

BACTERIOPHAGES AS A THERAPY FOR SHRIMP DISEASES

Email: vijay@salemicrobes.com

D. Vijayanand

Director-Business Development, Salem Microbes Pvt Ltd.

Salem Microbes Private Limited, established in 1999, is a pioneer in Probiotics for Animal Health with modern infrastructure and trained manpower, started research initiatives based on bacteriophages in 2018. With its dedicated R&D team supported by qualified field technical staffs and aqua lab, the product design, development and field demonstration is executed flawlessly.

Why Bacteriophages?

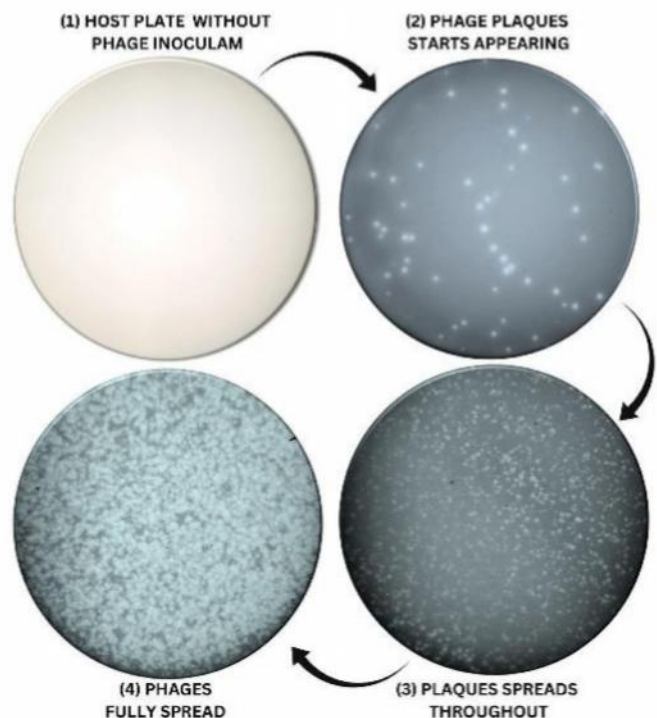
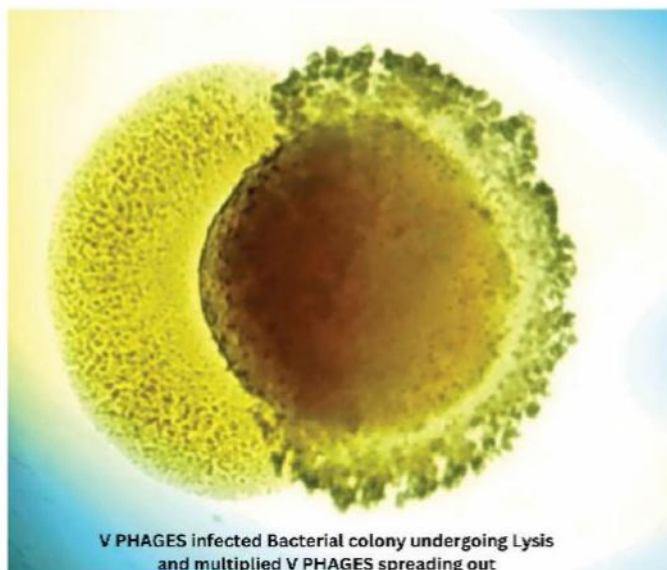
With emergence of highly virulent pathogens in animal health and aquaculture, there is need for highly effective therapeutic product which can reduce usage of sanitisers and antimicrobials. Continuous use of sanitisers and antimicrobials lead to damage of microbiome (the normal non-pathogenic beneficial bacteria) in aquaculture pond ecosystem and shrimp gut. Recent explosion of scientific research has brought to light the importance of maintaining good and unfluctuating microbiome in shrimp and fish health and aquaculture success.

