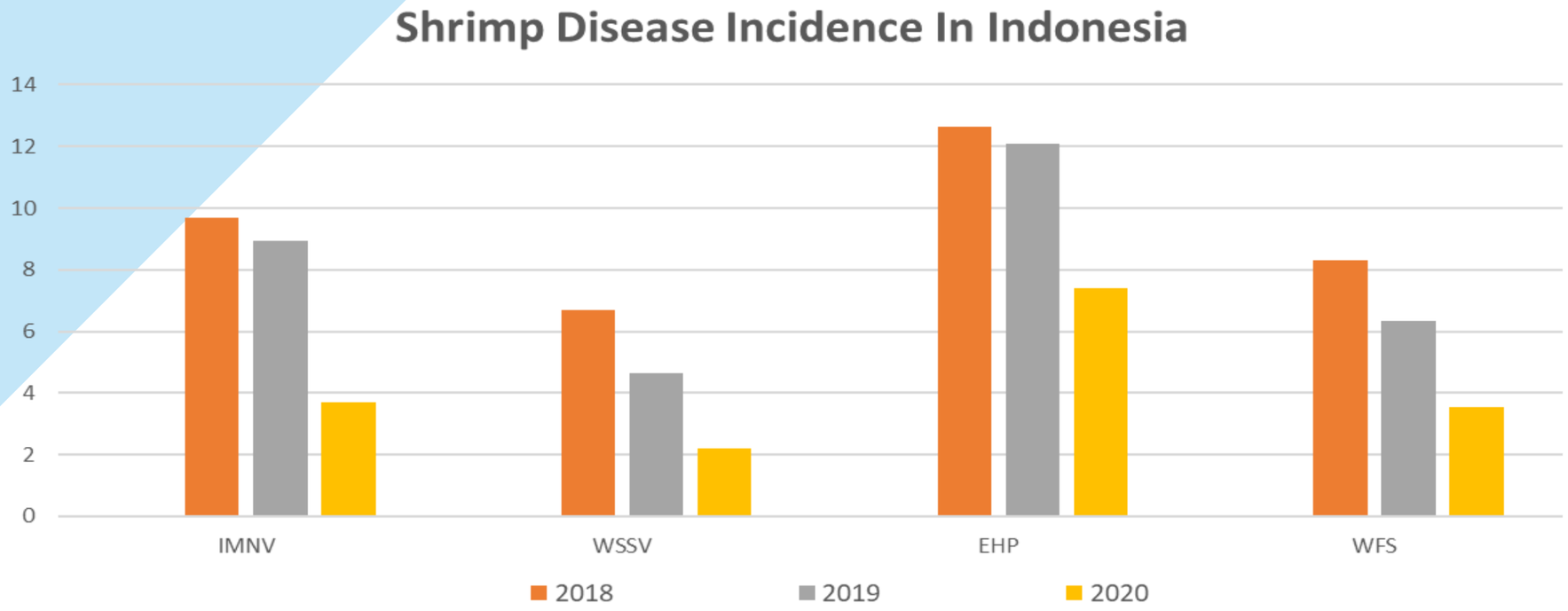
Parameters	Saudi	India	China	Vietnam
Area (ha)	100	80	10	15
Stocking Density (pcs/m^2)	35	35 - 40	600	120-180
Survival Rate (SR) (%)	10% higher using Pondguard	15% higher using Pondguard	ON GOING	ON GOING
Disease	Effective against WSSV and Low survival rate	Effective against WSSV and IMNV	EMS and WSSV target. Started trial in late 2021	Effective against WSSV and EMS. SR 5-10% higher using Pondguard
Pondguard Uses	Water and Feed	Water and Feed	Water and Feed	Water and Feed

*REMARKS

Our main target are :

1. To Reduce EMS incidence in Vietnam
2. To Reduce the number of WSSV, IMNV and EHP cases in India
3. To Reduce the WSSV incidence Saudi

FIELD OBSERVATION



Diseases	2018	2019	2020
IMNV	9.7	8.95	3.7
WSSV	6.7	4.65	2.2
EHP	12.635	12.1	7.4
WFS	8.3	6.35	3.55

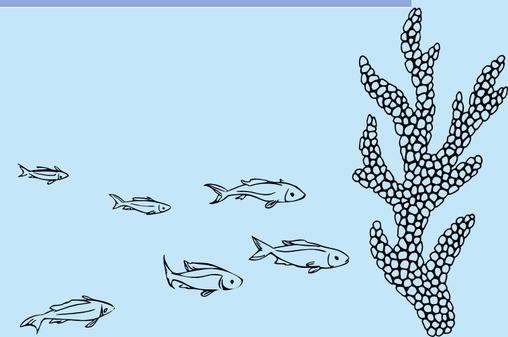
- There is a decrease in all the pathogen monitored in 2020 and 2021 as compared to 2019 and 2018.
- There is a reduction in IMNV incidence from 8.95 % to 3.7 % and 4.8 %.
- There is a reduction in WSSV incidence from 6.7 % to 2.2 % and 3.6 %.
- There is a reduction in EHP incidence from 12. 6 % to 7.4 % and 4.5 %.
- There is a reduction in White Feces Syndrome incidence from 8.3 % to 3.5 % and 5.2 %.

Fish Culture Using Pondguard

Tilapia, Common Carp, Seabass, Seabream, Grouper & Yellow Croaker

RECOMMENDED DOSE FOR FISH

Parameters of Pondguard Application	Water supplement	Feed Supplement (mixed with the feed)	Feed Supplement (top-dressed on the feed)
Dose	0.4 ppm	4 to 8 ml/kg feed	4 to 8 ml/kg feed
Frequency	Two times a week	Daily	Daily



PONDGUARD PERFOMANCE ON TILAPIA FISH (TANK TRIAL)

Group	MBW (gr)	ADG (gr/day)	Biomass (gr)	Feed Intake (gr)	FCR	SR (%)	Productivity (Ton/Ha)
Normal CP Feed	104.4a	1.621a	3,132a	2,743a	1.34a	96.7%a	62.64
PG Feed *	110.9a	1.790a	3,251a	3,183b	1.44b	98.8%a	65.02

*PG Feed was produced from normal CP feed mixed with Pondguard (4L/ton feed) in the feedmill

*The PG Feed provide better performance than normal feed, but statistically not significantly different.

Group	MBW (gr)	ADG (gr/day)	Biomass (gr)	Feed Intake (gr)	FCR	SR (%)	Productivity (Ton/Ha)
Normal CP Feed	104.4a	1.621a	3,132a	2,743a	1.34a	96.7%a	62.64
PG-top dressed Feed*	114.2a	1.857a	3,427a	3,335b	1.43b	100%a	68.54

*PG-top dressed feed was made from normal CP feed top-dressed with Pondguard (4 ml/kg feed) in the field.

*The PG-top dressed Feed provide better performance than normal feed, but statistically not significantly different.

PONDGUARD PERFOMANCE ON TILAPIA FISH (CAGE TRIAL)

Performance	Treatment		*P-value*
	Normal CP Feed	PG Feed	
MBW (g)	260.4[a]	274.3[a]	*0.157*
ADG (g/d)	2.35[a]	2.48[a]	*0.114*
Biomass (g)	15,718[a]	18,163[b]	*0.005*
Feed accumulation (g)	26,333[a]	27,373[a]	*0.157*
FCR	1.81[b]	1.60[c]	*0.003*
SR (%)	75.4[a]	82.9[b]	*0.013*
Productivity (Kg/Ha)	39.30	45.40	

- PG Feed was produced from normal CP feed mixed with Pondguard (4L/ton feed) in the feedmill.
- PG Feed is able to provide better performance than the normal feed, especially in MBW, ADG, Biomass, FCR and SR

Performance	Treatment		*P-value*
	Normal CP Feed	PG-top dressed Feed	
MBW (g)	260.4[a]	286.2[a]	*0.157*
ADG (g/d)	2.35[a]	2.60[a]	*0.114*
Biomass (g)	15,718[a]	19,170[b]	*0.005*
Feed accumulation (g)	26,333[a]	26,082[a]	*0.157*
FCR	1.81[b]	1.44[a]	*0.003*
SR (%)	75.4[a]	83.8[b]	*0.013*
Productivity (Kg/Ha)	39.30	47.50	

- PG-top dressed feed was made from normal CP feed top-dressed with Pondguard (4 ml/kg feed) in the field.
- PG-top dressed Feed is able to provide better performance than the normal feed, especially in MBW, ADG, Biomass, FCR and SR

Performance	Treatment		*P-value*
	Normal CP Feed	PG Feed & PG in the water	
MBW (g)	260.4[a]	273.9[a]	*0.157*
ADG (g/d)	2.35[a]	2.50[a]	*0.114*
Biomass (g)	15,718[a]	18,720[b]	*0.005*
Feed accumulation (g)	26,333[a]	26,666[a]	*0.157*
FCR	1.81[b]	1.50[ac]	*0.003*
SR (%)	75.4[a]	85.4[b]	*0.013*
Productivity (Kg/Ha)	39.30	46.80	

- *PG feed from feedmill were used and water were treated with Pondguard 0.4 ppm per week.
- This treatment is able to provide better performance than the normal feed, especially in MBW, ADG, Biomass, FCR and SR

PONDGUARD PERFOMANCE ON TILAPIA FISH (POND TRIAL)

Group	MBW (gr)	ADG (gr/day)	Biomass (kg)	FCR	SR (%)	Productivity (kg/Ha)
Normal CP Feed	180.1	1.683	2,501	2.088	49.6	17.9
PG Feed	192.3	1.798	2,161	2.406	46.8	18.0

Group	MBW (gr)	ADG (gr/day)	Biomass (kg)	FCR	SR (%)	Productivity (kg/Ha)
Normal CP Feed	180.1	1.683	2,501	2.088	49.6	17.9
PG-top dressed feed	198.3	1.853	2,744	2.236	53.2	21.1

- Pondguard dose was optimized on Tilapia
- The selected doses were :
  - In feed during production: Pondguard 8 liter/ ton of feed. Daily
  - On feed Spray: Pondguard 8 mL/ Kg of feed. Daily
- The outcome of 106 days trial suggested that Pondguard has positive impact on the Biomass increment, lowering the FCR and increasing the survival rate of tilapia.

Biofloc System advance technique on Tilapia Fish Farming

Parameter	Unit	Biofloc pond		Control 1	Control 2
		Standard feed	Premium feed		
Volume	m3	3	3	192	14
No of tank	unit	3	3	1	1
Initial stocking	pcs	254	253	19,200	1,400
Stocking Density	animal/m2	85	84	10	21
Initial MBW	gram	28	28	10	21
Initial Biomass	Kg	7	7	19	29
Harvest DOC	days	90	90	95	75
MBW (harvest)	gram	285	295	213	160
ADG (harvest)	gram/day	2.86	2.96	2.13	1.85
Harvest Biomass	Kg	67	71	3,264	174
Population	Pcs	237	240	15,360	1,092
SR	%	93	95	80	78
ACC. Feed	Kg	67	70	3,150	150
FCR		1.12	1.1	1.03	1.04
Water exchange		287%	287%		
Productivity	Kg/m3	22.5	23.6	17	12.4

*Premium Feed has a higher crude protein content

*Control group is a group of conventional tilapia farming systems.

