LABORATORY STUDY OF THE EFFECT OF HEXADECANOL MONOLAYER ON THE AQUATIC FAUNA (CASE OF *Tilapia nilotica*)

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Abstract: The present study aimed to investigate the effect of monolayer on the larva of *Tilapia nilotica*. An experiment was device consisted of 174 larva distributed in three aquariums during five weeks was installed. The first aquarium was not covered by the monolayer and considered as the control, the second one was covered by a monolayer of Hexadecanol (quantity of 0,09 g/m^2) and The last aquarium was covered by a monolayer of the same alcohol (quantity of 0,15 g/m^2). The results showed that the monolayer did not have a big effect on the physical parameters of the aquatic environment, but it affected the dissolved oxygen and delayed the growth of larva (size and weight) without killing them.

Key words: *Tilapia nilotica*, Hexadecanol, glass aquaria, evaporation.

Introduction

Water conservation is a necessity in arid regions that have scant rainfall and high evaporation losses. Boutoutaou (1995) [1] reported that 2600 to 4000 mm of water is lost due evaporation each year in southern Algeria which is an arid region.

Many physical and chemical methods have been considered in an attempt to reduce water evaporation losses from open water. One of the most promising techniques and old concept is the application of some organic substances form 'monolayers' (a continuous layer one molecule thick) on the water surface to reduce evaporation [2, 3, 4, 5]. However, the presence of monolayers on water surface changes some of physical and chemical characteristics of the aquatic environment [6].

The present study has been to evaluate, under laboratory conditions, the effect of the continuous application of monolayer of different quantity of Hexadecanol (which is a saturated fatty alcohol which spontaneously spreads and has high evaporative resistance) on aquatic fauna (case of *Tilapia nilotica*).

1. Materials and methods

1.1. Preparation of laboratory experimental Ecosystems

The ecological effects of a continuous monolayer of Hexadecanol on aquatic ecosystems were studied in the aquatic laboratory at Ouargla University (southern Algeria). There consecutive thirty five-day (5 weeks) tests were run during the period may and June 2011. Chemical, physical and biological analyses were made on untreated and treated ecosystems. The used materials consist three glass aquariums with a surface area (air –water interface) of 0.315 square meter and 0.5 meter of deep (photo 1): one glass aquarium untreated (control) and two others treated with Hexadecanol. For the aquatic fauna we used the *Tilapia nilotica* fish species which adapts wide variations of ecological factors in the aquatic environment [7, 8].

Photo 1: glass aquaria

Samples of *Tilapia* species were collected at the embryonic stage (one to two weeks old), this choice is based on the fact that at this stage this fish is very sensitive to the variations and allows convenient observation of the changes.

1.2. Monolayer Materials and Methods

Three glass aquariums were filled by 124 L of water for each one which means79% of total glass aquarium volume. For adaptation, larva were put in the glasses aquaria for five days (58 larvae in each glass aquaria) without applying monolayer. After that, the two treated aquatic systems were filmed every three days with Hexadecanol which was applied as powder as follow :

- First glass Aquarium presents the control aquarium (AQUA1);
- Second glass Aquarium: 0.09 g/m^2 (equivalent to about 15 monolayers/day) (AQUA2);
- Third glass Aquarium: 0.15 g/m^2 (equivalent to about 25 monolayers/day) (AQUA 3).

Chemicals analyses were conducted using the methods and techniques out lined in Standard Methods for the Examination of Water and Wastewater [9]. The following chemical tests were performed: hydrogen ion concentration and dissolved oxygen. The physical parameters monitored were air temperature and water temperature. The chemical and physical parameters were measured with multi-parameters every three days. The fauna morphological parameters measured were the weight and length of larvae, with measurements taken every six days and the calculation of the weight average and the length average of 10 randomly-selected individuals. And in the last week, all the individuals are taken to calculate the average of Morphological parameters.

2. Results and discussion

2.1. Water chemistry

Hydrogen ion concentration: The hydrogen ion concentration in the treated systems, generally, was lower than the pH in the untreated systems (AQUA1). Figure 1 compares the hydrogen ion concentration in the untreated and treated aquatic systems.

