EFFECT OF DIETARY ADMINISTRATION OF SAFE ORGANIC COMPOUNDS FOR ANTI-MICROBIAL ACTIVITIES IN FOOD FISH

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INTRODUCTION

Aquaculture is the fastest-growing food production sector and plays a vital role in global food security. Intensive indoor aquaculture systems adopted to enhance fish production through advanced technologies & sustainable farming practices, but intensified farming conditions elevate the risk of disease outbreaks, while the excessive use of antibiotics & chemicals raises concerns regarding antimicrobial resistance, environmental sustainability, and food safety.

Organic acids (OAs) and medium-chain fatty acids (MCFAs) have emerged as functional feed additives antimicrobial properties and potential to improve gut health & growth performances[1,2,3].

OBJECTIVES

To evaluate the potential of organic acids (OAs) and medium-chain fatty acids (MCFAs) as sustainable alternatives to antibiotics for improving growth performance, gut health, and overall fish health

METHODS

Selective combinations of food grade OAs were screened for antibacterial activity using MIC and MBC assays

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Preparation of OAs incorporated fish feed - Blend A and Blend B and conduct 60-day feeding trial using Tilapia fingerlings

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Growth performance indicators- SGR & FCR were evaluated. Gut samples were collected on Day 30 & 45 for Gut microbiome profiling

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Microencapsulation conditions for three selected OAs were optimized using suitable polymers and coating agents prior to feed incorporation

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Quantification of encapsulated OAs in formulated feed was performed by HPLC method for future *in-vivo* feeding trials

RESULTS

TABLE 1. Minimal bactericidal concentration (MBC) and Minimum Inhibition concentration (MIC) assays to determine final concentration of OAs and MCFAs using reference bacterial strains

OAs/ MCFAs	MBC	MIC	Final concentration added with feed
OA1 (blend A)	0.16%	0.63%	0.63%
OA2 (blend A)	0.31%	0.31%	0.31%
OA3 (blend A)	0.31%	0,31%	0.31%
OA4 (blend A)	0.31%	1.50%	NA
OA1 (blend B)	0.16%	0.31%	0.31%
OA2 (blend B)	0.16%	0.63%	0.63%
OA3 (blend B)	0.16%	0.31%	0.31%
OA4 (blend B)	0.16%	0.31%	0.31%

NA: No or Low activity

TABLE 2. The growth performance of experimental fish groups during the feeding trial *(mean±standard deviation, n = 10)*

TRAIL 1	Blend A	Blend B	Mock Ctrl
Initial wt	6.69+2.46	6.62+0.96	6.13+1.12
Final wt	8.76+2.02	9.05+0.93	6.91+1.02
SGR	0.52+0.42	0.53+0.15*	0.21+0.15*
Total feed	7.89+1.81	8.15+0.83	6.22+0.92
FCR	3.80+3.43	3.35+0.80*	7.96+5.83*

TRAIL 2	Blend A	Blend B	Mock Ctrl
Initial wt	6.43+1.43	8.31+1.37	7.01+2.53
Final wt	7.71+1.35	11.31+1.06	7.89+2.40
SGR	0.32+0.17	0.53+0.20*	0.22+0.14*
Total feed	6.94+1.21	10.18+0.96	7.1+2.16
FCR	5.41+3.60	3.4+1.21*	8.12+5.50*