Cage trial on Grass Carp Fish Farming- SOU China

Effects of pondguard on growth performance of grass carp

GROUP	the average rate of gain (%)	Specific growth rate （SGR, %·d^{-1}）	Survival rate （SR, %）	Feed coefficient (FCR)
0	13.00±0.71^{d}	0.36±0.01^{d}	80.00±0.00^{b}	2.26±0.11^{a}
1%(W4)	20.36±2.66^{c}	0.54±0.07^{c}	92.50±2.50^{a}	1.27±0.19^{c}
2%(W5)	26.35±2.37^{a}	0.69±0.06^{a}	91.67±3.82^{ab}	0.97±0.11^{c}
3%(W6)	21.99±0.04^{bc}	0.59±0.01^{bc}	93.65±5.16^{a}	1.16±0.09^{c}

Notes: Value with different letter superscripts in the same row mean siginificantly different($P < 0.05$).

Effects of pondguard on growth performance of grass carp

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0	13.00±0.71^{d}	0.36±0.01^{d}	80.00±0.00^{b}	2.26±0.11^{a}
1%(W4)	20.36±2.66^{c}	0.54±0.07^{c}	92.50±2.50^{a}	1.27±0.19^{c}
2%(W5)	26.35±2.37^{a}	0.69±0.06^{a}	91.67±3.82^{ab}	0.97±0.11^{c}
3%(W6)	21.99±0.04^{bc}	0.59±0.01^{bc}	93.65±5.16^{a}	1.16±0.09^{c}

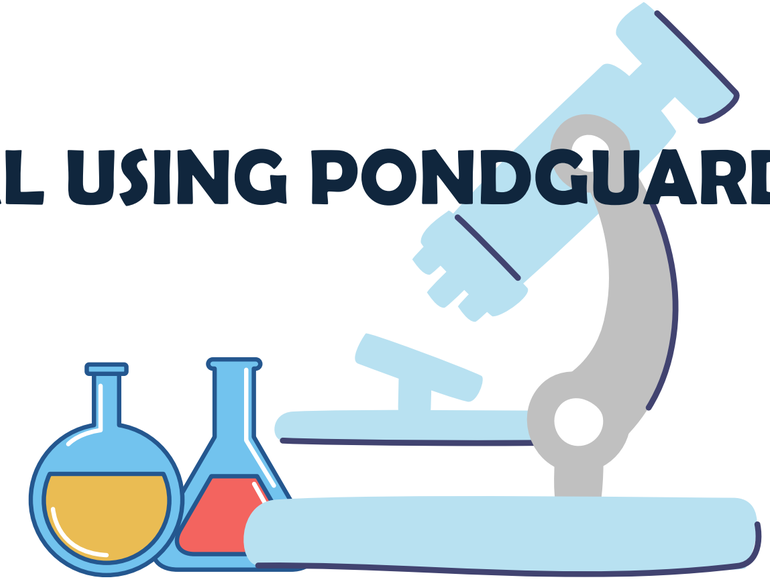
Notes: Value with different letter superscripts in the same row mean siginificantly different($P < 0.05$).

* 2 % pondguard was the best feed for grass carp, so it was more appropriate to choose 2 % concentration when adding pondguard as feed additive.

CONCLUSIONS

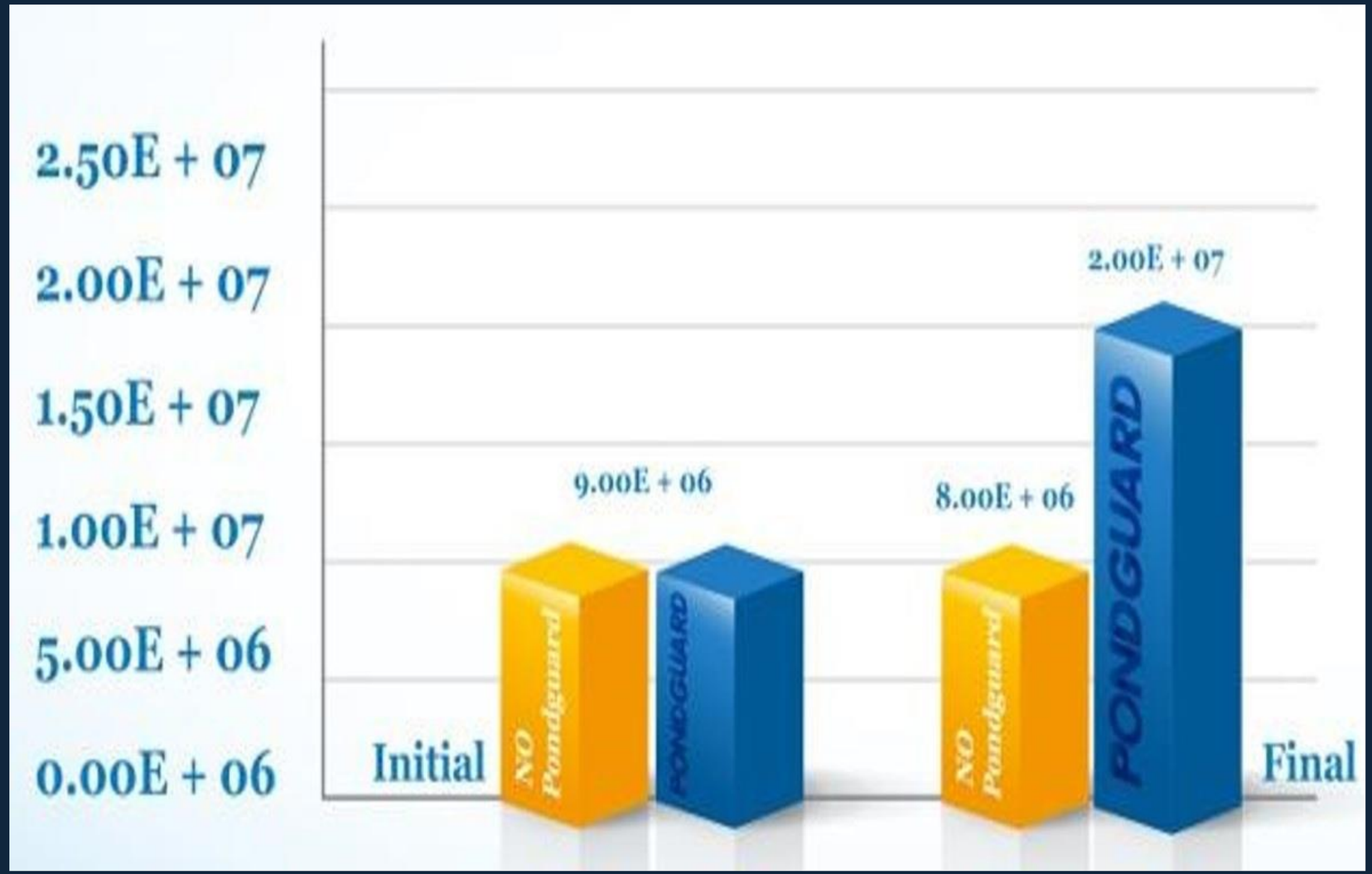
The developed blend formulation Pondguard is an effective immunomodulator and anti-pathogenic agent which supports shrimp and fish to grow in its optimum condition, which resulted in better productivity.

LAB TRIAL USING PONDGUARD



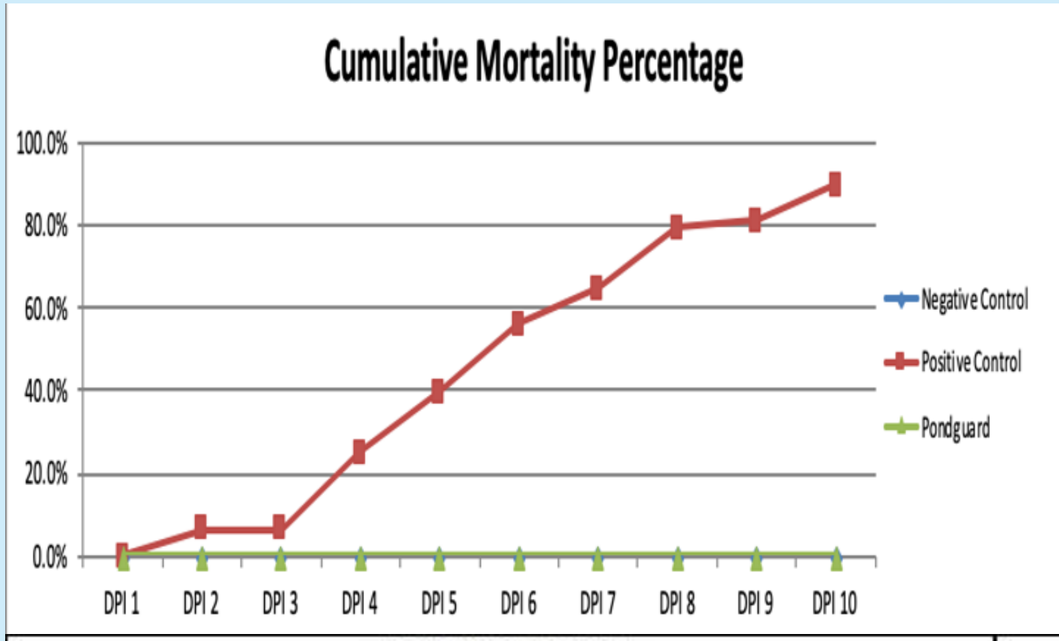
PONDGUARD AS IMMUNOMODULATOR

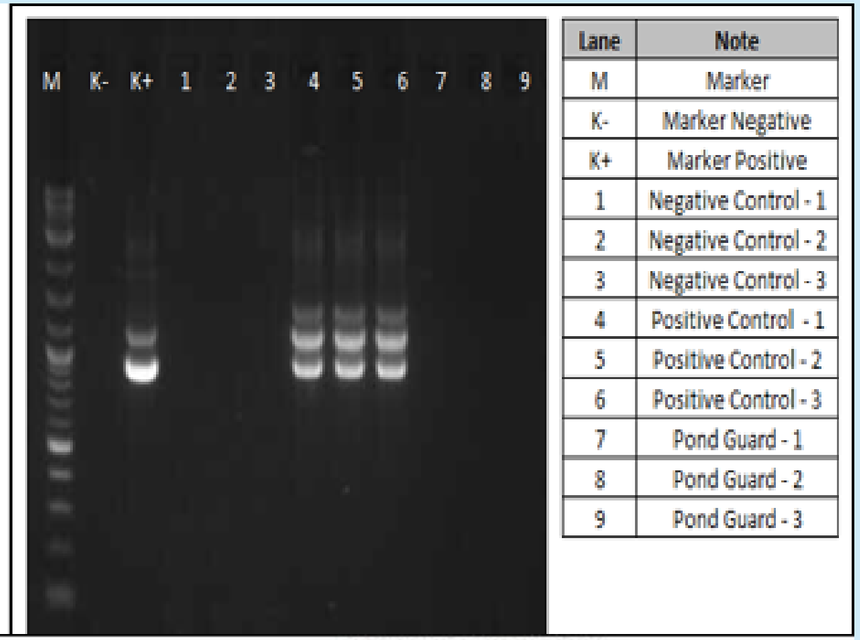
Total Hemocyte Count: Shrimp Total Hemocyte Count increased after 3-4 weeks of PG application.



