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### RESEARCH ARTICLE

#### TRIAL OF AQUA SAFE BIOSORBENT AS AMMONIA CONTROLLER AND PRODUCTIVITY ENHANCER FOR SAFE AQUACULTURE

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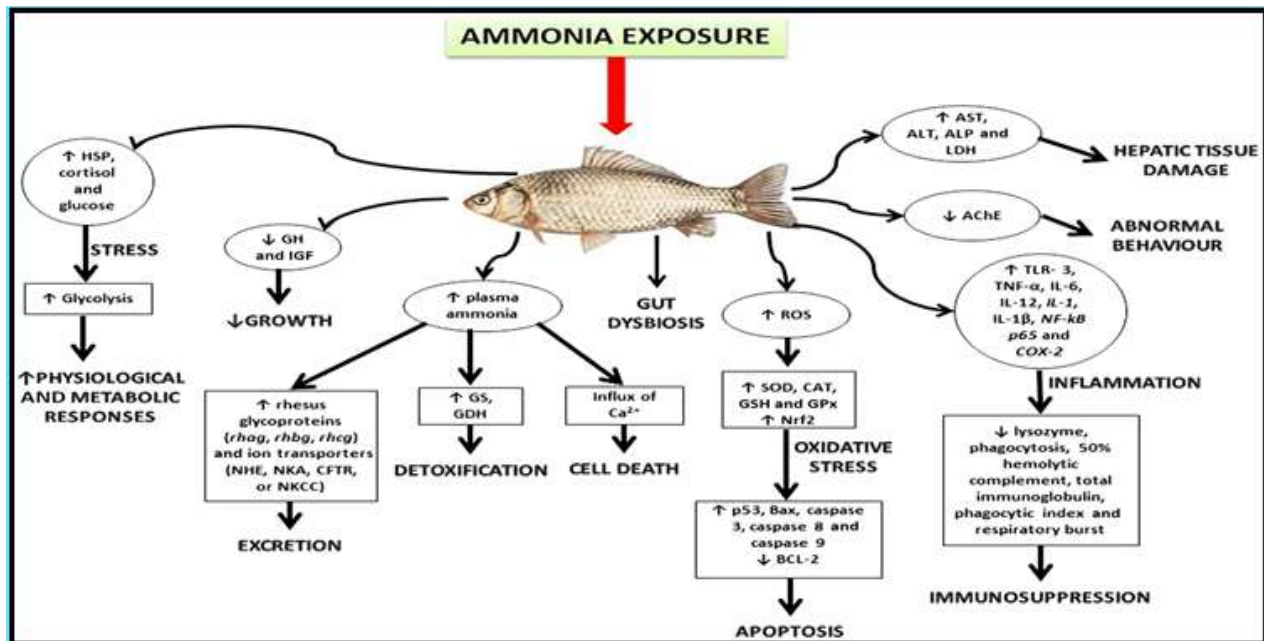
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#### Abstract

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#### Introduction:-

Ammonia and other obnoxious gases in Aquaculture ponds are a result of the normal metabolic processes of the animal and all those inputs containing proteins, in either case ammonia is the by product that is excreted through the gills. They are also a result of the breakdown and decomposition of the waste accumulation on the pond bottom – the sludge, uneaten feed, fecal matter, dead algae that release ammonia mainly.



This ammonia problem greatly affects the growth, health and productivity of the culture systems, sustaining to great economic losses too. Hence an effort to develop a potent, efficient biosorbent that could effectively control these has been taken up.

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Ammonia loss or transformation in the water system is via two main processes, the most important being the uptake of ammonia by the plants and algae mainly. Plants use the nitrogen as a nutrient for growth, in its organic form. This plant and algal photosynthesis acts like a sponge absorbing ammonia. The other process of transformation of ammonia in a water body is by the nitrification. This ammonia is oxidized first to nitrite ( $\text{NO}_2^-$ ) and then to nitrate ( $\text{NO}_3^-$ ) by bacterial action majorly.

