Characterization of Nutrients Hydrolysis from Shrimp Pond Sediment

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(1) Rational and objective of work

The majority of pollutants in shrimp pond are nutrients such as nitrogen and phosphorus from of fertilizer and feed (1, 2, 3) that become to sediment. And cause the nutrients releasing to accumulate in the shrimp pond water (4). In-situ treatment after cultivation is the interesting way due to it does not need extended spaces and facilities. The rate of nutrients hydrolysis from sediment should be considered for pond managing. Burford and Lorenzen (5) founded that intensive cultivation with 20% of sediment removal per day can decrease ammonia from 10 mg/l to 2 mg/l without other treatment. Our study investigated shrimp pond sediment hydrolysis process in several sediment ages and conditions. The fate of nutrients was observed in both well mixed and difference height hydrolysis experiment to determine the true rate of hydrolysis and diffusion of nutrients.

(2) Approach and methodology

Chemical Characterization The sediment was sampled from shrimp farms in Thung Kru district, Bangkok during Jan-Feb 2006. It was determined for water content, total Kjeldalh nitrogen, ammonia nitrogen, nitrate nitrogen, total phosphorus and phosphate

Well-mixed hydrolysis experiment Mixed sediment with distilled water at ratio of 1/10 in 500 ml Erlenmeyer flask in difference initial conditions (pH at 6, 7, 8 and 9, Salinity at 10, 20 and 30 ppt). Aerated and periodically sampling for 24 hours.

Hydrolysis at difference height experiment Filled the sediment in the cylindrical glass container at 5 cm height) and added the shrimp pond water approx. 25 cm. above sediment surface. Surface aeration and sampling at 5, 15 and 25 cm. above sediment surface everyday for 2 weeks.

Both experiments were analyzed for ammonia, nitrite, nitrate nitrogen and phosphate and determined the relation of nutrients concentration with time.

(3) Results and discussion

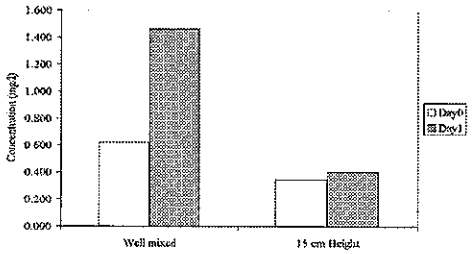
Characteristics of shrimp pond sediment from Thung Kru area

Parameter	5th Jan	21st Jan	9th Feb	24th Feb	Avg.
TKN (mg/kg dry weight)	129.5	172.3	241.0	195.9	184.68
TP(mg/kg dry weight)	68.13	27.88	49.61	44.12	47.44
Ammonia nitrogen (mg/l)	6.51	8.65	19.54	11.60	11.58
Nitrite nitrogen (mg/l)	0.16	0.07	0.01	0.04	0.07
Nitrate nitrogen (mg/l)	1.93	1.22	0.34	0.86	1.09
Phosphate (mg/l)	14.72	3.90	6.13	7.45	8.05

The nutrients concentration in sediment had higher concentration when compare with shrimp pond water except for nitrite (0.42 mgNH_4/l, 0.11 mgNO_2/l, 1.59 mgNO_3/l and 0.27mgPO_4/l). TKN and ammonium nitrogen concentration tended to increase over cultivation due to the higher feeding rate (Table 1). While inorganic forms of nitrogen, both nitrite and nitrate, do not accumulate in the sediment.

Well-mixed hydrolysis experiment The nutrients concentrations were increased with incubation time. Samples with pH 7 and salinity 10 ppt. had higher hydrolysis rate. Sediment was taken from low salinity pond (less than 5 ppt) so the microbe in sediment had higher activity in condition which close to natural pond. pH of pond water was adjusted to near neutral during cultivation so the salinity of water, which varies in each season, should be considered as the critical factor for sediment hydrolysis.

Hydrolysis at difference height experiment The nutrients concentrations were accumulated with time but the releasing rates were almost the same. 25 cm height level did not affect the nutrients concentration. It might due to the dissolved oxygen in each height level were not much different which affect the microbial activities. When compare with well-mixed experiment at 24 hr. It was found that well mixed sample had much higher hydrolysis rate.



Ammonium concentration in difference height hydrolysis experiment

(4) Conclusion

In-situ treatment using sediment hydrolysis is one of the interested methods for shrimp pond management. This method does not consume the extended land space and facilities and could be done after cultivation. Both hydrolysis conditions, well-mixed hydrolysis and hydrolysis at difference height have their own behavior since the water movement is one of the major influent. Understanding of hydrolysis rate could also help the farmers to guide their pond management such as water exchange rate and sediment removal. It could be solved both environmental problems and meet the economy issue.

References

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