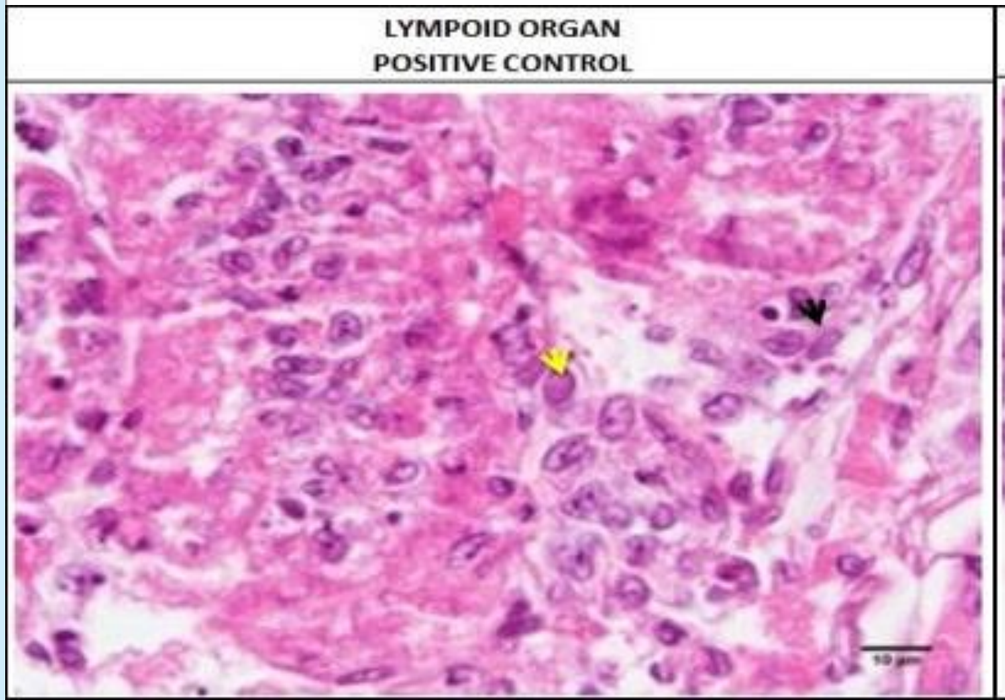
- This trial was designed to observe the efficacy of Pondguard as immunomodulator.
- A hemolymph count of a normal healthy shrimp should be about log 7.
- A 3 weeks controlled small scale trial was conducted.
- The initial and final hemolytic count of shrimps were analyzed from Pondguard applied tanks and not applied tanks.
- The hemolytic count of shrimp in Pondguard applied tanks were found in optimum level i.e. log 7 after 3 weeks of application.
- The trial shows that Pondguard is acting as immunomodulator.

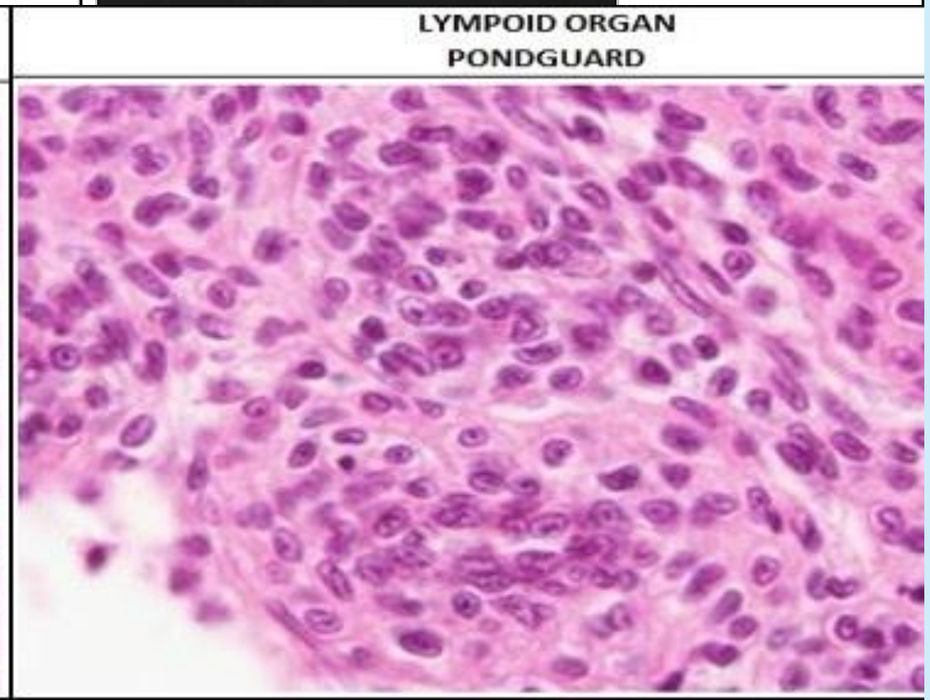
Pondguard against White Spot Syndrome Virus (WSSV)





Lane	Note
M	Marker
K-	Marker Negative
K+	Marker Positive
1	Negative Control - 1
2	Negative Control - 2
3	Negative Control - 3
4	Positive Control - 1
5	Positive Control - 2
6	Positive Control - 3
7	Pond Guard - 1
8	Pond Guard - 2
9	Pond Guard - 3

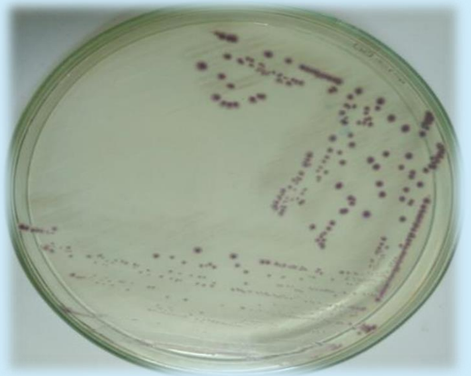


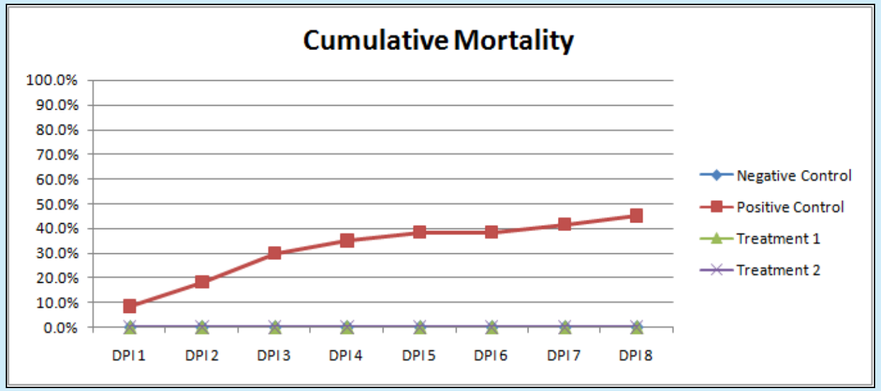


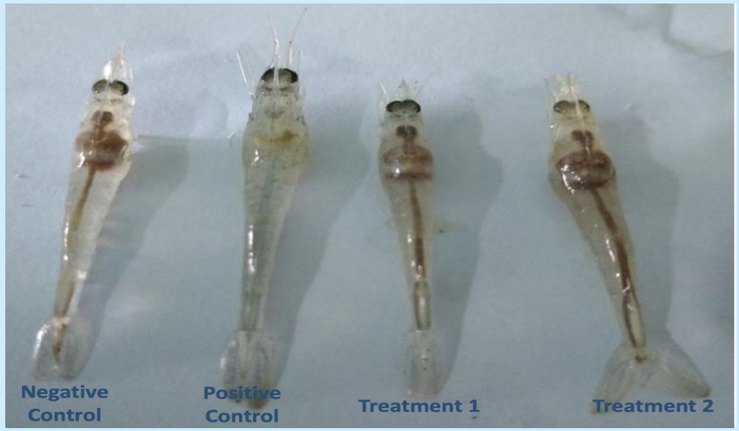
- There was 100% protection achieved by applying PG against WSSV.
- The PCR test of the remaining shrimp on the day of termination i.e., DPI 10 stated that all the shrimp in PG group were negative to WSSV. The positive control shrimp were positive to WSSV.
- The sub-lethal dose of virus was submerged in the PG and incubated for 2-3 hours before feeding to the shrimp.
- The trial was repeated two times leading to similar results.

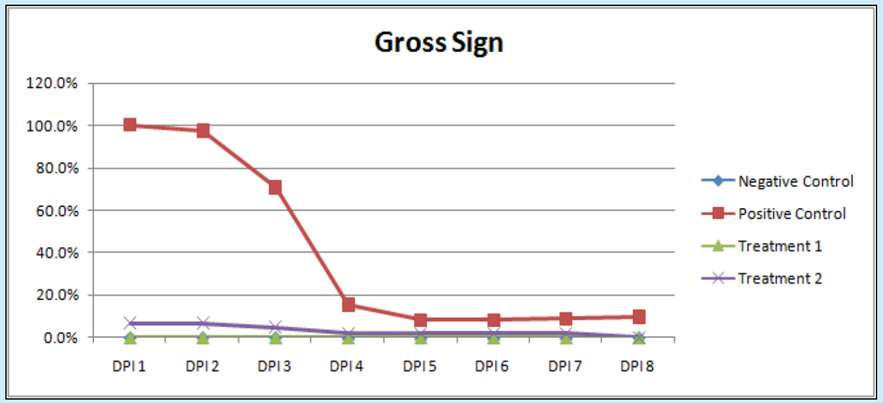
Pondguard against EMS/AHPND in Shrimp

Group	R	Shrimps		Challenge Methods		Product Application	Water Exchange	
		MBW	Number of shrimps	Volume of Bacteria/TSB	Immersion Time		Rate	Frequency
Negative Control	3	0.6 - 0.8	20	30 mL of TSB	15 minutes		20%	Every day started at dpi 3
Positive Control				30 mL of bacteria				
Treatment 1				30 mL of bacteria		0.2%		
Treatment 2				30 mL of bacteria		0.3%		