For this efficacy study commercially important group of fish (*L. rohita*) and shrimp (*P. vannamei*) were selected. A potent Biosorbent AQUA SAFE obtained from M/S ADVANCE AQUA BIOTECHNOLOGIES INDIA PRIVATE LIMITED, VIJAYAWADA, ANDHRA PRADESH, INDIA was selected, now named BIOSORBENT – AS\* was used for the efficacy study.

#### **Main Components Of Biosorbent-AS\***

*Yucca schidigera*, *Nitrobacter*, *Nitrosomonas*, *Rhodobacter*, *Azadirachtaindica*, *Allium sativum*, *Zingiber officinale*, *Terminalia arjuna*, Aluminium Hydroxide, Calcium peroxide,  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{K}_2\text{O}$ ,  $\text{Na}_2\text{O}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{CaO}$ , Trace Elements.

#### **Physico chemical index – as Granules.**

This study was conducted to understand the efficacy of BIOSORBENT-AS as necessitated and claimed for absorption of ammonia and other toxic gases of the pond, conversion of nitrites and nitrates to non-toxic forms. Removing ammonia reducing water toxicity by the physical binding of its saponins to ammonia. Maintaining and balancing the pond pH. Improving and maintaining stable phyto and zoo plankton growth, for soil conditioning (Loose soil, Black soil). Decomposition of dead plankton, waste feed & optimized DO levels in pond.

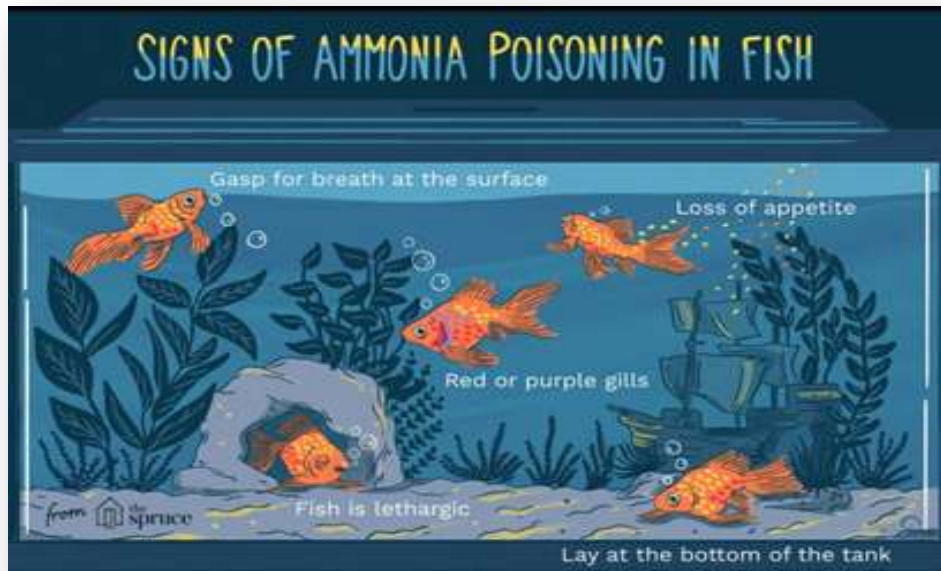
This study mainly aimed at evaluating the efficacy of BIOSORBENT-AS in handling the ammonia problem and related issues of the pond, while embarking upon the fact that it is a good mineral supplement indirectly influencing the growth and wellbeing of the animal.

There is extreme production loss due to diseases and poor water quality management. Of these the first place goes to DO problem wherein a low level leads to untold stress and mortality. The turbidity management takes an important position, pH is also very crucial, managing these is the primary task.

