Optimization of yield and biofiltration efficiencies of *Hypnea spinella* C. Ag. (Rhodophyta) cultivated in an integrated system with *Sparus aurata* L. waste waters

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Integrated aquaculture and particularly the use of seaweed (marine macroalgae) biofilters have been proposed as an environmentally interesting alternative of recycling wastes, especially those produced through the cultivation of high trophic level species.

In the present study, the red seaweed *Hypnea spinella* has been cultivated in glass-fiber semi-circular 750 L (1.8 m^2) outdoor tanks with open flow-through N-enriched waste waters ($N\text{-}NH_4^+$ concentration ranges between 50 - 250 µM) from Sparus aurata cultivation ponds. Optimal stocking density and exchange rates have been stablished during two different culture periods: autum/winter (october-january) and spring-summer (may-august) with the main interest to maximize algal yields and biofiltering efficiencies. Seaweed densities assayed in tanks were 4, 6, 7 and 10 g FW L^{-1} (1.6, 2.5, 2.9 and 4.2 kg m^{-2}). Seawater exchange rates assayed were 4, 7 and 10 vol. d^{-1}. Maximum yields (37.7 g DW m^{-2} d^{-1}) and biofiltering efficiencies (NUE = 94.5 %) were obtained at a density of 4 gr FW L-1 (1.6 kg m^{-2}) and turnover rates of 10 vol. d^{-1}.

Biochemical composition (ash, lipid, protein and carbohydrate) and carrageenan content have been analyzed and compared to those values obtained from nitrogen-depleted *Hypnea spinella* (grown without nitrogen additions).