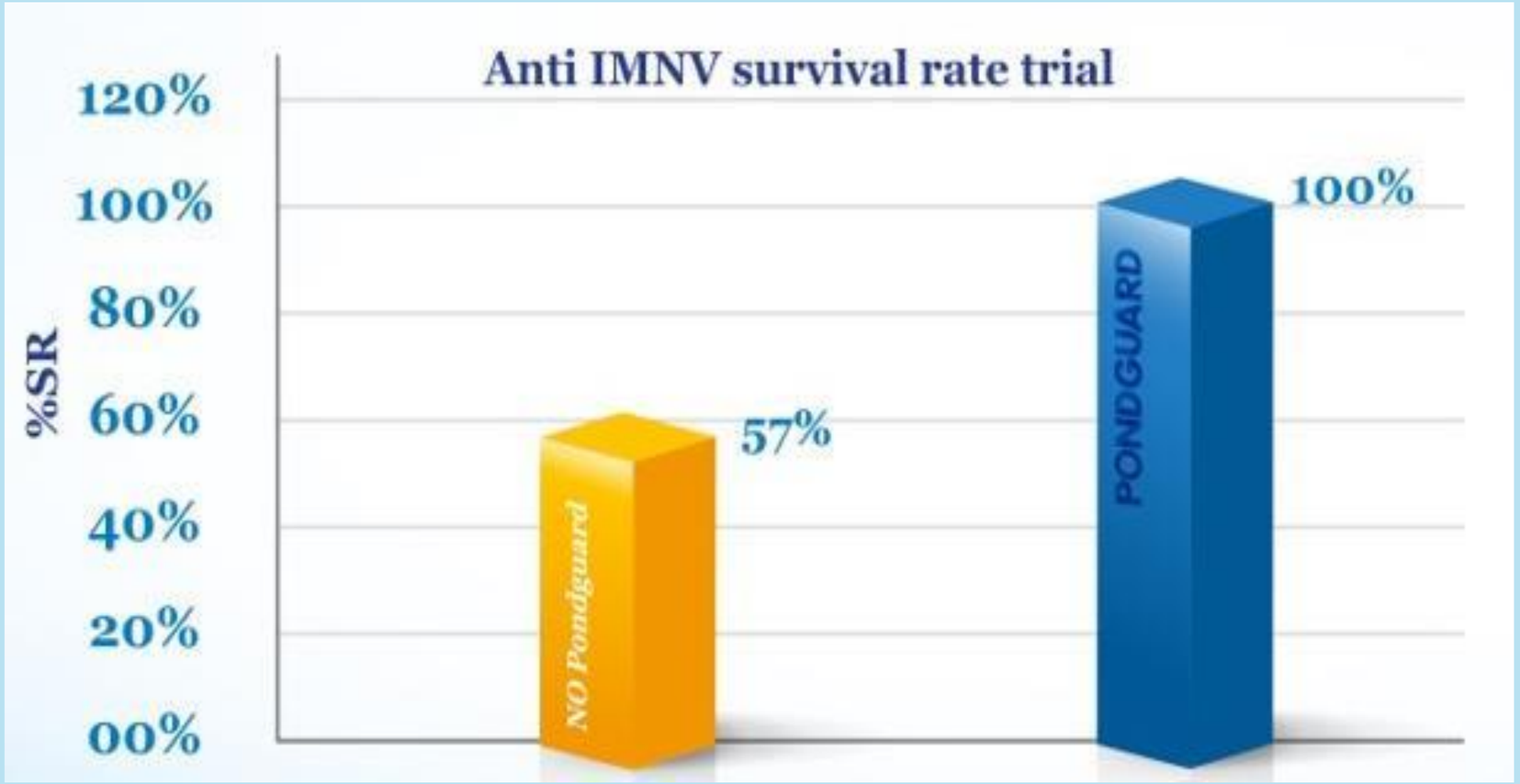


Conclusions:

- *Vibrio parahaemolyticus*-EMS strains performed the mortality in shrimps with typical gross signs of EMS/AHPND.
- Pondguard has ability to inhibit the *Vibrio parahaemolyticus*-EMS growth, therefore, NO mortality and gross sign of EMS were appeared in the treated shrimps.

Group	R	RT PCR Results (CT Value)									
		Bacteria after Incubation	Shrimps Samples								
			After Challenge	DPI 1	DPI 2	DPI 3	DPI 4	DPI 5	DPI 6	DPI 7	DPI 8
Negative Control	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Positive Control	1	24.3	33.4	28.4	27.1	23.2	21.8	33.6	0.0	32.7	0.0
	2	23.7	33.6								
	3	25.4	33.6								
Treatment 1	1	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2	14.0	0.0								
	3	13.8	0.0								
Treatment 2	1	13.8	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2	15.8	34.4								
	3	16.2	35.4								

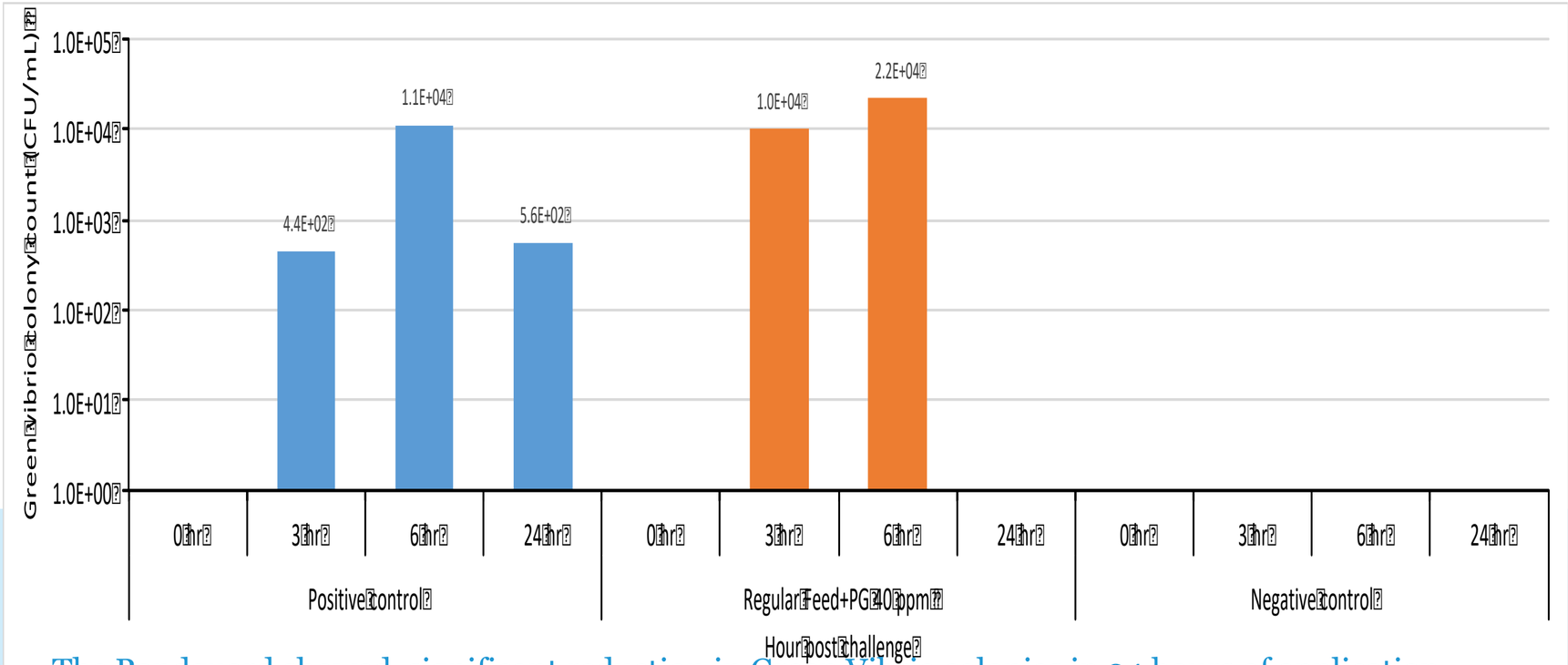
Pondguard against IMNV in Shrimp



Pondguard application was able to maintain SR 60-100% against Infectious Mionecrosis Virus (IMNV) in several trials conducted.

- **A small scale bioassay trial was conducted to determine the efficacy of Pondguard against IMN Virus of shrimp.**
- **Pondguard was applied for 2 weeks in the tanks prior to challenge.**
- **The shrimp were challenged by sub-lethal dose of IMN Virus using the *per os* method.**
- **The higher survival rate i.e. 100% was recorded in Pondguard applied tanks after 10 days of observation.**
- **The trial results prove that Pondguard improved the immune system of shrimp to fight against IMN Virus.**

Pondguard against PATHOGENIC GREEN VIBRIO in Shrimp

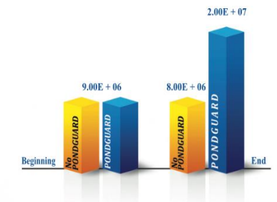


- The Pondguard showed significant reduction in Green Vibrio colonies in 24 hours of application

- **A small scale bioassay trial was conducted to determine the efficacy of Pondguard against Green Vibrio.**
- **Pondguard was applied for 2 weeks in the tanks prior to challenge.**
- **The shrimp were challenged by sub-lethal dose of VP-AHPND i.e. log 6.**
- **The obtained result shows that Pondguard was able to reduce the green Vibrio load up to zero % in 24 hours of the challenge period.**
- **The trial results prove that Pondguard is able to reduce the Vibrio load in a controlled environment.**

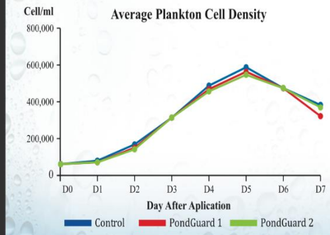
PRODUCT PACKAGING

EFFICACY OF PONDGUARD AS IMMUNOMODULATOR



Trial of PondGuard treatment on shrimp shows results of hemocyte count at an optimum level, log 7 after 3 weeks of application, significantly higher than control (non PondGuard treatment).

PONDGUARD HAS NO NEGATIVE IMPACT ON PLANKTON



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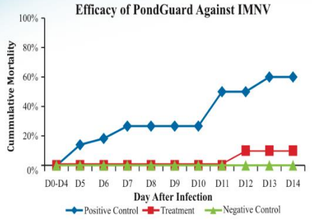
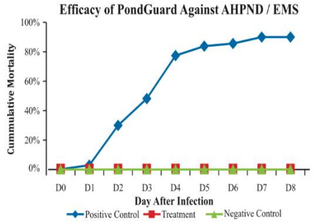
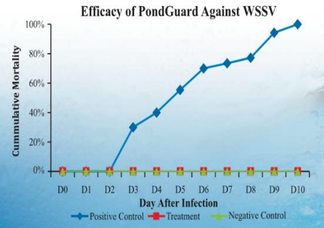
animalhealthcaresolution@cpp.co.id

EFFICACY OF PONDGUARD AGAINST PATHOGENIC VIRUSES AND BACTERIA







KKP RI No. D 16060285 - HBC

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Jakarta Pusat 10270

POND GUARD

WHAT IS PONDGUARD?

PondGuard is an immunomodulator consisting of essential oils that have an ability to improve immune response so that shrimp can withstand pathogenic attacks and play a role in reducing inflammation.

PondGuard maintains healthy immune system of shrimp. If level of the immune system is low, it will be increased and maintained at its optimum level.