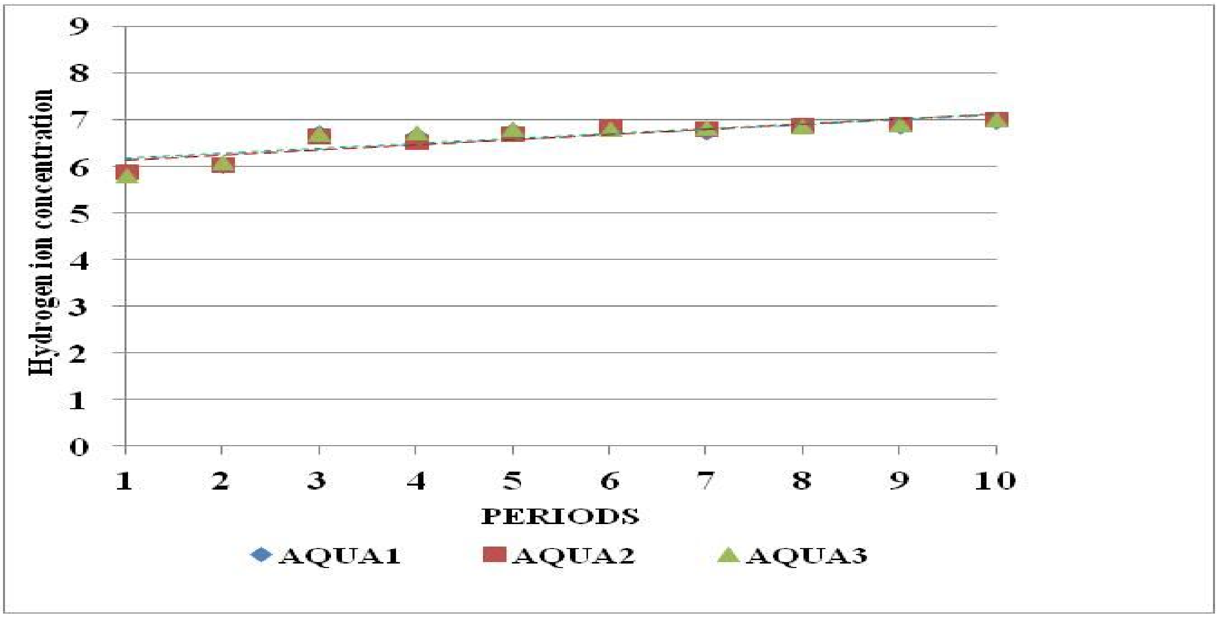

Figure 1: A comparison of the hydrogen ion concentration in treated and untreated aquariums

Figure 1 shows that the values of the pH at three aquariums are almost identical, and that there is no significant change when the quantity of the monolayer used varies.

The registered values in our experience were between 6 and 8 and were in the range of tolerance (3.7 and 11) [10].

Dissolved oxygen: The figure 2 points up that the quantities of O_2 dissolved during the first two weeks (first five points with pump) was superior (approximately 4mg / L) to those registered during the last two weeks (last five points without pump). The quantity of O_2 was always superior in the untreated systems.

The registered concentrations of dissolved oxygen were greater than the tolerated value which is 0.1 mg/l [11].