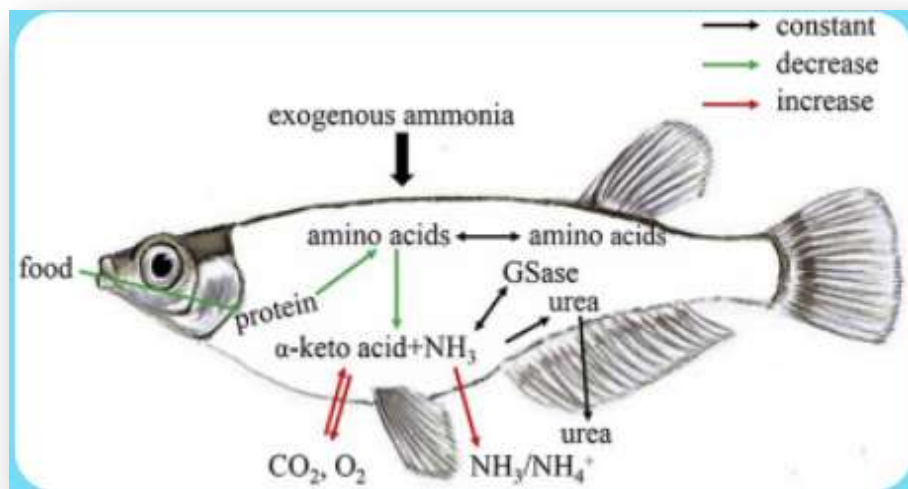
#### **BIOSORBENT-AS in ammonia control and enhancement of primary production in fish culture (*L. rohita*)**

Primary data collected from small and marginal farmers, literature review also done for secondary information, scientific intervention the need that is felt to enhance knowledge on health management and overall aquaculture practices to formulate effective management strategies. The issues to be addressed were pH, turbidity, obnoxious gas formation and productivity.

Healthy active disease free fingerlings 2000 nos. weighing an average of 200 g were selected and stocked in the holding tanks. 2 different aquaculture holding tanks 4.5 m x 4.5 m x 1 m (20 m<sup>2</sup> x 1 m) volume capacity were taken. Tank –C used as control without application of Biosorbent AS. The other Tank - T, is the test tank where in Biosorbent AS was applied @ 2 kg in the interval of 7 days for a testing time of 25 days (application 1st day, 14th day and 21st day). Testing water collected with 50 ml plastic bottle in the afternoon of the testing days. Ammonia measured using Nessler's Method. The amount of toxic unionized ammonia in the pond was measured with test kit. This fraction was multiplied by the TAN value to find the concentration (mg/l or ppm) of toxic unionized ammonia present in the water.



