ATTAPULGITE: A CLAY MINERAL TO CONTROL AMMONIA IN AQUACULTURE AQUATIC ENVIRONMENT

AQUA 2024

Peppa I.[1,2], Artemiou G.[1,2], Katouni A.[1], Psofakis P.[1] Papadouli C.[1], Karatzinos T.[1], Karapanagiotidis I.[1], Panagiotaki P.[1], Golomazou E.[1*]

[1] Department of Ichthyology and Aquatic Environment - Aquaculture Laboratory, School of Agricultural Sciences, University of Thessaly, Fytokou str., 38446, Volos, Greece,
*e-mail: egolom@uth.gr

[2] Farmart Ltd, Athienou, Kleanthi Koumeni 6, 7600, Athienou, Cyprus

26-30 AUGUST 2024
Copenhagen, Denmark

Introduction

Attapulgite

- Feed additive (EU2023/1699), primarily used for technological functions in feed (binding, anti-caking, mycobinder).
- It can perform zootechnical functions by influencing the gastrointestinal flora and improving feed digestibility in animals.
- It reduces ammonia during composting (1) and efficiently removes $NH4^+$-N from overlying water (2).

Evaluation of the effectiveness of attapulgite in mitigating ammonia excretion in the aquatic environment during fish farming.

Materials and methods

Experimental fish: Gilthead seabreams, *Sparus aurata* L. (n=636) (2.63 ± 0.46g)

Experimental facilities: 12 x 250L aquaria, EL-43BIO/exp-01, 33ppt salinity, 21±1°C, 12:12h light:dark

Experimental diets:
- ✓ attapulgite-supplemented diet (3 kg/ton)
- ✓ attapulgite-free diet

Experimental groups: three replicates (53 fish/aquarium)
- Attapulgite-supplemented diet fed at 4% of biomass
- Attapulgite-free diet (control) fed at 4% of biomass
- Attapulgite-supplemented diet fed *ad libitum*
- Attapulgite-free diet (control) fed *ad libitum*

Experiment duration: 15 days

Daily record: NH_3
- before feeding
- two hours post-feeding
- nine hours post-feeding

Food consumption
Mortality

Statistical analysis: Student's t-test, $P < 0.05$.

Results

No statistical differences were observed in feeding behaviour, feed consumption, and weight gain between the atta-pulgite-supplemented & attapulgite-free diet groups in both feeding treatments (4% of biomass and *ad libitum*).

The attapulgite diet significantly **reduced the ammonia** excretion in the aquatic environment, when the fish were fed *ad libitum* by
- ✓ **60.58%** before feeding
- ✓ **47.19%** two hours post-feeding
- ✓ **52.35%** nine hours post-feeding (Fig. 1).

