

Applications of Humic and fulvic acids in aquaculture

Humic and fulvic acids are natural organic substances found in natural water systems and thus are compatible with all aquatic life forms. Prolonged stress and inadequate adaptation to stress in aquaculture could result in the reduction of the immune defense systems of fish which could lead to infection and disease. Treatment of diseases in fish is limited because of:

1. Only a few chemicals approved for use in aquaculture and these are not effective against all pathogens.
2. Chemical treatment may be linked to side effects such as toxic stress (Meinelt et al. 2001b, 2002).
3. All chemicals approved for use in aquaculture are suspected of being mutagenic or carcinogenic with a high potential to non-target organisms.

Benefits of humic and fulvic acids application in aquaculture

1. Increase in brood yield, through prophylactic treatment of fish eggs and larvae.
2. Improvement in growth and food utilization.
3. Improvement in condition, strength and resistance to disease, wellness and vitality of culture, particularly during transportation.
4. Faster healing of ectoparasite infected fish through therapeutic medication.
5. Suppression of secondary infection.
6. Inhibition of outbreaks of primary infection through prophylactic application.
7. Detoxification of harmful metals and chemicals in water.
8. Treatment with humic acid at concentrations of **50-90 mg/L** reduced sickness and mortality (Schreckenbach et al., 1991). This therapeutic success was greater than standard chemical treatments such as a bath of a mixture of formaldehyde, methylene blue and malachite green.
9. Humic acid healed fish infected by natural and artificial skin lesions (Hartung, 1994). Burkart et al. (1994) also report astonishing and greater healing effects on fish than with FMM (a mixture of formaldehyde, methylene blue and malachite green). Humic and fulvic acids treatment was more effective than FMM for more sensitive fish such as members of the *Characidae*.
10. Marked increase in hemosiderin (complex of ferric hydroxides, polysaccharides and proteins) in neutral granulocytes and monocytes of carp upon humic acid treatment. This resulted in marked increase in phagocytosis of damaged erythrocytes.
11. One hour exposure of rainbow trout eggs to **5 mg/L** of humic acid protected them from mycosis (fungal infection mainly by *Saprolegnia* and *Achyla sp.* Which are ubiquitous fungal pathogens of fish and their eggs; Gamygin et al. 1992a).
12. A significant protection from *Saprolegnia* infection and an increase in hatching was observed (Schreckenbach et al. 1994) in rainbow trout when fulvic acid (FA) concentrations of 15, 30 and 50 mg/L was used in treatment. These concentrations exceed those present in water but similar to those in sediments where fish eggs

and embryos lie. Thus, these results are environmentally relevant (Steinberg, 2003).

13. Humic acid treatment of fish was effective against parasites through the improvement of the physiological condition of the fish (Gamygin et al., 1991).
14. The chemical acriflavine is used as a long-term bath to treat external bacterial and protozoan diseases of fish. The treatment with humic acid in protocol reduces the toxicity of acriflavine (Meinelt et al. 2002).

References

1. Meinelt, T, Playle R. C., Schreckenbach K, Pietrock M. 2001b. Interaction of the antiparasitic mixture FMC, humic substances and the water calcium content. *Aquacult Res* 32: 405-410.
2. Meinelt T., Rose A., Pietrock M. 2002. Effects of calcium content and humic substances on the toxicity of acriflavine to juvenile zebrafish *Danio rerio*. *J Aquat Anim. Health* 14:35-38.