**FISH THAT DIED DUE TO AMMONIA EFFECT**



### EFFECT OF pH AND TEMPERATURE/UNIONISED AMMONIA IN PPM

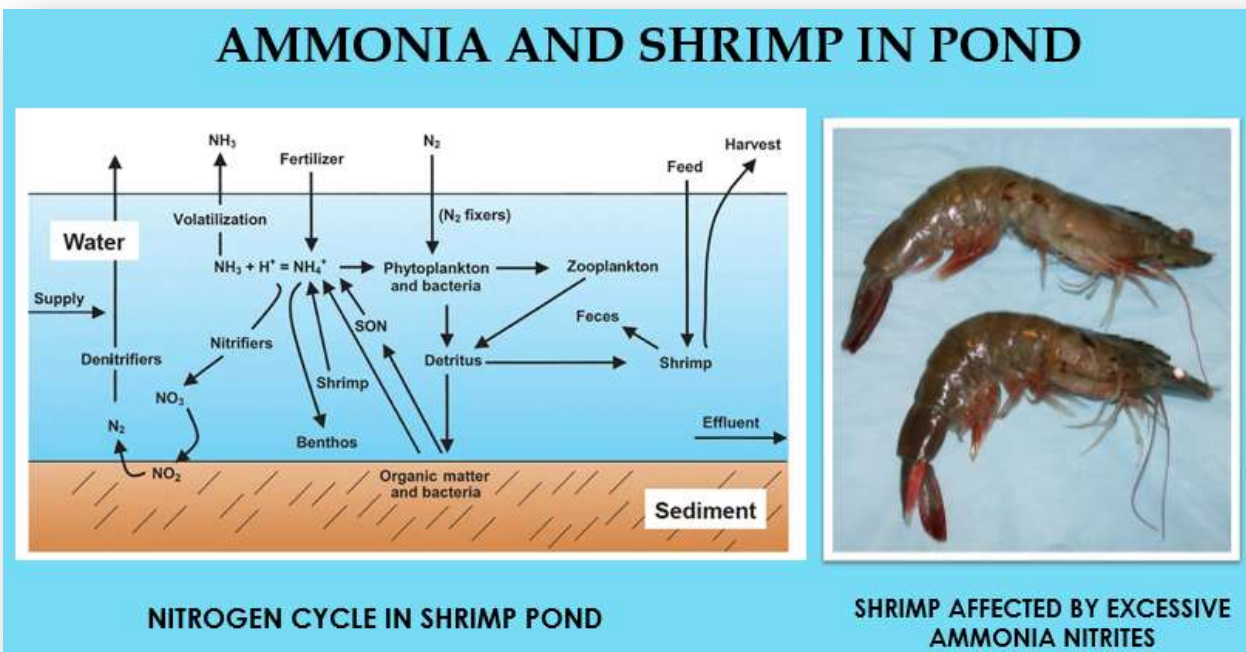
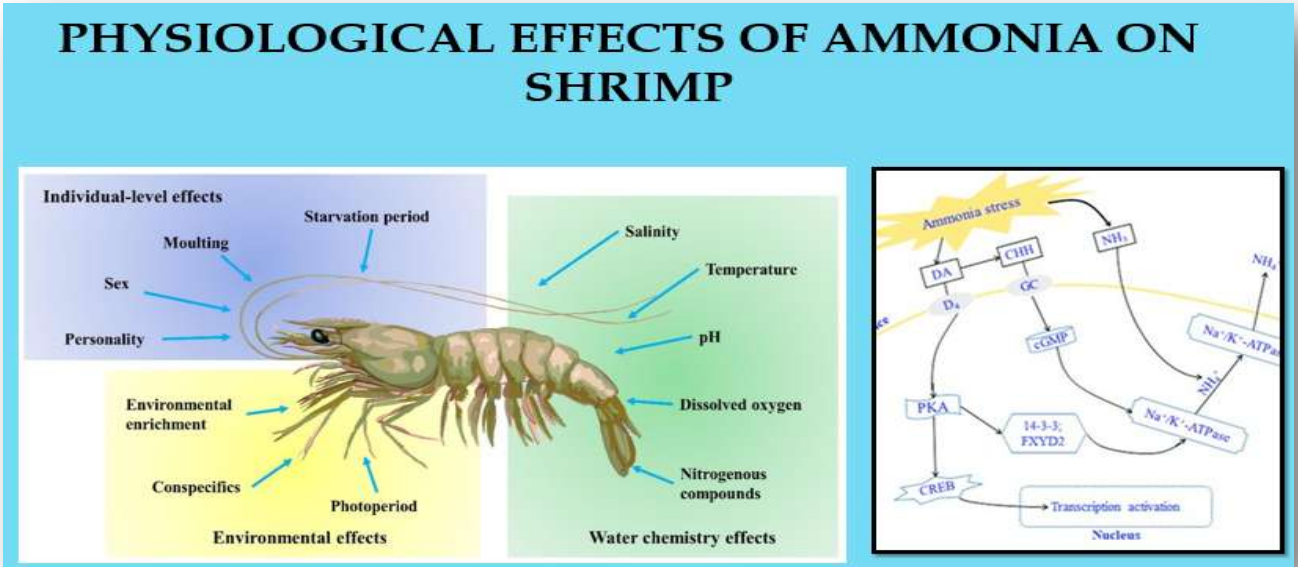
Temp pH	25 c	26 c	27 c	28 c	29 c	30 c
7.5	0.0040	0.0048	0.0057	0.0065	0.0074	0.0082
8.0	0.0384	0.0440	0.507	0.0579	0.0659	0.0748
8.5	0.0910	0.1048	0.1750	0.1968	0.2175	0.02402
9.0	0.2850	0.3120	0.3471	0.3800	0.4172	0.4543.
9.5	0.6120	0.6556	0.6881	0.7081	0.7381	0.7679
10.0	0.7989	0.8310	0.8421	0.8590	0.8762	0.8845

