

# Review of: "Aquaponics Unveiled: Efficient Household Farming"

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**Potential competing interests:** No potential competing interests to declare.

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Title: "Aquaponics Unveiled: Efficient Household Farming"

In this manuscript, the complex characteristics of aquaponic systems have been displayed, elucidating their constituent elements, their roles, and the interconnecting mechanisms pivotal for coherent operation.

A critical point in an aquaponics systems evidences nitrogen as key element, with inputs of nitrogen represented by fish food introduced in tanks. Fish consume the feed which is converted into proteins for meat production. As consequence, waste is generated and excreted by the fish entering the water in form of total ammonia nitrogen (TAN). At this point, filters capture solid waste and bacterial communities adhered on filter surfaces, can allow the process of nitrification, including ammonia oxidation to nitrite and nitrite oxidation to nitrate. Nitrate formed is consumed by the plants as the water flows from the fish tank to the hydroponic unit. Clean waters exit the plant-growing area of the aquaponic system and return to the fish tank, thus re-starting the whole process.

Moreover, a description of the components involved in the aquaponic system and including fish tanks and water filtration apparatus was carried out in this study. The description of the water movement and aeration system and the deep well system have also been reported in this manuscript. Again, the plant systems, the nutrient film technology system, the ebb and flow systems and the bucket system have been described.

The manuscript deals with an innovative and important aspect of productivity, indeed aquaponics represents a combined culture of fish and plants in closed recirculating systems combining a system of aquaculture in which the waste produced by farmed fish supplies the nutrients for plants grown hydroponically and purifying the water.

The References are not reported along the text of the manuscript and this is an error, as authors must include each article for a correct contextualization of the concepts as they arise in the text. Please add the references along the text of the manuscript, according to the indications for authors of the journal *Qeios*.

In the Introduction section, I would suggest to add information on general aspects concerning aquaponics and the importance of this technique for sustainable productivity and for economy.

In the Discussion section, it could be useful to add some examples from other studies about aquaponics and give some

information about other experiences, highlighting the advantages and pointing out possible disadvantages that can occur during the process.

Further references, concerning articles describing other experiences of aquaponics to be included in the Discussion section, could be added to the manuscript. Each article must be reported in the text and included in the final References list.

The manuscript is interesting and the aspects of aquaponics reported are important for research, offering insights for future studies. The manuscript needs to be revised in some aspects.

## Revisions

page 2: 'ammonia (NH<sub>4</sub>)' change to 'ammonia (NH<sub>3</sub>) and ammonium (NH<sub>4</sub><sup>+</sup>)';

page 2: 'nitrite (NO<sub>2</sub>)' change to 'nitrite (NO<sub>2</sub><sup>-</sup>)';

page 2: 'nitrate (NO<sub>3</sub>)' change to 'nitrate (NO<sub>3</sub><sup>-</sup>)';

page 4: When describing the role of bacteria in the nitrification process, include at least the most significant bacterial genera involved. Please, add "In particular, it must be pointed out the importance of bacterial adhesion to substrates in biofilters. In the nitrification process, ammonia and ammonium originate from the feed consumed by the fish. To neutralize the effects of these metabolites, fish waste is consumed by ammonia-oxidizing bacteria (*Nitrosomonas*). They allow the conversion of ammonia (NH<sub>3</sub>) to nitrite (NO<sub>2</sub><sup>-</sup>). The latter further is converted to Nitrate (NO<sub>3</sub><sup>-</sup>) by nitrite oxidizing bacteria, as in the presence of bacterial species of the genus *Nitrobacter*. The formed nitrate (NO<sub>3</sub><sup>-</sup>) represents the source of nitrogen for the plants, thus permitting their growth and the production of clean water to be reused in the same aquaponic system".;

page 5: Legend Figure 4, 'Solid setting device (A) ... and (B) mixed media bed ...' please, uniform the letters, before or after the explanations;

page 5: In Figure 5, the substrates in lightweight plastic for bacterial adhesion of bacteria involved in nitrification processes. As an alternate material to be used, could it be possible to substitute plastics substrates with sterilized pumice?;

page 7: In the paragraph of Plant Systems, seed germination in Rockwool is suggested. Are there materials not dangerous for human health to be used instead of this substrate?;

Page 12: '... the wealth of information provided in this publication ...' I would suggest to change to '... the information provided in this study could provide insights for future research, underscoring the critical importance ...'.