Scaling up
Artemia Decapsulation

Isaac Adatto

Children’s Hospital Boston
Aquatic Resources Program
Research’s Next Top Model

Zebrafish Popularity
Google Lab’s Books Ngram Viewer
Feed Types

- Manufactured Feeds
  - Flake, Pellet
- Freeze-Dried Feeds
  - Blood Worms, Brine Shrimp, Krill
- Live Feeds
  - Rotifers, *Artemia*

Supports:
1) High Survival
2) Rapid Growth to Sexual Maturity
3) High Reproductive Output
Artemia Nauplii
Artemia Nauplii/Cyst

• Beneficial Food Source for Various Reasons
  • Favorable Nutritional Profile
  • Easy to Culture
  • Easily Distributed
  • Evenly Distributed within the Water Column
  • Visually and Chemically Attractive
  • Easily Digestible
  • Deficient in HUFA’s –
    • Non-discriminate filter feeders

Nauplii Nutritional Composition

37-71% Protein, 12-30% Lipid, 11-23% Carbohydrate, 4-21% Ash
Artemia Cysts

- Fertilized eggs
  - Dormant (blastula stage)

- Encased in an impermeable complex shell

- Three-layered chorion
- Alveolar layer (buoyancy)
Artemia Cysts

• Chorions are not digestible
  • May cause blockage of the gut

• Chorions are a vector for pathogens
  • Carrier of bacterial spores, plant, and animal spp.

  *Bacillus*,  *Staphylococcus*,
  *Erwinia herbicola*,  *V. parahaemolyticus*,
  *Micrococcus*,  *Aeromonas*,
  Gram-negative rods  Gram-positive rods

Isolated from dehydrated cysts and cyst hatching water.
Artemia Cysts

• Described by Sorgeloos et al., 1977
  • Artemia Decapsultaion

• Exothermic Oxidation Reaction

\[(C_8H_{13}O_5N)_n + H_2O_{(aq)} + NaOH_{(aq)} + NaOCl^{-2}_{(aq)} + NaCl_{(aq)}\]

• Chemically remove chorion
  • Without affecting embryo viability

• Hypochlorite solution
  • Liquid bleach: NaOCl
  • Bleaching powder: Ca(OCl)_2
Disadvantages of *Artemia* Decapsulation

- Caustic Chemicals
- Labor Intensive
Advantages of *Artemia* Decapsulation

- Eliminates separation step
- Disinfects cysts
- Maximizes hatchability
- Increases digestibility
- Increases energetic content
  - Fed out:
    - Instar I Nauplii Stage
    - Decapsulated Cysts
      - 30% – 40% more energy
## Improvements on Decapsulating *Artemia*

<table>
<thead>
<tr>
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**Artemia Decapsulation**

- **Materials**
  - 6 cans of *Artemia* (GSL)
    - 2.724 kg
  - Solution A
    - 11L of Austin’s A-1 Bleach (5.25% NaOCl)
  - Solution B
    - 1.8L of 35ppt Seawater
    - 400mL of 2.5M NaOH
Artemia Decapsulation

• Materials continued . . .
  • Container for reaction
    • 100 L Artemia Hatcher
  • 100 micron sieve
Artemia Decapsulation

• **Step 1** - Hydration
Artemia Decapsulation

- Step 1 - Hydration

24 L of RO H₂O
Kept in continuous suspension for 2hrs +
Artemia Decapsulation

• **Step 1** - Hydration
Artemia Decapsulation

• Step 2 – Drain, Rinse & Return
Artemia Decapsulation

• Step 2 – Drain, Rinse & Return
Artemia Decapsulation

- **Step 3** – Add Chemicals & Aerate

- Solution A:
  - Sodium Hypochlorite (bleach)
- Solution B:
  - 1.8L 35ppt Seawater & 400mL 2.5M NaOH

Chilled to 4°C
Artemia Decapsulation

• Step 3 – Add Chemicals & Aerate

1 Note gradual color change during chemical reaction
dark brown – grayish orange – rusty orange
Artemia Decapsulation

- **Step 3 – During Reaction**

![Graph showing change in temperature over time](image1)

![Image of a test tube](image2)
Artemia Decapsulation

• **Step 4** – Stop Reaction

Drain
**Artemia** Decapsulation

- **Step 4 – Stop Reaction**

Remove all chemicals & rinse
Artemia Decapsulation

• **Step 4** – Stop Reaction

Neutralize Bleach with 10% Acetic Acid
Artemia Decapsulation

• Results
Artemia Decapsulation

• Step 5 – Transfer Decapsulated Artemia
Artemia Decapsulation

• Step 5 – Transfer Decapsulated Artemia
**Artemia Decapsulation**

- Store in Refrigerator (4°C)
- Good for at least 4 weeks
- Dehydrate for longer storage
  - Aerating overnight + supersaturated hypersaline
Artemia Decapsulation (Timeline)

Step 1
Hydration

Step 2
Drain, Rinse, Return

Step 3
Add Chemicals & Aerate

Step 4
Stop & Neutralize

Step 5
Prep for Storage

2 hrs +

7-10 min.

10 min.

18-25 min.

10 min.

Total
45 – 50 min.
Advantages of Decapsulating *Artemia*

- Eliminates separation step
- Use less consumables
- Disinfects cysts
- Maximizes hatchability (> 75%)
- Increases digestibility
- Increases energetic content

Highly Recommended!
Conclusion

• 6 Can Artemia Decapsulation
  • Efficient use of time
    • 45 - 50 Minutes
  • Use less chemicals per can
    • reduced bleach orders by half

• Hatch more *Artemia* per feed
• Feed more *Artemia* to our fish
Thank You!

Acknowledgements

- Nick King
- Eric Sanders
- Jason Best
- Kara Maloney
- Althea James
- Leonard Zon
- Chris Lawrence

References

- Bengston D.A. et. al. Use of Artemia as a food source for aquaculture. 1991. Ch. 11.