#### Observations:-

- ✓ The unionized ammonia followed the same pattern with concentrations ranging from 0.002 to 1.1 mg/l.
- ✓ Ammonia level was found to be highest in the first week and low in the last week.
- ✓ A level of 0.6 mg/L considered lethal came down 0.06 ppm within 48 hours of application, at this level gill damage can occur, this came down to 0.03mg/L in the course of the trial and the fish and gills became normal.
- ✓ Proactively managed the overall ammonia level in the pond. Also enhanced the DO level, pH maintained. A desirable level of primary productivity was observed.
- ✓ The ratio of NH<sub>3</sub> to NH<sub>4</sub> increased 10 folds for each unit rise in pH alone. As the temperature increased NH<sub>3</sub> to NH<sub>4</sub> ratio increased twice as much.

#### **BIOSORBENT – AS in ammonia control, enhancement of primary production & reduction in bottom sludge in prawn culture (P. vannemi)**

Healthy, disease free, active seed weighing an average of 1.2 g, were randomly divided in duplicates into 2 groups. The first group – GC not treated with Biosorbent AS and the second group – GT was treated with Biosorbent AS @ 1 KG/TANK for a trial period of 25 days with application of Biosorbent AS every week 7th, 14th 21st day for a trial period of 25 days, in an indoor recirculatory aquarium set up, with all other quality parameters maintained constant without external interference. Both the groups were fed with protein rich diet @ 10% body weight with sampling every 7 days.



**Observations:-**

- ✓ After the trial the unionized ammonia level of 0.05 mg/l also could be harmful and the use of Biosorbent AS brought it down to 0.03 mg/l on the very day of application
- ✓ In lower temperatures the management of Ammonia is more difficult, this seemed to be self-managed in Group GT since the primary producers were maintained.
- ✓ The manual raking to remove Humus gas replaced by the application of Biosorbent AS, that adsorbed the gaseous release.
- ✓ The Final weight gain was more in Group – GT (Avg. 17/GC Avg. 20/GT)
- ✓ The average weight gain was more in GT upto 31 g and in GC upto 15.8 g
- ✓ The specific growth rate was 5.86 and 4.73 as seen in GT & GC respectively.

✓ The FCR was 1.25 in GT and 2 in GC.