PONDGUARD CHARACTERISTICS

A liquid containing natural and harmless ingredients that have characters as such drinking water with a salinity of 0 ppt with a pH of 6.5 - 7.5.

PondGuard has no negative impact on plankton, probiotic bacteria or enzymes used during culture.

PONDGUARD BENEFITS

- Reduce load of harmful pathogens (viruses and bacteria) in pond environment.
- Maintain shrimp immunity to help protecting from infectious diseases.
- Maintain metabolic functions of shrimp body.
- Reduce stress level of shrimp.

Composition :
Mixture of lavender oil, eucalyptus oil and pine oil.

Packaging : 1 liter and 5 liters.

HOW TO USE

Application on Feed

- Mix PondGuard according to the dosage into a soluble liquid (2 ml or 4 ml PondGuard + 150 ml water per kg of feed). Stir the PondGuard mixture homogenously.
- Apply the PondGuard mixture to feed evenly distributed. *(Mix PondGuard into the feed in the shade).*

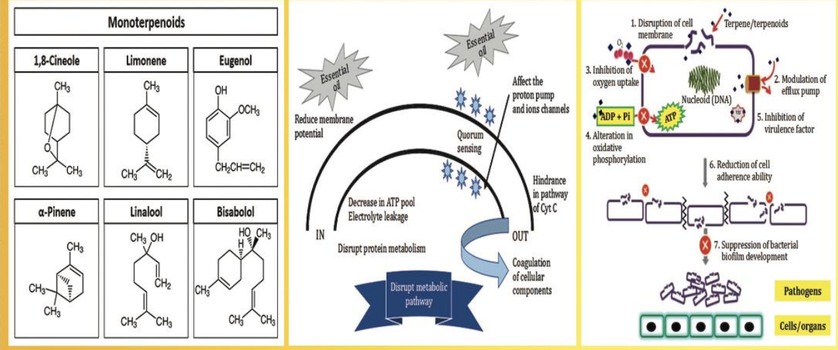
Application in Pond Water

- Mix PondGuard according to the dosage into 10 liters of water. Stir the PondGuard mixture homogenously (2 - 3 minutes).
- Apply the PondGuard mixture into culture/ treatment pond water and ensure aerators are functioning to distribute evenly.

DOSAGE AND FREQUENCY OF USE

Culture Stage		Application on Feed	Application in Pond Water
Stocking Preparation		Not applicable	Dose of 0.4 ppm applied on the 7th and 3rd day before fry stocking.
During Culture	**Normal Condition**	• Dose of 2 ml (DOC ≤ 60) and 4 ml (DOC > 60) per kg of daily feed • Apply daily at 2 highest feeding times (highest amount of feed)	• Dose of 0.4 ppm per application • Apply at least once a week
	Stress Condition *(any signs or symptoms of disease infection, environmental changes, etc)*	• Dose of 4 ml per kg of daily feed • Apply daily at 2 highest feeding times (highest amount of feed)	• Dose of 0.4 ppm per application 1 – 2 times a day • Apply for 3 – 7 consecutive days

PONDGUARD MECHANISM OF ACTIONS



PUBLICATIONS

SURAT NOMOR PENDAFTARAN OBAT IKAN
Nomor: KKP RI NO. D 16060285 - HBC

Nama Produsen Obat Ikan	: PT. CENTRAL BALI BAHARI
Alamat lengkap Produsen Obat Ikan	: Jl. Yos Sudarso No. 257, Kelurahan Garuntang, Kecamatan Bumi Waras, Kota Bandar Lampung, Provinsi Lampung
Alamat tempat Produksi obat ikan	: Jl. Yos Sudarso No. 257, Kelurahan Garuntang, Kecamatan Bumi Waras, Kota Bandar Lampung, Provinsi Lampung
Nama Produsen obat ikan diluar negeri	: -
Nama Pemberi Licensi	: -
Nama dagang/merek obat ikan	: PONDGUARD
Klasifikasi Obat Ikan	: Obat bebas
Bentuk Obat Ikan	: Cair
Jenis Sediaan Obat Ikan	: Obat Alami
Komposisi Obat Ikan	: Minyak Lavender, Minyak Eucalyptus, Minyak Pinus, Methyl Paraben, Kupri Sulfat, Emulgator (Tween 80), Brilliant Blue, Carmoisine, Air Suling
Ukuran Kemasan	: 300 ml; 500 ml;800 ml; 1 Lt; 1,2 Lt; 3 Lt; 5 Lt; 10 Lt; 20 Lt

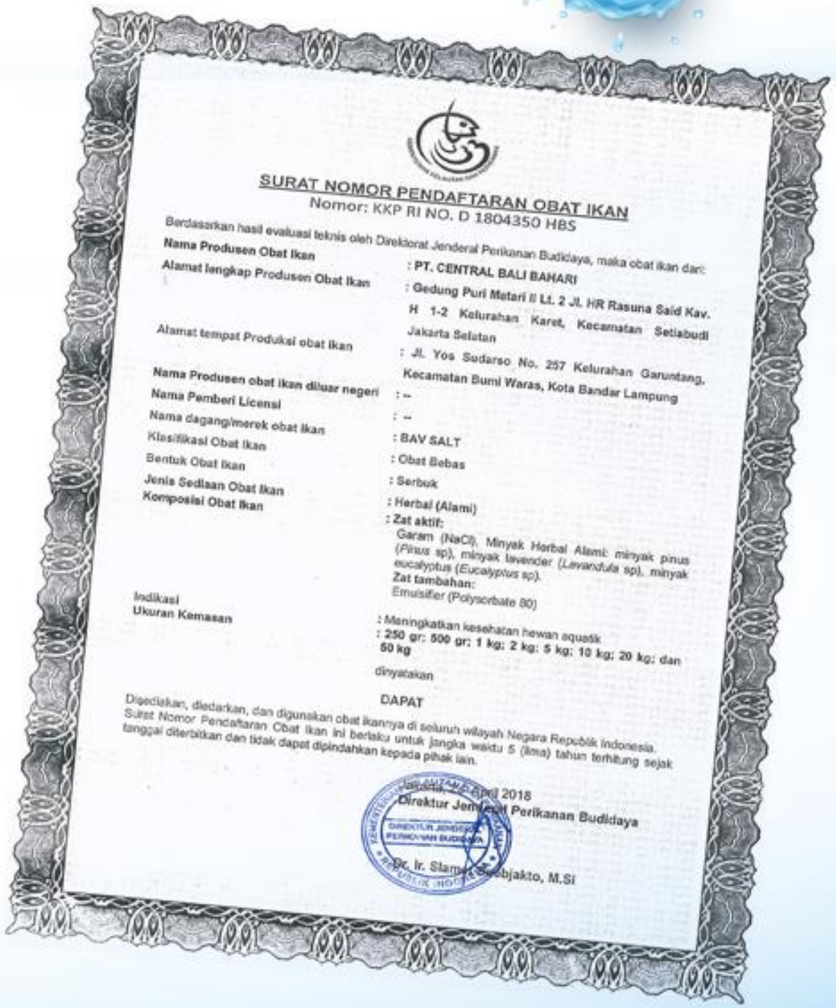
dinyatakan

DAPAT

Disediakan, diedarkan, dan digunakan obat ikannya di seluruh wilayah Negara Republik Indonesia.
Surat Nomor Pendaftaran Obat Ikan ini berlaku untuk jangka waktu 5 (lima) tahun terhitung sejak tanggal diterbitkan dan tidak dapat dipindahkan kepada pihak lain.

Jakarta, 10 Juli 2018
Direktur Jenderal Perikanan Budidaya

Dr.Ir. Slamet Soebjakto, M.Si



SURAT NOMOR PENDAFTARAN OBAT IKAN
Nomor: KKP RI NO. D 1804350 HBS

Berdasarkan hasil evaluasi teknis oleh Direktorat Jenderal Perikanan Budidaya, maka obat ikan dari:

Nama Produsen Obat Ikan	: PT. CENTRAL BALI BAHARI
Alamat lengkap Produsen Obat Ikan	: Gedung Puri Metari II Lt. 2 Jl. HR Rasuna Said Kav. H 1-2 Kelurahan Karet, Kecamatan Setiabudi Jakarta Selatan
Alamat tempat Produksi obat ikan	: Jl. Yos Sudarso No. 257 Kelurahan Garuntang, Kecamatan Bumi Waras, Kota Bandar Lampung
Nama Produsen obat ikan diluar negeri	: --
Nama Pemberi Licensi	: --
Nama dagang/merek obat ikan	: BAV SALT
Klasifikasi Obat Ikan	: Obat Bebas
Bentuk Obat Ikan	: Serbuk
Jenis Sediaan Obat Ikan	: Herbal (Alami)
Komposisi Obat Ikan	: Zat aktif: Garam (NaCl), Minyak Herbal Alami: minyak pinus (*Pinus* sp), minyak lavender (*Lavandula* sp), minyak eucalyptus (*Eucalyptus* sp). Zat tambahan: Emulsifier (Polysorbate 80)
Indikasi	: Meningkatkan kesehatan hewan aquatik
Ukuran Kemasan	: 250 gr; 500 gr; 1 kg; 2 kg; 5 kg; 10 kg; 20 kg; dan 50 kg

dinyatakan

DAPAT

Disediakan, diedarkan, dan digunakan obat ikannya di seluruh wilayah Negara Republik Indonesia.
Surat Nomor Pendaftaran Obat Ikan ini berlaku untuk jangka waktu 5 (lima) tahun terhitung sejak tanggal diterbitkan dan tidak dapat dipindahkan kepada pihak lain.

Jakarta, 17 April 2018
Direktur Jenderal Perikanan Budidaya

Dr. Ir. Slamet Soebjakto, M.Si

CONFERENCE & PUBLICATIONS

MEEGID XV
15th International Conference on Molecular Epidemiology and Evolutionary Genetics of Infectious Diseases
ONLINE
Live and On-demand
2-5 November
2021

/ MEEG 2021 Help

AMEND CONTINUE

15th International Conference on Molecular Epidemiology and Evolutionary Genetics of Infectious Disease – MEEGID XV (Online and On-Demand)

Submission ID

29

Title

Natural oil blend formulation (NOBF) protects Penaeus vannamei Boone, 1931 from white spot syndrome virus (WSSV) and enhances the productivity in the culture ponds

Abstract

White spot syndrome virus (WSSV) is lethal in penaeid shrimp. Successful efforts were made to develop a natural oil blend formulation (NOBF) with anti-WSSV properties using *Eucalyptus globulus*, *Pinus sylvestris*, and *Lavandula latifolia* in an equal proportion of water at a ratio of 1:1. A bioassay challenge trial was conducted using 1 g of 144 specific pathogen-free *Penaeus vannamei* Boone, 1931 samples in 4 aquarium replicates for each group. A NOBF dose of 0.2 ppm was applied throughout the trial period by mixing in aquarium water daily, starting seven days before challenge. The efficacy of NOBF against WSSV was measured using a modified *per os* method of challenge demonstrated in the current work. The cumulative mortality in the positive control group reached 89.6 % ten days post challenge. NOBF was also applied in six commercial shrimp ponds in a WSSV-prone area in East Java, Indonesia. Each pond was of equal size, 1000 m^2 and 1.2 m depth. The pathogenic Vibrio count of pond water was acceptable (<1000 cfu.mL^{-1}). The NOBF-applied ponds had better productivity (control 14.239 ton.ha^{-1} and NOBF ponds 15.421 ton.ha^{-1}). The trial outcomes show that NOBF is safe and user-friendly, with properties that reduce WSSV load.