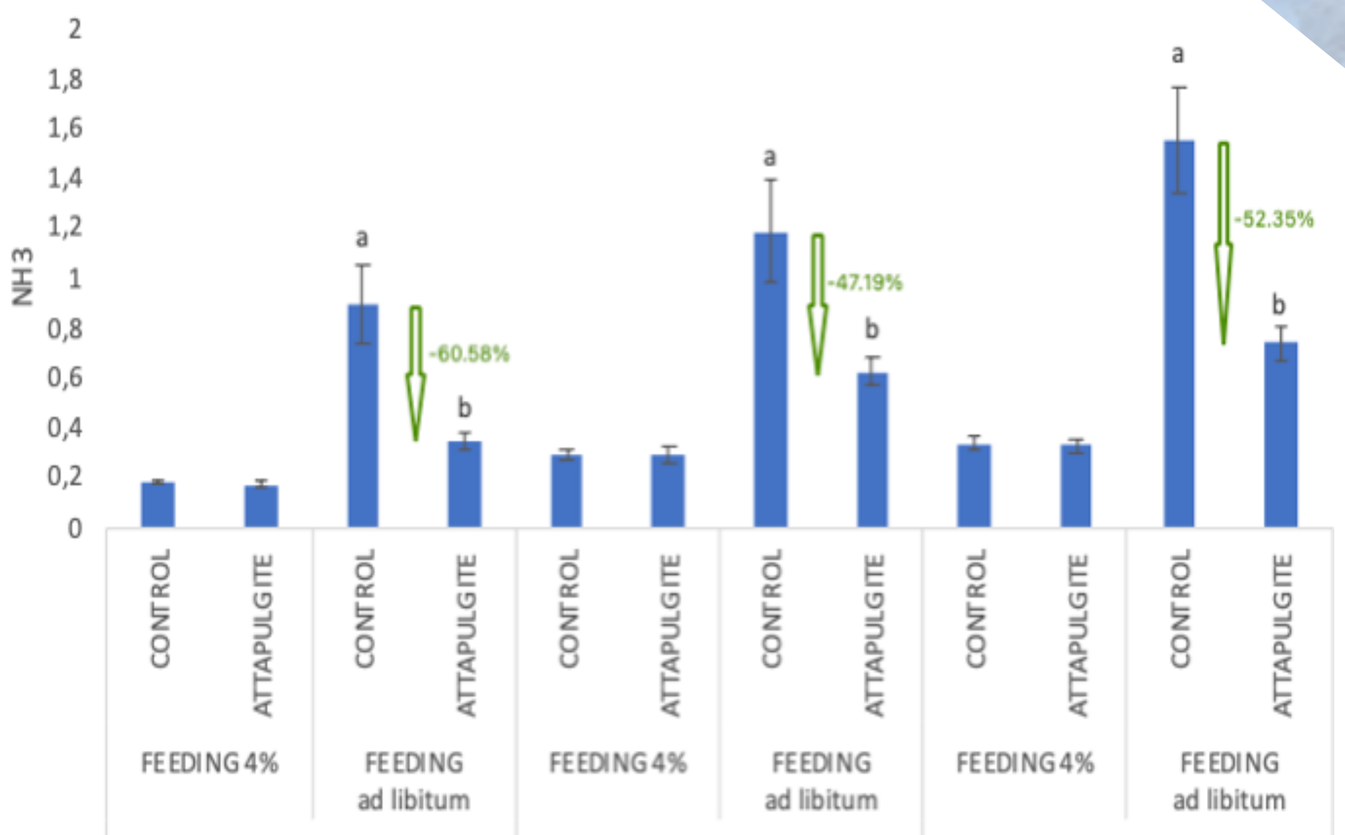

Figure 1. NH_3 values (mean ± standard error) in treatment groups, measured before feeding, 2 hours post-feeding, and 9 hours post-feeding. Different letters indicate statistically significant differences among means within the same feeding treatment ($P<0.05$).

Discussion

Attapulgite is a promising clay mineral with a wide range of applications in aquaculture and aquatic environments, offering significant potential in mitigating the adverse effects of ammonia on fish health. This readily available and cost-effective material has superior surface-absorbing capabilities, making it an attractive option as a potential catalyst support for NH_3 decomposition (3).

References

1. Xie K. et al., 2012. The addition of modified attapulgite reduces the emission of nitrous oxide and ammonia from aerobically composted chicken manure, Journal of the Air & Waste Management Association, 62(10), 1174-1181.
2. Teng, Q. et al., 2024. Ru/Attapulgite as an Efficient and Low-Cost Ammonia Decomposition Catalyst. Catalysts, 14, 197.
3. Xu S., et al., 2023. Effective removal of nitrogen and phosphorus from a black-odorous water by novel oxygen-loaded adsorbents, Chemical Engineering Journal, 466, 143146.

Acknowledgment

FarmArt Ltd funded the research project. The project ''Research and Educational Actions in Fish Health Protection and Welfare'' supported the AQUA2024 presentation. This work is a part of the dissertation submitted in partial fulfillment of the requirements for the degree of MSc Course in Mediterranean Aquaculture, Department of Ichthyology and Aquatic Environment, University of Thessaly, Greece.