**Trial Study Analysis**

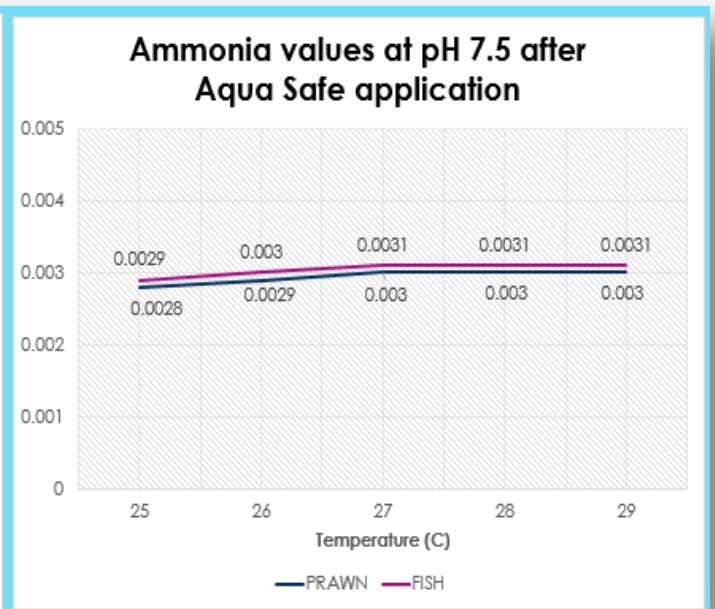
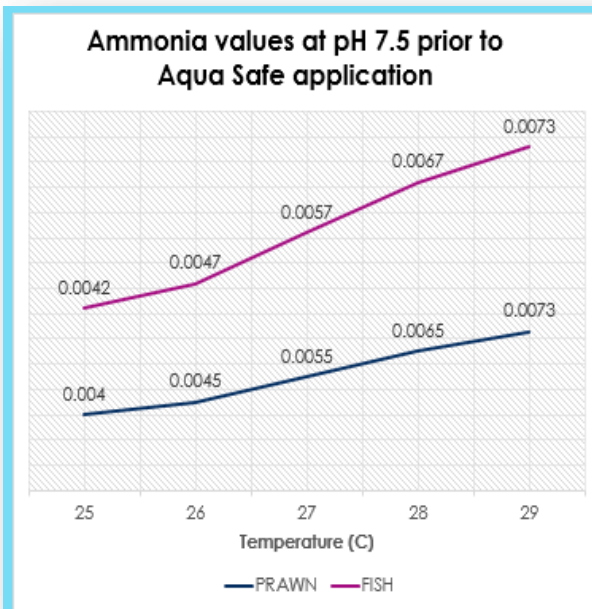
TAN (both Ionized Ammonia NH<sub>4</sub><sup>+</sup> and Unionized Ammonia NH<sub>3</sub> exist simultaneously) Total Ammonia Nitrogen. NH<sub>3</sub> is what we typically know as Ammonia, when this dissolves in water it forms ammonium ions also known as NH<sub>4</sub><sup>+</sup>. This unionized form is less able to pass through the gill membranes than the Ionized form (NH<sub>4</sub><sup>+</sup>) making it less harmful. BIOSORBENT AS helps in nitrifying converting the NH<sub>4</sub><sup>+</sup> to NH<sub>3</sub> this is absorbed by the phytoplankton available as a nutrient there by primary productivity maintained.

As unionized ammonia does not thrive at lower pH, BIOSORBENT AS acts as a limiting agent to correct and balance the pH values. As the proportion of TAN in the toxic form increased with increase in temperature and pH. H<sup>+</sup> + NH<sub>3</sub> = NH<sub>4</sub><sup>+</sup> (and vice versa).



**Biosorbent-**

AS acts as a limiting agent in the correction of pH values and also practically manages the ammonia level. The Nitrifying bacteria of the product use the inorganic minerals for their energy and efficiently convert the toxic ammonia to the less toxic nitrites, which in turn is taken up by the primary producers, enhancing the primary productivity. All together this product as it is designed adsorbs toxic and obnoxious gases, acts as a mineral supplement containing both micro and macro minerals and an enhancer of primary productivity.



### Conclusion on functionality of BIOSORBENT -AS\* - AQUA SAFE for SAFE AQUA

This study mainly aimed at evaluating the efficacy of AQUA SAFE as BIOSORBENT in handling the Ammonia problem and related issues of the pond, while embarking upon the fact that it is a good mineral supplement indirectly influencing the growth and wellbeing of the animal. Improves and maintains stable phyto& zooplankton, decomposes dead plankton, waste feed, improves DO levels of the pond bottom and helps in the soil conditioning too. The results of the trials and practical application on aquatic animals like fish, prawn/shrimp stand proof of the significant benefit of this formulation.

AQUA SAFE, the specially designed Biosorbent AS, a combination of time tested scientifically proven Herbals, nitrifying bacteria, yucca and minerals, competitively inhibited the obnoxious gas formation, ammonia controller, a mineral supplement and productivity enhancer, a special brand of ADVANCE AQUA BIO TECHNOLOGIES INDIA PVT. LTD., a result of research and innovation for superior quality feed supplements, premixes and growth promoters to augment global animal health and living.

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