/ MEEG 2021 Help

AMEND CONTINUE

15th International Conference on Molecular Epidemiology and Evolutionary Genetics of Infectious Disease – MEEGID XV (Online and On-Demand)

Submission ID

30

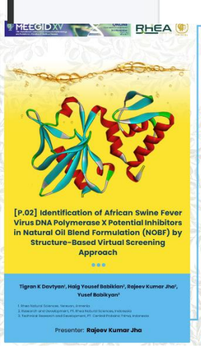
Title

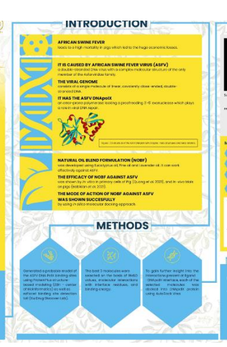
Development of essential oil blend formulation as a disinfectant against African Swine fever virus (ASFV)agent in PAM cells of Swine

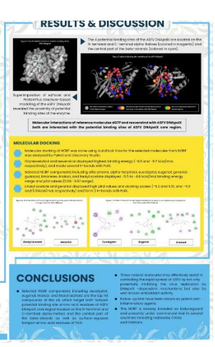
Abstract

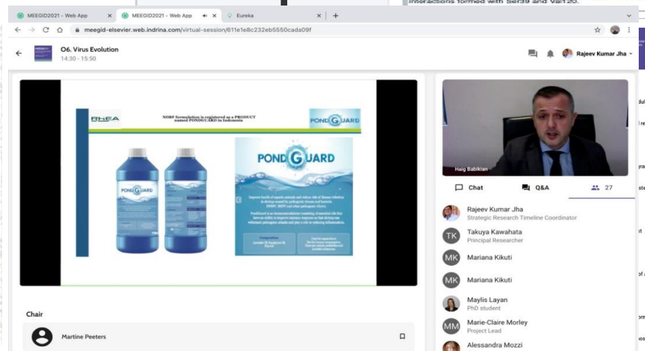
African swine fever virus has a significant impact on swine production and the economics of the swine-producing countries. The role of strict biosecurity measures becomes critical when there are no known remedies yet. Disinfection is considered a significant part of biosecurity measures and plays a vital role in reducing the risk of contaminating the environment.

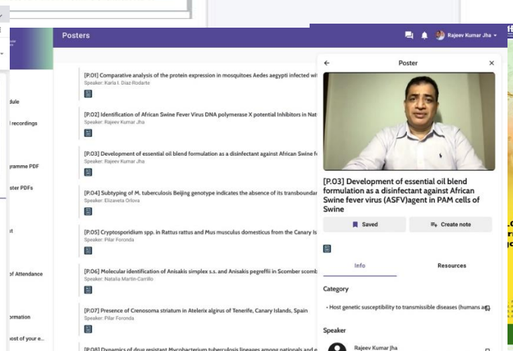
Successful efforts have been made to optimize a formulation Essential Oil Blend (EOB) product to determine its efficacy against the African swine fever virus (ASFV) in *in vitro* conditions. The Essential Oil Blend (EOB) comprises a blend of, i.e., Eucalyptus oil, Gardenia oil, and Jasmine *oil*. The *in vitro* trial results demonstrated that EOB up to dilution ten could degenerate the lethal dose log 5 of ASFV. The work was shown by observing hemadsorption (Rosetta formation) and conducting a real-time PCR test. There was no Rosetta formation up to dilution 11 of EOB. The Ct value of the EOB group at 96 hours post-infection (hpi) was the same as the initial value or lower (25) than it, whereas the Ct value of positive control increased several folds (17.84). It is a potential water supplement to work against ASFV and enhance pig immunity to fight against common pathogens.

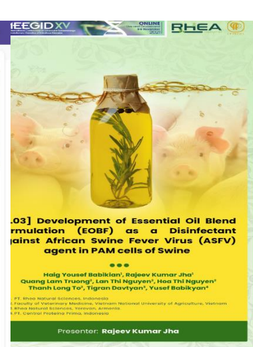


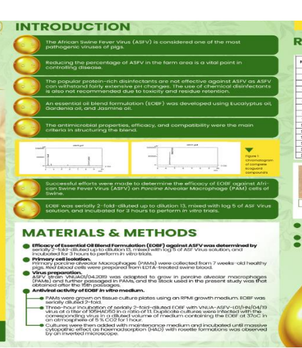


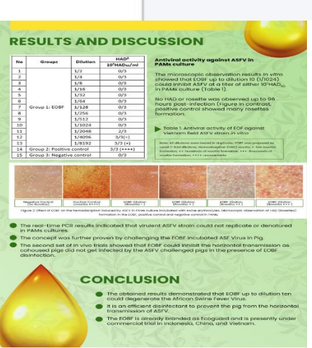












CONFERENCE & PUBLICATIONS

BIT's 5th Annual World Congress of Aquaculture and Fisheries-2016 Qingdao, China

Title: Development of Natural Herbal Oil Formulation as an Anti-White Spot Syndrome Virus Agent in *Penaeusvannamei*

Dr. Rajeev K. Jha, Benjamin Jiaravanon, Yousef H. Babikian, Haig Y. Babikian, Sarayut Srisombat, Soy D. Wisoyo, and Yuli Asih*
Head
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Indonesia

Abstract

The Natural Herbal Oil Formulation (NHOF) have been designed to work against White Spot Syndrome Virus in Shrimp. The essential oil blend from the following plants, *Lavandullatifolia, Pinussylvestrisa, Jasminum Officinale, C. Limon, Prunusavium, Viola odorata, Gardenia jasminoides, Cocosnucifera, Rosa damascene* and *Eucalyptus globulus.* The product were added in the feed, as feed additive and also applied in tank water as liquid product named as "Pondguard". A bioassay trial was conducted to determine the efficacy of developed formulation as an anti-WSSV candidate. The treatment was fed on treatment feed and "Pondguard" applied in the tank water whereas control fed on the regular feed throughout the experiment. The shrimp of both treatment and control were challenged by WSSV on day 8. Two methods of WSSV challenge was applied, *per os* challenge and immersion challenge. The cumulative mortality in positive control reached up to 100% at dpi 10 whereas mortality appeared in treatment and in negative control. The trial results show that the developed anti-WSSV formulation significant effect against WSSV in a controlled condition.

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Performance of natural oil blend formulation (NOBF) against white spot syndrome virus (WSSV) agent in *Penaeus vannamei* boone, 1931

Haig Babikian, Yusef Babikyan, Rajeev Kumar Jha, Soy Daniel Wisoyo, Yuli Asih and Sarayut Srisombat

DOI: https://doi.org/10.22271/fish.2020.v8.i6c.2389

Abstract
The white spot syndrome virus (WSSV) is lethal in penaeid shrimp. Successful efforts made to develop a natural oil blend formulation (NOBF) by blending Eucalyptus globulus, Pinus sylvestris, and Lavandula latifolia in different compositions with anti-WSSV properties. A bioassay challenge trial conducted using 1 g of specific pathogen-free Penaeus vannamei Boone, 1931 shrimp in 4 replicates of aquaria for each group. The NOBF dose of 0.4 ppm applied throughout the trial period by mixing in the aquarium water daily, starting seven days before the challenge. The efficacy of NOBF against WSSV was measured using the per os method of a challenge. The cumulative mortality in the positive control group reached 100 % after ten days of the challenge. The NOBF was applied in the commercial shrimp ponds to study its efficacy and palatability. A study in 8 ponds in a WSSV prone area in Indonesia, demonstrated no significant difference in crucial water quality parameters, especially on algae as natural food. The NOBF applied ponds had higher productivity (1.28 Kg of shrimp per m3) as compared to control (1.18 Kg of shrimp per m3). The FCR of NOBF group was lower (1.41) than control (1.53). The survival rate of the NOBF group was higher (86.96%) than control (80.36). The trial outcomes show that NOBF is safe and user-friendly, with properties to reduce pathogen load.

Keywords: White spot syndrome viral disease, natural oil, *per os* challenge, shrimp pond culture, shrimp productivity, natural food

Introduction
The white spot syndrome virus (WSSV) is the most lethal pathogen of culture shrimp worldwide [1]. It is an enveloped non-occluded DNA virus of the family Nimaviridae under the new genus Whispovirus and is also the most devastating shrimp pathogen ever isolated and studied. This virus is extremely virulent and causes up to 100 % mortality in 3–7 days in all the cultured species of penaeid shrimp [2, 3, 4].
Some successful efforts made previously using natural herbs against shrimp viruses [5, 6, 7, 8].
The plants, such as Eucalyptus globulus, Pinus sylvestris, and Lavandula latifolia are well documented for their anti-viral properties. Eucalyptus extract shows strong anti-viral and anti-bacterial properties [9, 10, 11]. Pinus species have potent anti-viral, anti-bacterial, and immune-modulating properties [12, 13]. The Lavandula have shown strong anti-viral [14] as well as immunomodulatory [15] effects.
A successful effort made to blend the oils of similar properties to fight against WSSV more vehemently. The efforts made to test the palatability and its impact on critical water quality parameters in commercial shrimp ponds.

Materials and Methods
The materials and methods divided into two sections, section 1 as laboratory level trials and section 2 as field trials.

Section 1: Laboratory trials
NOBF preparation and composition
Eucalyptus globulus, *Pinus sylvestris* and *Lavandula latifolia* oils obtained from vendors who comply with the strictest industry practices:

Journal of
Pharmacognosy & Natural Products
Research Article OMICS International

Effectiveness of Natural Herbal Oil Formulation against White Spot Syndrome Virus in *Penaeus vannamei*

Rajeev Kumar Jha*, Yousef Haig Babikian, Haig Yousef Babikian, Soy Daniel Wisoyo, Yuli Asih, Sarayut Srisombat and Benjamin Jiaravanon
PT Central Proteina Prima, Indonesia

Abstract
The Natural Herbal Oil Formulation (NHOF) have been designed to work against White Spot Syndrome Virus (WSSV) in Shrimp. The essential oil blend extracted from the following plants, *Lavandula latifolia, Pinus sylvestris, Jasminum officinale, Citrus limon, Prunus avium, Viola odorata, Gardenia jasminoides, Cocos nucifera, Rosa damascene and Eucalyptus globulus*, mixed together to develop as anti-WSSV product. The product were added in the feed, as feed additive. Another product developed which was applied in tank water as water supplement named as "Pondguard" (Reg no. KKP RI no. D.16060285-HBC). The Pondguard is composed of three essential oils i.e., *Eucalyptus globulus*, *Pinus sylvestris* and *Lavandula latifolia*. A bioassay trial was conducted to determine the efficacy of developed formulation as an anti-WSSV candidate. The experimental shrimp was fed on NHOF-mixed feed and "Pondguard" applied in the tank water whereas control shrimp were fed on the regular feed. The shrimp of both experimental and control were challenged by WSSV on 15th day of feeding. Two methods of WSSV challenge were applied, per-os challenge and immersion challenge. The cumulative mortality in positive control reached up to 100% on DPI 10 whereas no mortality appeared in the experimental group and in negative control. The trial results show that the developed natural herbal formulation has significant effect against WSSV in a controlled condition.