Under this condition bacteriophages against virulent pathogens in aquaculture will be highly helpful in maintaining the natural ecosystem of the pond while killing the aquaculture pathogens. This strong argument inspired

Salem Microbes to initiate bacteriophage research as early as 2018 and has invested in infrastructure, technology and technical competence in bacteriophages-based solution development for aquaculture, poultry and food safety.

Salem Microbes possessing 23 years of probiotic tradition has always travelled with bacteriophages hand in hand from screening to production operations. In the current day scenario, we are 'embracing the foe as a friend' to control pathogens of aquaculture. So, we are just jumping sides and exploiting their potential.

Today, we assure that we are in the forefront of bacteriophage research, specialising in isolation, characterisation, and formulation of phage cocktail within a short turnaround time. Our research and development ensures quick screening in case of a sudden disease outbreak to make custom formulation of bacteriophages from our expansive library of bacteriophages maintained on-campus.



Phages and Probiotics, a Synergistic combination.

Probiotics have played an undeniable role in the environmental management of the shrimp pond and are going to continue to sustain the shrimp ecosystem microbiome, the only catch here is use of quality probiotic inputs which farm owners and technical experts should be aware of.

Probiotics reduce the chances of infection by competitive

exclusion, but once the critical levels of vibrio species dominate the environment, it become nearly impossible for probiotic bacteria to exclude Vibrio species. Such critical condition demands quick and sure shot treatment, which is non residual in nature and non-GMO and which does not affect the (microbiome). Here comes the concept of Phage Therapy which is highly specific and quick acting in nature specifically targeting the aquaculture pathogens.

SALIENT FEATURES	Probiotics Application only	Bacteriophage Application only	Both Bacteriophages and Probiotics applied condition
Mode of action	Competitive exclusion of pathogens by exhausting nutrients for the pathogens.	Works on identified targeted pathogens by killing them by lysis.	Phages Eradicates Identified pathogens. There by nutrients are available for probiotic microbes.
How it manages pathogens ?	Dominates Pathogens but when conditions are conducive for pathogens, they cause disease Long acting	Eradicates pathogens thereby reduces frequency of disease. Self-limiting	Probiotics have a conducive environment to multiply fast and full Phages keeps check on fresh entrants
Residual formation	No Residues	No Residues	Phages leaves un-identified Natural Probiotic flora to thrive better
How they really work ?	Bacteriocin & Enzymatic action	Cell Lysis of Pathogenic bacteria.	Phages prevents horizontal transmission of toxin bearing plasmids.
Source	Non-GMO, Nature isolates	Non-GMO, Nature isolates	
Traceability and proprietary nature		Identified and Genotyping done	
Is Product Upgradation possible ?	Continuous Improvement in Performance based on the new strains introduced.	Continuous update of Phages for New Identified Pathogens makes it a safe therapeutic product with broad spectrum of action.	
Limitations	Fights with unknown pathogens. Virulent pathogens with Toxins continue to exist, multiply and cause infections.	For Greater Benefit – It’s recommended to use Probiotics after this to dominate the environment and maintain positive balance for maximum results. Virulent pathogens with toxins are destroyed, thus halting their propagation.	

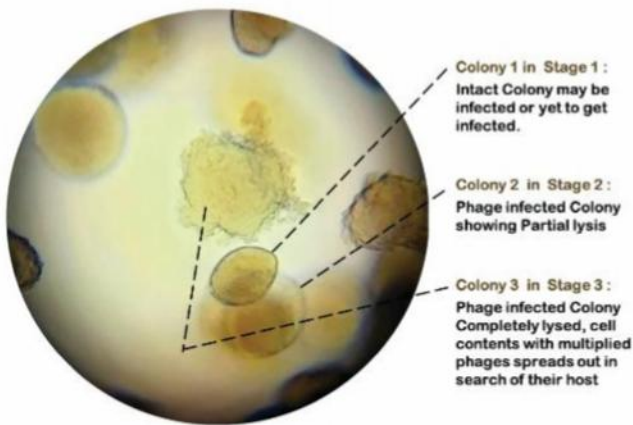
How a Bacteriophage product become relevant to a condition?

