AQUACULTURE III

13. WEEK

Off-Flavors in Aquaculture

WEEKLY TOPICS

Week	Topics
1. Week	Aquaculture Science and Aquaculture Engineering
2. Week	Aquaculture: Economic and Environmental
3. Week	Aquaculture: Innovation and Social Transformation
4. Week	Aquaculture: Food Ethics
5. Week	Shellfish Aquaculture and the Environment
6. Week	Advances in aquaculture hatchery technology
7. Week	Recirculating Aquaculture
8. Week	Selection and Breeding Programs in Aquaculture
9. Week	Ecological and Genetic Implications of Aquaculture Activities
10. Week	Aquaculture: Biotechnology
11. Week	Aquaculture nutrition: gut health, probiotics, and prebiotics
12. Week	Mucosal Health in Aquaculture
13. Week	Off-Flavors in Aquaculture
14. Week	Sustainable Aquaculture Techniques

- Off-flavor problems in aquaculture.

- Foods produced in aquaculture are often more expensive than other sources of animal protein. To capture and maintain market share, they must therefore be of consistent, superior quality. This article reviews off-flavor problems in aquaculture that can adversely affect market demand, with emphasis on off-flavors acquired prior to harvest of the cultured animals. Odorous compounds responsible for preharvest off-flavors may be acquired from the water or diet, although flavor problems of dietary origin are uncommon in aquaculture. The most common preharvest off-flavors in aquaculture products are caused by geosmin and 2-methylisoborneol, two highly odorous, earthy-musty metabolites of aquatic microorganisms.

Tucker, C. S. (2000). Off-flavor problems in aquaculture. *Reviews in Fisheries Science*, *8*(1), 45-88.

- Off-flavor problems in aquaculture.
- Planktonic cyanobacteria in the order Hormogonales are principally responsible for synthesis of geosmin and 2-methylisoborneol in aquaculture ponds and other eutrophic aquatic ecosystems. The compounds are rapidly absorbed by fish and stored in lipid-rich tissues. Elimination of geosmin and 2-methylisoborneol is slower than uptake, and the rate of elimination is reduced as water temperature decreases and tissue lipid content increases. Management of off-flavors caused by aquatic microorganisms is difficult under commercial conditions. Abatement strategies have focused either on eliminating odor-producing cyanobacteria from culture systems or allowing the taints to depurate naturally by holding animals in clean water. Although flavor problems attributable to pollution are rare in aquaculture, accidental spills of petroleum products occasionally cause off-flavors. Odorous petroleum hydrocarbons are extremely lipophilic, so they are rapidly absorbed from the environment and then slowly eliminated. Management of pollution-related off-flavors is difficult because the accidents leading to flavor problems cannot be predicted.

Tucker, C. S. (2000). Off-flavor problems in aquaculture. *Reviews in Fisheries Science*, *8*(1), 45-88.

- Off-flavors in aquaculture: an overview.

- The latter has received the most attention in terms of research approaches for developing methods to prevent off-flavors in aquaculture products. The production of off-flavor compounds by certain species of cyanobacteria is the greatest contributing factor to off-flavor in fishery products. In this chapter, the types and causes of off-flavor that may occur in a wide variety of aquaculture products are discussed. In addition, the most recent developments in research for the prevention of offflavor in aquaculture are discussed, and recent technological advances in off-flavor detection are presented.

Schrader, K. K., & Rimando, A. M. (2003). Off-flavors in aquaculture: an overview.

- **Instrumental versus sensory detection of off-flavors in farm-raised channel catfish.**

- Results from an instrumental method for determining the presence of the earthy, muddy or blue-green off-flavor in catfish were compared with those of four professional flavor checkers. Solid phase microextraction and gas chromatography/mass spectrometry were used to detect the off-flavor compounds, 2-methylisoborneol and geosmin. The odor threshold for an average flavor checker was determined to lie between 0.1 and 0.2 µg/kg for 2-methylisoborneol and estimated at 0.25 to 0.5 µg/kg for geosmin. The odor threshold for geosmin in channel catfish appears to be only slightly greater than that of MIB. The lower end of the sensory limits served as the instrumental cutoffs for grading fish off-flavor. Comparison of the instrumental method versus the flavor checkers resulted in a high correlation (R=0.9).

Grimm, C. C., Lloyd, S. W., & Zimba, P. V. (2004). Instrumental versus sensory detection of off-flavors in farm-raised channel catfish. *Aquaculture*, *236*(1-4), 309-319.

- **Development of phytoplankton communities and common off-flavors in a biofloc technology system used for the culture of channel catfish (*Ictalurus punctatus*)**

- The use of biofloc technology production systems continues to increase in the aquaculture industry worldwide. Recent research demonstrated that outdoor biofloc systems can be used to produce high yields of channel catfish (Ictalurus punctatus). However, studies have not yet been performed to determine the development and composition of phytoplankton communities and related off-flavor problems in these biofloc production systems. In this study, water samples were collected biweekly from May to November and channel catfish samples were collected during harvest in November from nine 18.6 m2 biofloc culture tanks. Water and fillet samples were analyzed for levels of the common off-flavor compounds geosmin and 2-methylisoborneol (MIB). The development and composition of phytoplankton communities in each culture tank was also monitored. In addition, water and biofloc samples were evaluated to assess the microbial sources of geosmin and MIB within the culture tanks.

Schrader, K. K., Green, B. W., & Perschbacher, P. W. (2011). Development of phytoplankton communities and common off-flavors in a biofloc technology system used for the culture of channel catfish (Ictalurus punctatus). *Aquacultural engineering*, *45*(3), 118-126.

- Development of phytoplankton communities and common off-flavors in a biofloc technology system used for the culture of channel catfish (*Ictalurus punctatus*)

- Phytoplankton (including algae and cyanobacteria attached to bioflocs) biomass, as determined by concentrations of chlorophyll a in the water, gradually increased in all tanks over time. Phytoplankton communities that developed in the culture tanks were dominated by fast-growing, unicellular and small colonial types of green algae (chlorophytes) and diatoms (bacillariophytes) and slower growing, small colonial types of cyanobacteria (cyanophytes). A positive correlation ($p < 0.05$) between cumulative feed addition and chlorophyll a concentration was found. Although geosmin and MIB were present in the culture water of each tank during most of the study, levels were typically low and only one tank yielded catfish with geosmin and MIB in their flesh at levels high enough to be designated as off-flavor. A positive correlation ($p < 0.05$) between cumulative feed addition and MIB concentrations in the water of culture tanks indicates a greater potential for MIB-related off-flavor problems at high feed application rates. The microbial sources responsible for production of geosmin and MIB in the culture tanks remain unknown.

Schrader, K. K., Green, B. W., & Perschbacher, P. W. (2011). Development of phytoplankton communities and common off-flavors in a biofloc technology system used for the culture of channel catfish (Ictalurus punctatus). *Aquacultural engineering*, *45*(3), 118-126.

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