Introduction
White Spot Syndrome Virus is the most deadly pathogen of cultured shrimp [1,2]. The cumulative mortality in infected shrimp reaches up to 100% in 4-7 days in lab and 10-14 days in the ponds [3-6]. The intensity of infection and severity depends on the viral load. The stress factors, like, fluctuation in critical water quality and environmental parameters, like temperature, pH and Dissolved Oxygen parameters stimulates the process of infection.
Researchers and technicians have been continuously trying to control the spread of White Spot Viral Disease [7]. The limited knowledge on the mode of action and method of application of various agents restricts the success [8]. Various plants in the form of phenolic, polyphenolic, alkaloid, quinone, terpenoid, lectine, and polypeptide compounds etc. have shown anti-viral properties. Various efforts have been made to identify the anti-WSSV properties in the plants, such as, *Cynodon dactylon* [9,10], *Durio zibethinus Murr* (Durian) [11] and *Ceriops tagal* [12] and *Eucalyptus* spp. and *Pistargenium roscum* [13].
A successful effort has been made to develop a formulation by adding essential oil blend extracted from ten plants together and mixed it with the feed as feed additive. The feed was supported by a liquid formulation, named as Pondguard, containing three essential oil extract. A trial was conducted to determine the efficacy of feed with Natural Herbal Oil formulation and Pondguard against White Spot Syndrome Virus (WSSV) in *Penaeus vannamei* [14].

Materials and Methods
Bioassay lab and glass aquaria
A bioassay trial was set-up using 10 aquaria each for experimental groups as well as for control groups. The Specific Pathogen Free (SPF)-juvenile shrimp of average weight 0.25 g, 10 in number were maintained in each aquarium. The glass aquaria were cleaned, sun dried and disinfected with 70% alcohol. Each aquarium was filled with 5 L of seawater provided with required Dissolved Oxygen (DO) supply.

Water quality parameters
The seawater utilized during the experiment was gone through the process of sedimentation, filtration and disinfected with 30 ppm active chlorine and finally treated with Ultra Violet radiation (SS-175W, Matala Water Technology, Taiwan). The water quality parameters maintained during the trial were as followed, Dissolved Oxygen (DO) (>5 ppm), Temperature (27 ± 1°C), Salinity (20 ppt), pH (7.5-8.15) and alkalinity (80-120 ppm).

Experiment start
The duration of trial was of 30 days i.e., 5 days acclimatization, 14 days feeding, day 15 challenge and from day 16 onwards continues feeding and observation for 10 days. Shrimp of treatment group were fed on experimental feed whereas regular feed was fed to the control. There was no change in feed quality and the rate of feeding throughout the experiment. The liquid supplement, Pondguard was applied on daily basis in experimental tanks throughout the experiment. The shrimp were observed intensively for their behavior and feeding rate and cumulative mortality during the trial.

Shrimp food
The shrimp feed was produced in Feed Mill of PT. Central Proteina Prima, Indonesia. Treatment group of shrimp was fed on experimental

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Research

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Efficacy of Natural Herbal Formulation against Acute Hepatopancreatic Necrosis Disease (AHPND) causing *Vibrio parahaemolyticus* in *Penaeus vannamei*

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ABSTRACT

A formulation was developed using combination of blended natural essential oils as an anti-*Vibrio parahemolyticus* causing acute hepatopancreatic necrosis disease (AHPND) candidate. *Lavandula latifolia, Pinus sylvestris, Jasminum officinale, Citrus limon, Prunus avium, Viola odorata, Gardenia jasminoides, Cocos nucifera, Rosa damascene* and *Eucalyptus globulus*, mixed together to develop as anti-*V. parahemolyticus* product. The treatment group was fed on essential oil mixed feed whereas control group were fed on the regular feed throughout the experiment. The shrimp of both treatment and control were challenged by immersion method at day 8. The cumulative AHPND-gross sign appearance in positive control reached up to 95% at dpi 10 whereas no gross sign appeared in treatment and in negative control. The cumulative mortality reached up to 46.7% at dpi 10 in positive controls whereas no mortality recorded in treatment and in negative control. The *V. parahaemolyticus* isolated from the hepatopancreas of infected shrimp matched 100% with the existing AHPND strain. The trial results show that the developed natural herbal formulation has significant effect against AHPND in a controlled condition.

KEYWORDS: Acute hepatopancreatic necrosis disease (AHPND); *Vibrio parahemolyticus*; Essential oil blend; anti-AHPND feed.

ABBREVIATIONS: AHPND: Acute Hepatopancreatic Necrosis Disease; SPF: Specific Pathogen Free; DO: Dissolved Oxygen; WSSV: White Spot Syndrome Virus; IMNV: Infectious Myonecrosis Virus; IHHNV: Infectious Hypodermal and Haematopoietic Necrosis Virus; TSV: Taura Syndrome Virus; YHV: Yellow Head Virus; PCR: Polymerase Chain Reaction; BLAST: Basic Local Alignment Search Tool.

INTRODUCTION

The acute hepatopancreatic necrosis disease (AHPND) has affected shrimp farming in several countries, like, Vietnam, Malaysia, Thailand, Mexico and in Philipines.[1-4] The unique symptoms and characteristics of this disease consisting of massive sloughing of hepatopancreas epithelial cells.[5] The external symptoms in infected shrimp like, empty stomach, bluish body color and shranken hepatopancreas could be observed. The rate of mortality is significantly higher on the 1st 3 days of infection. The AHPND appear in the culture ponds from 8-45 days of stocking.

The *Vibrio parahaemolyticus* was identified as causative agent of AHPND by Tran et al.[2] It carries a plasmid (pAP1) of approximately 69 kbp. This plasmid contains 2 genes which

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Research Article

Study on the Efficacy of Pondguard in Improving Clinical Performance of White Leg Shrimp (*Penaeus Vannamei*) in an AHPND Bacterial Challenge Model

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Abstract
A bioassay trial was conducted to determine the efficacy of developed product, Pondguard as an anti-Acute Hepatopancreatic Necrosis Disease (AHPND) candidate. The Pondguard (Registration no. D 16060285-HBC) is consisting of natural oils, like, lavender oil, Eucalyptus oil and Pine oil. It maintains the immunity level of shrimp, which helps to protect shrimp from infectious diseases. Two doses of Pondguard i.e. 40 ppm and 80 ppm were selected for the trial. The treatment groups tanks were applied Pondguard whereas no application in control tanks throughout the experiment. The shrimp of both treatment and control were challenged by immersion method. The cumulative mortality reached up to 56.7% in positive control whereas 23.3 % in 80 ppm pondguard group and 13.3% in 40 ppm pondguard group at dpi 8 whereas no mortality recorded in negative control. The Relative Percent Survival of 80 ppm group was 64.7% and of 40 ppm group was 76.5%. The trial results show that the developed Pondguard has significant effect against AHPND-Vibrio *parahaemolyticus* in a controlled condition.

Keywords: AHPND; *Vibrio parahemolyticus*; Essential Oil Blend; Pondguard

Introduction
The Acute Hepatopancreatic Necrosis Disease (AHPND) or Early Mortality Syndrome (EMS) have been reported in several shrimp producing countries, like, Vietnam, Malaysia, Thailand, Mexico and in Philipines [1-5]. There is significant impact on the world shrimp production [1,6], were successfully able to identify and isolate the causative agent *Vibrio parahaemolyticus* of AHPND. The unique symptoms and characteristics of this disease include severe atrophy of the shrimp hepatopancreas (HP) consisting of massive sloughing of HP epithelial cells [1]. The external symptoms in infected shrimp like, empty stomach, bluish body color and shrunken hepatopancreas, could be observed in the outbreak ponds. AHPND could transmit experimentally by horizontal transmission, co-habitation, immersion and by reverse gavage (Personal observation).
The AHPND appear in the culture ponds from 8-45 days of stocking. The shrimp cultured in earthen bottom ponds were reported more susceptible to AHPND as compared to the HDPE-lined ponds. The proposed trial was designed with the objective to conduct a laboratory scale trial by applying the developed anti-AHPND product i.e. Pondguard to determine its efficacy against the AHPND causative agent. The pre-determined doses, 40 ppm and 80 ppm were used to conduct the trial. The bioassay trial was conducted by the researchers of Department of Aquaculture and Fisheries, Cantho University, Cantho, Vietnam.

Materials and Methods
Experimental shrimp
White leg shrimp larvae (PL10) were spawned and nursed to 0.5 to 1g/individual (size most affected by AHPND) in recirculation system at shrimp hatchery and nursery of College of Aquaculture and Fisheries, Cantho University, Vietnam. Prior to being distributed to experimental aquarium, three shrimp samples were screened by PCR for Infectious Hematopoetic and Hypodermal Necrosis Virus, White Spot Syndrome Virus, Monodon Baculorvirus. Taura syndrome Virus. *Vibrio parahaemolyticus* causing AHPND and *Enterocytozoon hepatopenaei* to ensure shrimp were free from those specific pathogens. Experimental shrimp were in good health prior to being distributed to experimental aquaria. Moulting shrimp were removed prior to start of feeding and prior to challenge. Prior to start of Pondguard application and prior to challenge, weight and length of 30 shrimp were measured. Prior to start of trial, the

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Efficacy of Anti-AHPND formulated feed in vannamei shrimp in Vietnam

Benjamin Jiaravanon, Yousef Haig Babikian, Haig YousefBabikian, Le Van Khoa, Iswadi, Rajeev Kumar Jha*
Research Division at Central Proteina Prima, Indonesia

A bioassay trial was conducted to determine the efficacy of developed feed as an anti-AHPND candidate. The treatment was fed on anti-AHPND feed whereas control fed on the regular feed throughout the experiment. The shrimp of both treatment and control were challenged by per os method on day 8. The cumulative AHPND-gross sign appearance in positive control reached up to 95% at dpi 8 whereas no gross sign appeared in treatment and in negative control. The cumulative mortality reached up to 90% at dpi 8 in positive control whereas no mortality recorded in treatment and negative control. The Vibrio parahaemolyticus isolated from the hepatopancreas of infected shrimp were matched 100% with the existing AHPND strain. The trial results show that the developed anti-AHPND feed has significant effect against AHPND pathogen in a controlled condition.