A good bacteriophage consortia should contains identified lytic phages, specific against pathogens selected from the target environment. Phage cocktails against Pathogens should be continuously upgraded to maintain the pathogen spectrum, specificity and infectivity.

How does a Phage works?

Bacteriophages are viruses of bacteria which enter the bacteria, use the bacterial source of energy, hijack the bacteria, multiply inside the bacteria and kill them by lysis. When they kill the bacteria, each virus which enter the bacteria multiplies and releases 10 to 100 mature ready-to-

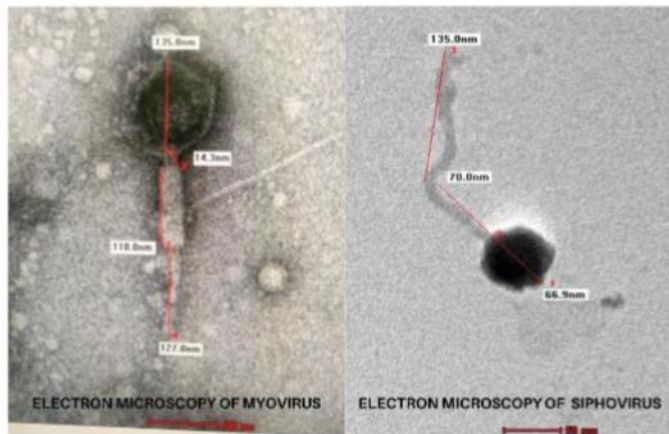
3 Different stages of *Vibrio* Colonies infected with V PHAGES and Progressive Lysis observed on an Agar Plate – Under Stereo Microscope



attack bacteriophages which are capable of infecting and destroying next set of target pathogenic bacteria.

V PHAGES Consortia.

V PHAGES Cocktails for Hatchery and Growout are quite different in their Formulation, specificity and purpose. **V PHAGES HATCHERY** satisfy the need for targeting pathogens specific and prevalent in Hatchery water source, live feeds and also its environment. **V PHAGES GROWOUT** targets the common pathogens esp *Vibriosis* which are the main cause for bringing down the productivity of a shrimp pond by causing *Vibriosis* leading to White gut, White faecal disease, off feed, Running Mortality Syndrome and crop loss.



“**V PHAGES** “ cocktails target *Vibrio* species as,

- *Vibrio parahaemolyticus*
- *Vibrio alginolyticus*
- *Vibrio harveyi*
- *Vibrio campbellii* and other pathogenic *Vibrio* sp.

When TO USE IN SHRIMP HATCHERIES?

- To reduce the load *Vibrio* sp. of the live/ wet/ frozen feed used in brood stocks.
- To reduce *Vibrio* sp. load in artemia tank.
- To reduce the *Vibrio* sp. associated problems in



Conversion and PL tanks.

- To reduce *Vibrio* sp. load in intake water thereby preventing biofilm formation in the storage. tanks and pipe line downstream of the intake tank.

When TO USE IN SHRIMP GROWOUT PONDS:

- Drop in feed intake with increase in yellow or green colonies in TCBS plates.
- White gut and white faecal matter appearance coupled with more green colonies in TCBS plates.
- Early stages of running mortality syndrome with empty gut symptom.
- During stocking to safeguard against survival loss of PL's.
- To increase the efficacy of probiotics by reducing their primary enemies, the pathogenic *Vibriosis*.

Comparing with Other Therapies.

V PHAGES are natural isolates screened and selected for their strong and fast action against their challenged targets. They do not disturb the probiotics and other non-pathogenic natural microbiome which are otherwise destroyed by other treatment approaches as sanitisers, disinfectants and any products of anti-microbial action. These phages does not leave any residues on the shrimp or environment as they are natural. All bacteriophages in V PHAGES cocktail are genotypically characterized to ensure proprietary formulation and traceability, which makes them special.

Conclusion:

Though Bacteriophage research and applications are known for many years very few products have seen the light of the day. Even these products become irrelevant when they are not supported by a strong expertise in the field and research infrastructure. Salem Microbes has established these capabilities and commits to be in the forefront of giving the best to its farmers to make their shrimps healthy, productive and profitable.



