Integrated System for Managing Fish Farm Effluents

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Recirculating aquaculture systems (RAS) are currently considered one of the paradigms of the Blue Revolution, as they allow to "grow fish anywhere". Enterprises employing RAS to grow marine fish in super intensive production still face several challenges to expand their activity. One of such constraints is the load of organic rich suspended particulate matter (SPM) present in the effluents generated (circa 5-10% of the circulating water). Due to their salt content SPM cannot be readily disposed in the environment, as it is still considered as a dangerous waste. Therefore, their collection and disposal presents an economic burden to enterprises.

The present project (STEP) evaluated for the first time in Portugal the performance of polychaete assisted sand filters (using the ragworm Hediste diversicolor) and constructed wetlands (using the autochthonous halophyte Halimione portulacoides) in the reduction of SPM in the effluent of a super-intensive fish farm using RAS to grow Senegalese sole (Solea senegalensis). After 5 months of operation, a reduction in 55% of SPM was recorded in tanks colonized with ragworms in comparison with non-colonized sand filters. Sand filters initially stocked with 180 large sized ragworms (LSR) per square meter exhibited an average density of 6750 LSR per square meter at the end of the trial, representing an average market value if traded as sports fishing bait of 2250 euros. Concerning the halophyte H. portulacoides, the initial biomass (wet weight) averaging 1.5 Kg per square meter increased 13 fold reaching 19 Kg per square meter at the end of the trial. This increase in halophytes biomass corresponded to a production of 5 Kg (dry weight) per square meter per year, which accounts for a stock of 1.4 Kg of C, 0.09 Kg of N and 0.02 Kg of P uptaken from the fish farm effluent. Overall, the STEP project opened a new window for innovative approaches towards integrated multi-trophic aquaculture.

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FIGURE 1
Overview of STEP integrated multi-trophic bioremediation system.