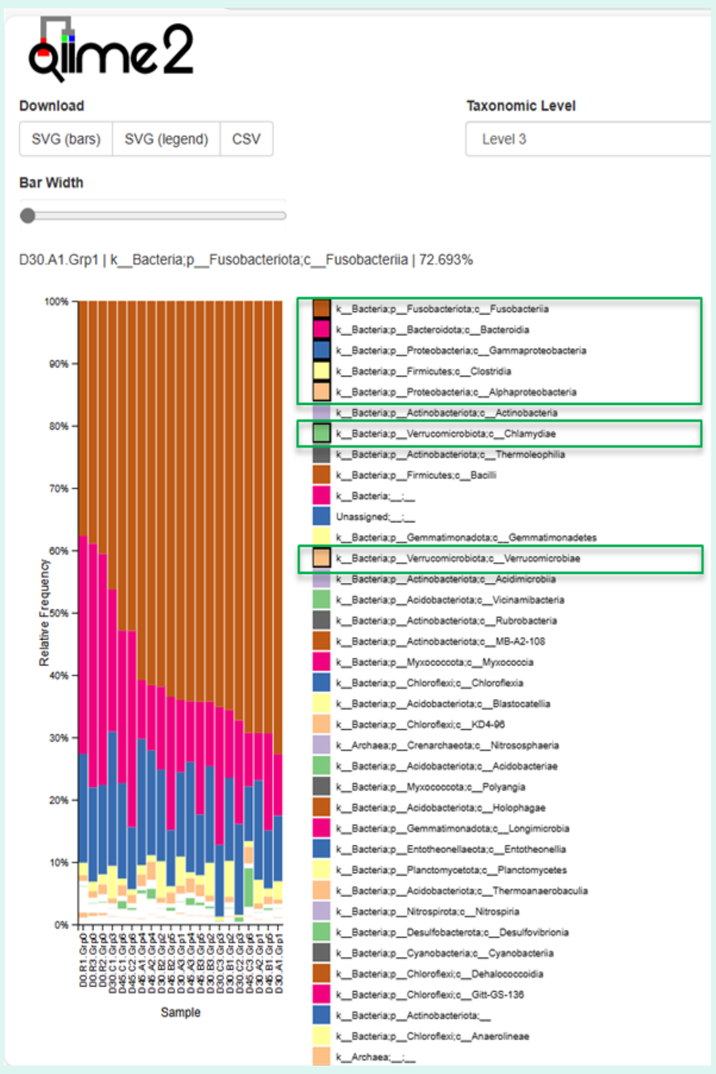
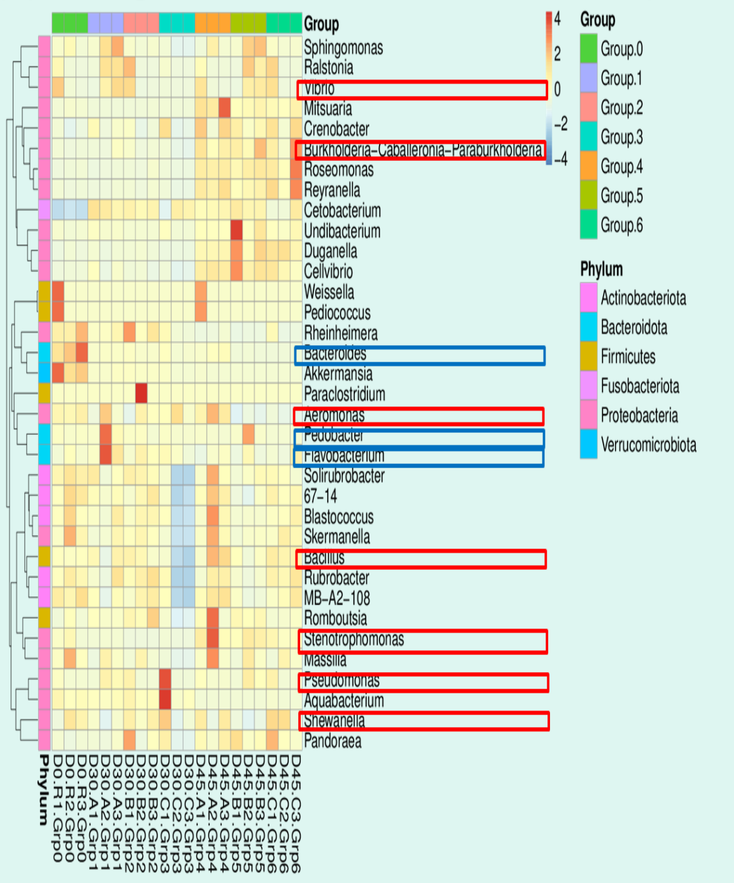


FIGURE 1. Gut Microbiome analysis of experimental fish groups.

(A) Histogram of Relative Abundance of Species



(B) Heat Map clustering of species abundance

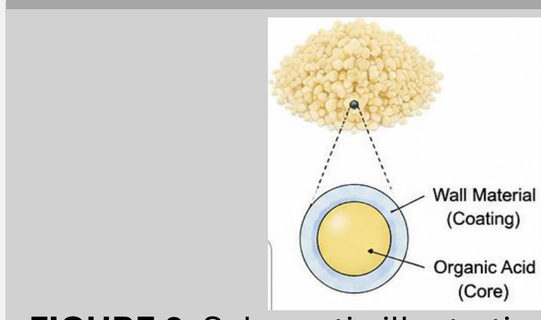


FIGURE 2. Schematic illustration of microencapsulation of selected organic acids using optimized polymers and coating agents

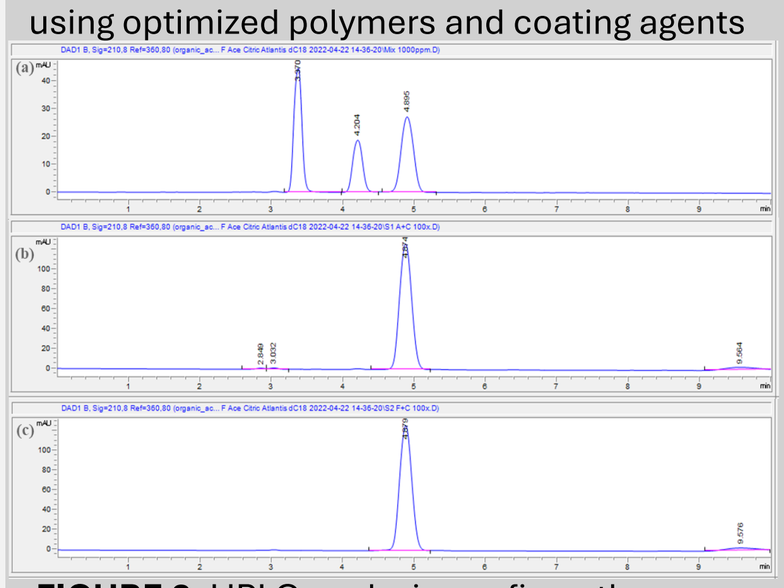


FIGURE 3. HPLC analysis confirms the quantification of encapsulated OAs incorporated into fish feed

DISCUSSION & CONCLUSION

- Blend B combinations significantly improved fish growth performance compared to the control group, with no adverse effects & 100% survival across all experimental groups.
- Gut microbiome profiling demonstrated enrichment of beneficial bacterial taxa associated with immune modulation, fermentation & gut health, together with reduction in potentially pathogenic bacteria, particularly in blend B group.
- Three selected OAs were successfully microencapsulated using optimized concentrations of polymers and coating agents, demonstrating the feasibility of controlled OAs delivery in aquafeed formulations.
- HPLC analysis confirmed the successful incorporation & quantification of encapsulated OAs in formulated feed.
- The study highlights the potential application of OAs as sustainable feed additives to support fish growth, gut health & antibiotic free aquaculture practices.

REFERENCES

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