Impact of Effective Microorganisms in Shrimp Culture Using Different Concentrations of Brackish Water

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Abstract
The cultivation of black tiger shrimps in Thailand is a popular enterprise due to its export potential. Effective Microorganisms (EM) has been used in this system for the production of shrimp under organic conditions. The use of different concentrations of brackish water had no impact on growth due to the use of EM. The water quality was maintained, and yields of shrimps were high. The potential of this technology for shrimp culture is presented.

Keywords: brackish water, water quality, yield

Introduction
Shrimp farming in Thailand has become a multi-billion dollar industry and a major export enterprise. Today, Thailand is the world's leading exporter and the largest producer of black tiger prawn (Direk et al., 1998). Studying the impact of EM technology for shrimp farming in water with different levels of salinity is a new aspect in organic shrimp production, as it is safe for both producers and consumers. Therefore, a project was initiated to ascertain the impact of EM in producing organic shrimps with EM Technology.

Materials and methods
The study was conducted on two farms. The first was the Chaiyapruek Shrimp Farm located in Chachoengsao Province, where the salinity of water ranges between 0 – 2 ppt. The second was the Laemsing Shrimp Farm located in Chantaburi Province, whose water salinity was 20 - 22 ppt.

Extended EM, Bokashi and EM5 were applied to the ponds during preparation and also during culturing until harvest. Garlic extract with EM5 was mixed with feed before feeding once a day. Banana extract with extended EM was mixed with feed before feeding the other meals (2 – 4 times) each day.
Water of the two ponds was tested for BOD, COD, NH_3, P, coliform, pH, and salinity in either ponds were done according to the following schedule: one day prior to releasing shrimps into the ponds (seeding), 60 days and 90 days after seeding respectively. The fresh weight of shrimps was also measured after harvest. Feed amount and EM consumption were calculated together with the whole costs, yields, income and profit.

Results and discussion
The principal water quality parameters for shrimp farms are dissolved oxygen, pH

and the concentration of ammonia (Direk, 1998 mentioned to Funge-Smith and Briggs, 1995). Quality of water of the two farms was not significantly different before and after seeding. The levels of ammonia, BOD, COD and phosphorus were low and the pH and coliform counts were at acceptable ranges (Table 1 and Table 2). These results suggest that EM can control the quality of water at various levels of water salinity. The shrimps were very healthy, had fewer odours and free from diseases.
The cost of production was low as EM is cheap (Table 3 and Table 4) and the use of EM produced lower Feed Conversion Ratios (Table 5). Farmers were also able to save costs expended for chemicals, which were approximately 90,000 baht per 5 rai pond or 0.8 ha pond. (Suwat, 1997). The use of EM made it possible to harvest three crops of shrimps per year without changing the water .In contrast, general conventional shrimp farmers could harvest shrimps only once or two times per year, with necessary changes in water (Direk et al., 1998). Therefore, farmers who apply EM in shrimp culture could derive profits from every crop from both fresh water and saltwater (Table 4). Analyses of shrimps for antibiotic residues illustrated the absence of any residues (Table 6). This indicated the organic nature of shrimps produced with EM. The potential of producing organic shrimps with EM was clearly evident from this study.

Table 1. The comparison of BOD, COD, NH_3, P, Coliform, pH and Salinity of EM pond at the Chaiyapruek shrimp farm: prior to shrimp launching, Day 60, and Day 90 after launching of shrimps.

Parameter	Pre-launching		D60		D90	Units
BOD	13.33	18.00		23.00	mg/L	
COD	164.33	224.66	178.00		mg/L	
NH_3	Not detected		Not detected		Not detected	
P	2.06	4.23	2.90		mg/L	
Coliform	833.33	346.66	433.33	MNP/100L		
pH(1100 – 1200 hrs)	8.16	8.13		7.82		
Salinity	2.00		1.30		1.00	ppt

Table 2 The comparison of BOD, COD, NH_3, P, coliform, pH and salinity of EM pond at the Laemsing Shrimp Farm : prior to shrimp launching, Day 60, and Day 90 after launching of shrimps.

Parameter	Pre-launching	D60	D90	Unit
BOD	9.30	12.00	-	mg/L
COD	48.66	64.33	-	mg/L
NH_3	Not detected	Not detected	-	
P	0.20	0.53	-	mg/L
Coliform	966.66	500.00	-	MNP/100L
pH	7.83	8.10	-	

Salinity	21.00	22.00	-	ppt

Table 3 The comparison of cost between the Chaiyapruek and Laemsing Shrimp Farms.

Parameter	Cost/Baht (USD)			
	Chaiyauek (300,000 seeds)		Laemprsing (200,000 seeds)	
Seed prawns	45,000	(1,046.51)	30,000	(697.67)
Bokashi	14,500	(337.21)	8,500	(197.67)
EM	6,800	(158.14)	4,896	(113.80)
EM5	16,250	(377.91)	9,000	(209.30)
Banana	2,500	(58.14)	2,000	(46.51)
Garlic	1,000	(23.26)	800	(18.60)
Feed	65,280	(1,518.14)	59,400	(1,381.40)
Workers	9,000	(209.30)	6,000	(139.53)
Petrol	25,000	(581.40)	10,000	(232.56)
Electricity	1,500	(34.88)	1,000	(23.26)
Total	186,830	(4,344.88)	131,596	(3,060.37)

Table 4 The comparison of cost, yield, income and profit between Chaiyapruek and Laemsing Farms

Parameter	Chaiyapruek farm	Laemsing farm
Cost (baht)	186,830 (4,344.88USD)	131,596 (3,060.37USD)
Yield (kg)	1,700	1,500
Income (baht)	595,000 (13,837.21USD)	225,000 (5,232.56USD)
Profit (baht)	408,170 (9,492.33USD)	93,404 (2,1725.19USD)

Table 5 The comparison of FCR (Feed Conversion Ratio) between Chaiyapruek and Laemsing Shrimp Farms.

Parameter	Chaiyapruek	Laemsing
No.of shrimp seed/m²	37.5	41.8
Total feed/crop (kg)	2,176	1,980
Total yield (kg)	1,700	1,500
No. of prawn /kg	40	70
FCR	1.28	1.32

Table 6 Results of anti- biotic accumulation analyses

Type of aquatic animal	Method of analysis		Result
	Microbiological Assay	HPLC Oxolinic acid (ppm)	
Black Tiger prawn	Not detected	Not detected	Passed

Basis of judging:
"Passed" means there is no anti-biotic accumulation by microbiological assay and > 0.05 ppm of oxolinic acid by HPLC method.

Conclusion

Shrimp farming with EM application in different levels and kinds of water salinity could control the quality of water such as pH, ammonia and phosphate etc. even though the water is not exchanged throughout the crop. This result suggests that it has a positive impact on the environment. The input cost is lower, so farmers can get more profit. The production of shrimp farming with EM is organic shrimp.

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results could guide others who would like to produce organic shrimp.

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