Biography
Rajeev Kumar Jha is working inTechnology and Research Division at Central ProteinaPrima, taking care of shrimp and fish Health research and monitoring.He is in-charge of shrimp and Fish Health and Disease Bioassay and Diseasediagnostics laboratories, which is well facilitated both with advanced molecular diagnostic tools and conventional Histopathology and rapid histology and Microbiology tools and techniques. He is conducting various Researches on the characteristics and behavior of various shrimp and fish pathogen and there remedial measures. Hewas awarded Chinese Government Full Scholarship during his Doctor and awarded Merit Scholarship by Govt of India during Masters. Rajeev has published more than 22 research articles in peer-reviewed journals and 15 populararticles in well-rated journals. He was awarded by ICAR for discovering 25 Indigenous Techniques on various Aquatic health and disease related aspects, which was transferred and patented by Indigenous Technology Knowledge (ITK), ICAR, Govt. of India.

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Notes:

CHAPTER - 14

Farming System Adaptation and Natural Herbal Oil Formulations against Various Emerging Diseases of Shrimp

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Regards,
Organizing Secretary, ClimFishcon 2020

Our book titled "Impact of Climate Change on Hydrological Cycle, Ecosystem, Fisheries and Food Security" has been published.
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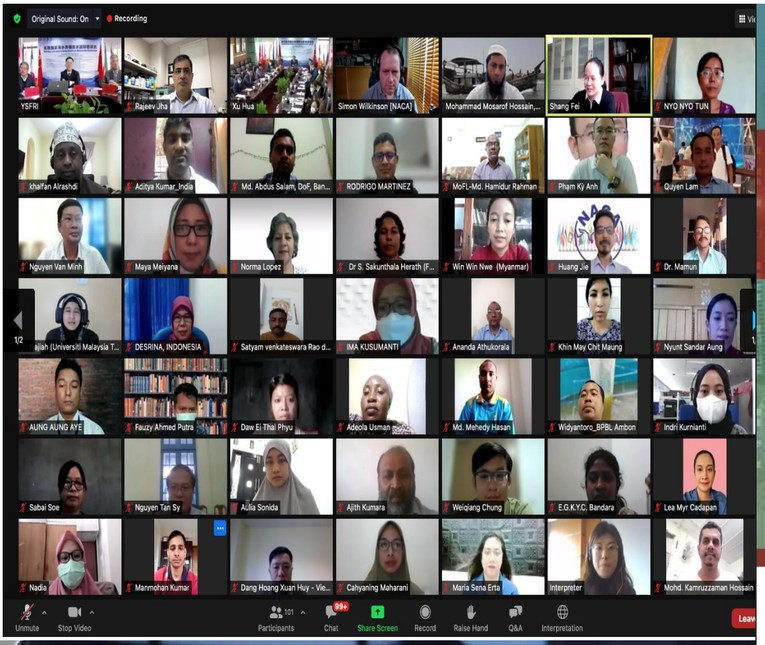

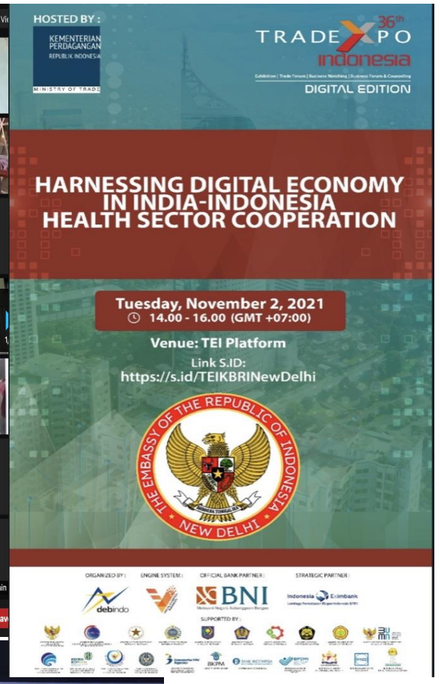

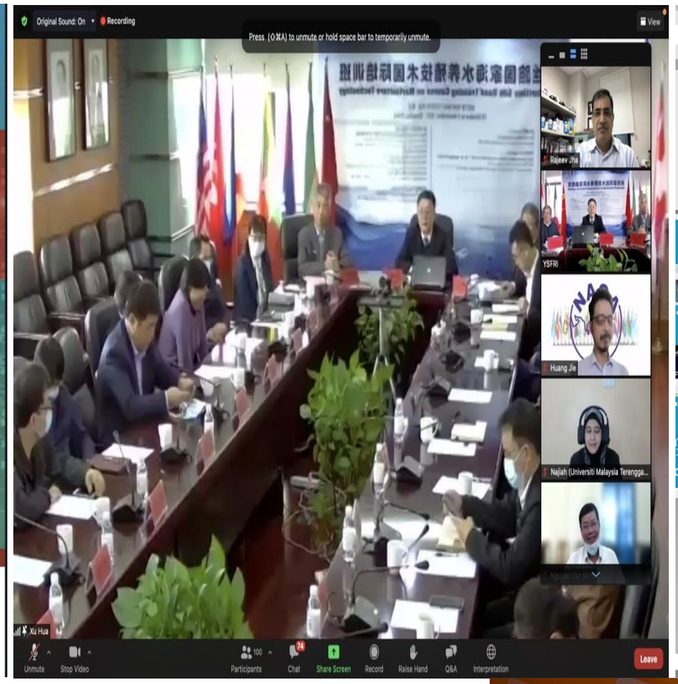

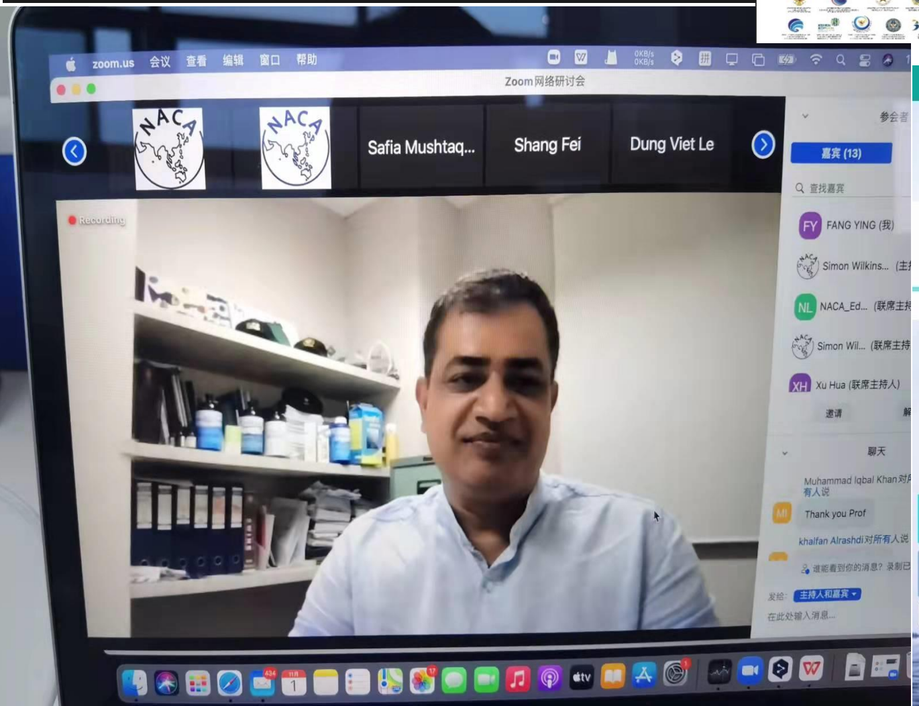

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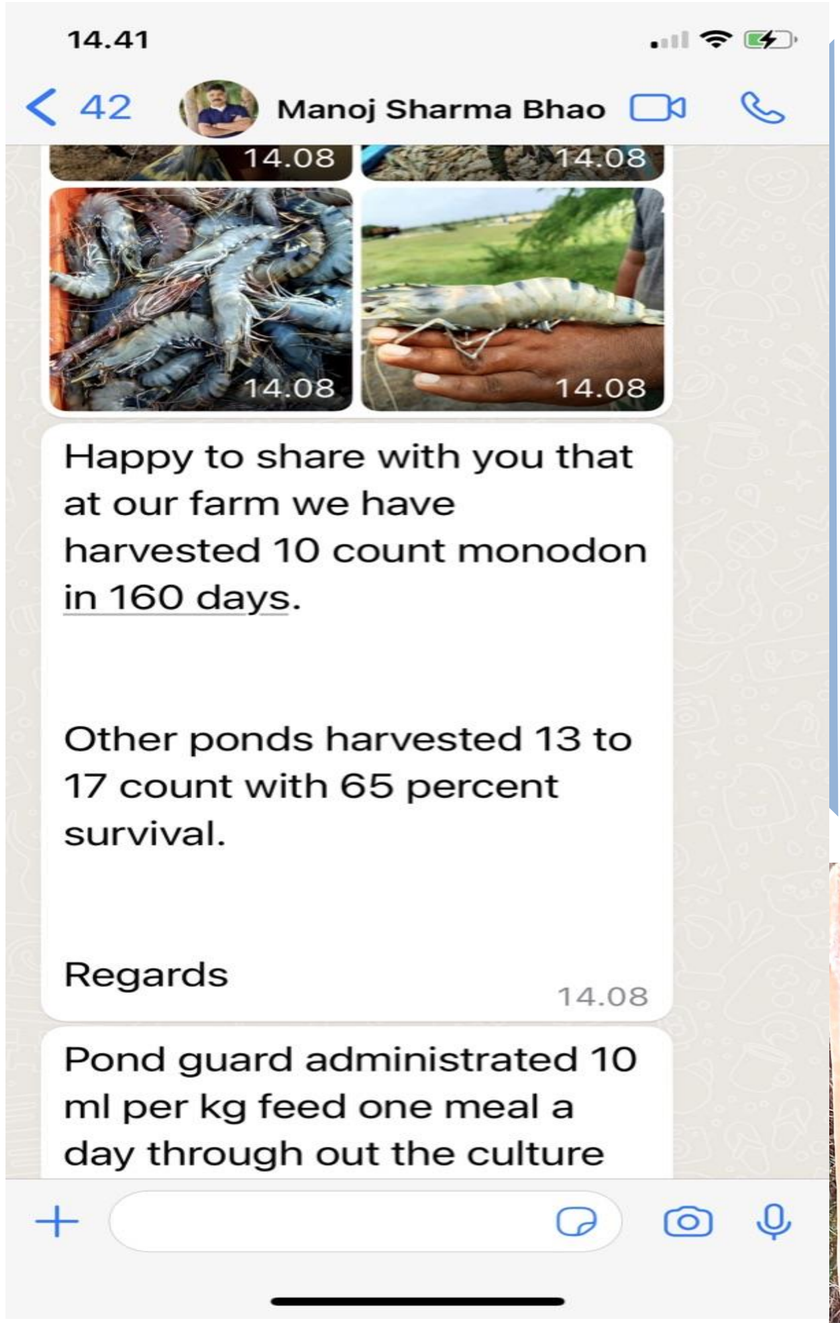

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THANK YOU

In association with RHEA natural

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