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AQUA INTERNATIONAL
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BG-4, Venkataramana Apartments,
11-4-634, A.C.Guards,
Hyderabad - 500 004, India.
Tel: 040 - 2330 3989, 96666 89554
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- Editor



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Special Feature

- At SRIBS, me and my team have a shared vision to drive our company to be counted amongst the best in Aqua Healthcare both for product quality and customer support.
- The motto makes Dr Aman Sayed even more ambitious and hopes to serve in large geographic areas in future.

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One Health
united approach for
balanced welfare of
people, animals
and ecosystems.



V PHAGES GROWOUT

/// EFFECTIVE ON SUPERBUGS



V PHAGES GROWOUT is a cocktail of Phages isolated from Natural environment. Hence they are safe on aquatic animals, people and ecosystems. This destroys pathogenic bacteria which are even resistant to antibiotics and increases the efficacy of probiotics.

"V PHAGES GROWOUT" cocktail targets against most common pathogenic *Vibrio species* in Shrimp Farming

- Vibrio parahaemolyticus*
- Vibrio alginolyticus*
- Vibrio harveyi*
- Vibrio campbellii* and other pathogenic *Vibrio sp.*



Lysis of pathogen and release of new phages for repetitive action

VIBRIOSIS



Use immediately when various symptoms of Vibriosis as Luminescence in water, infections in Shrimp and or Low feed intake etc. correlated with by lab test.

WHITE FAECAL DISEASE



Use immediately on observation of few strands on White fecal matter floating on water, or on check tray. Start treatment.

WHITE GUT DISEASE



Use immediately on observation of few shrimps with White Gut, in check tray or sampling net. If more than 5 days of White Gut Disease is reported, there is high chance of spread in soil and water and so treatment takes time to respond.

RUNNING MORTALITY SYNDROME



Use immediately on observation of dead pieces which is normally more than the regular Natural dead pieces observed in that pond on a daily basis. This will first control RMS due to VIBRIOSIS within 3 days and then reduce.



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Manufactured by:



SALEM MICROBES PRIVATE LIMITED

An ISO 9001 : 2015 Company

For Enquiries: +91 93448 37525/contact@salemmicrobes.com



V PHAGES HATCHERY

EFFECTIVE ON SUPERBUGS



V PHAGES HATCHERY is a cocktail of Phages isolated from Natural environment. Hence they are safe on aquatic animals, people and ecosystems. This destroys pathogenic bacteria which are even resistant to antibiotics and increases the efficacy of probiotics.

"V PHAGES HATCHERY" cocktail targets against most common pathogenic *Vibrio* species in Shrimp Hatchery.

- Vibrio parahaemolyticus*
- Vibrio alginolyticus*
- Vibrio harveyi*
- Vibrio campbellii* and other pathogenic *Vibrio* sp.

CAA/OCT22/PRO/04169

BENEFITS:



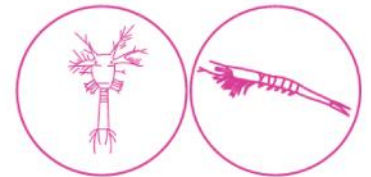
Broodstock:

Prevents entry of opportunistic pathogens and safeguards health of this high value asset.



Artemia:

Reduces the *Vibrio* sp. load in Artemia tank.



Zoea & Mysis:

Helps in better conversion and survival.



Post Larvae:

Stagewise control of *Vibrio* sp. results in remarkable reduction of *Vibrio* sp. load in post larval tanks. This results in high health seeds.

One Health unified approach for balanced welfare of people, animals and ecosystems.

Works as an Alternative to Antibiotics and complies with International Seafood export regulations.



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Regd. Off : No. 21/10C, Bajanai Madam Street, Gugai, Salem - 636 006. Tamilnadu. India.
Customer Care : +91 8695145602 E-Mail : contact@salemicrobes.com www.salemicrobes.com