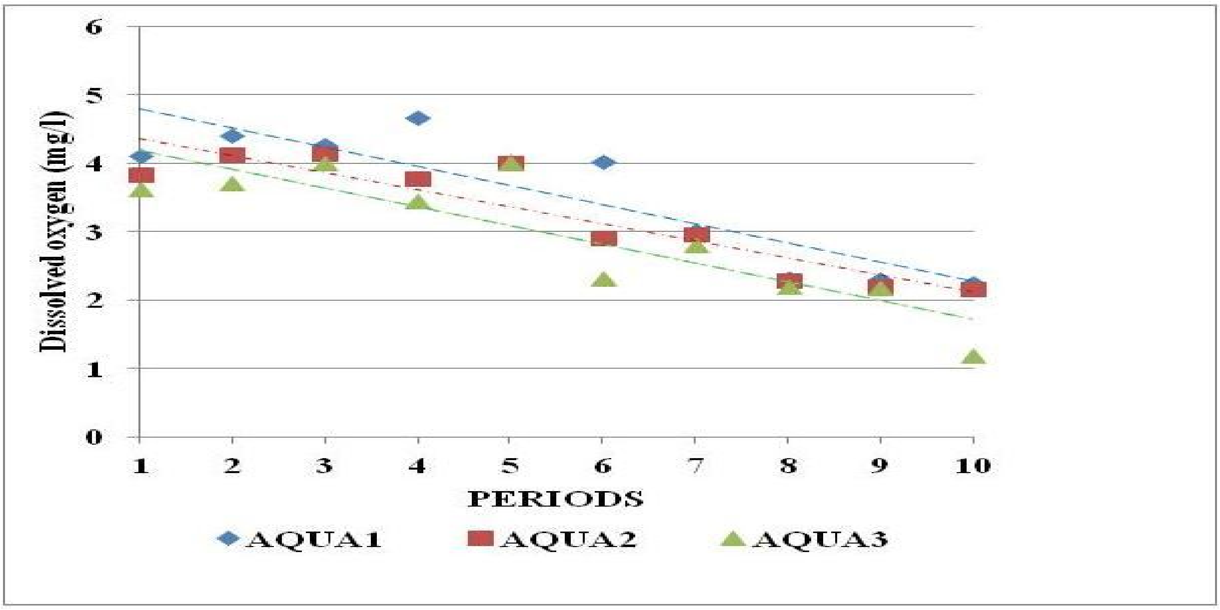

Figure 2: A comparison of the dissolved oxygen in treated and untreated aquariums.

2.2. Physical factors

Air and water temperatures: The water temperatures registered during the experience are between 28-34 °C they were max in the first treated aquaria (AQUA2) (figure 3).

For the air temperature it was superior to water temperature but not so far (because we were in laboratory conditions).

The measured values of water temperature were between 27 °C and 33 °C and they are in the tolerated range (8 °C to 42 °C) [12, 13].

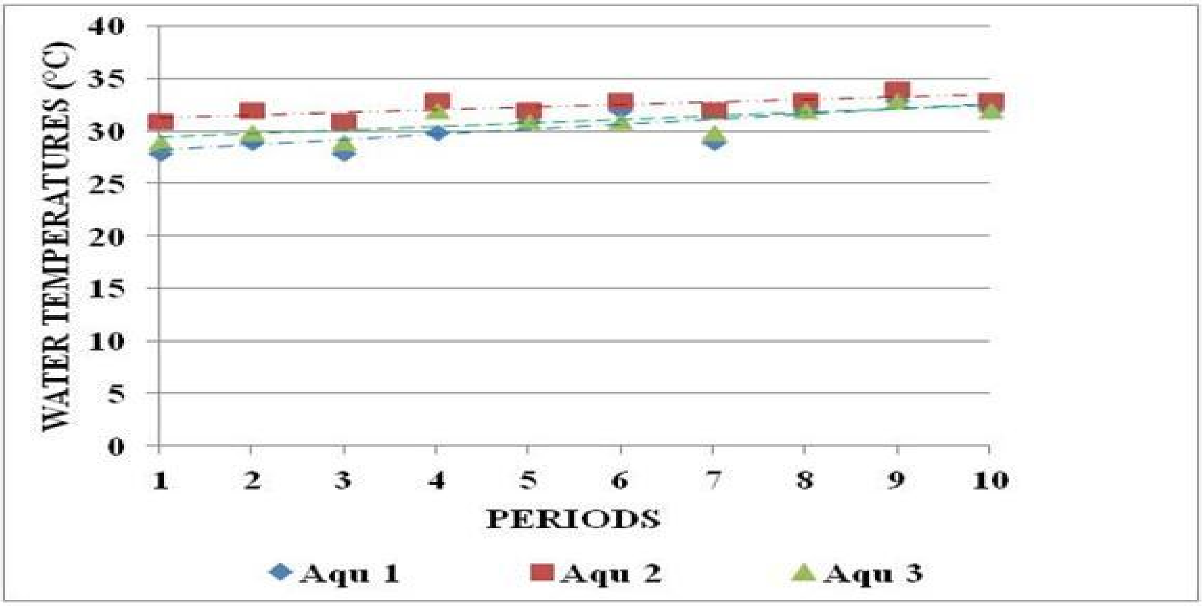

Figure 3: A comparison of the water temperature in treated and untreated aquariums.

2.3. Biological factors

Weight: figure 4 demonstrates that larvae in the untreated aquarium were heavier than larvae in the treated aquariums.

Length: figure 5 shows that larvae in the untreated aquarium were longer than larvae in the treated aquariums.

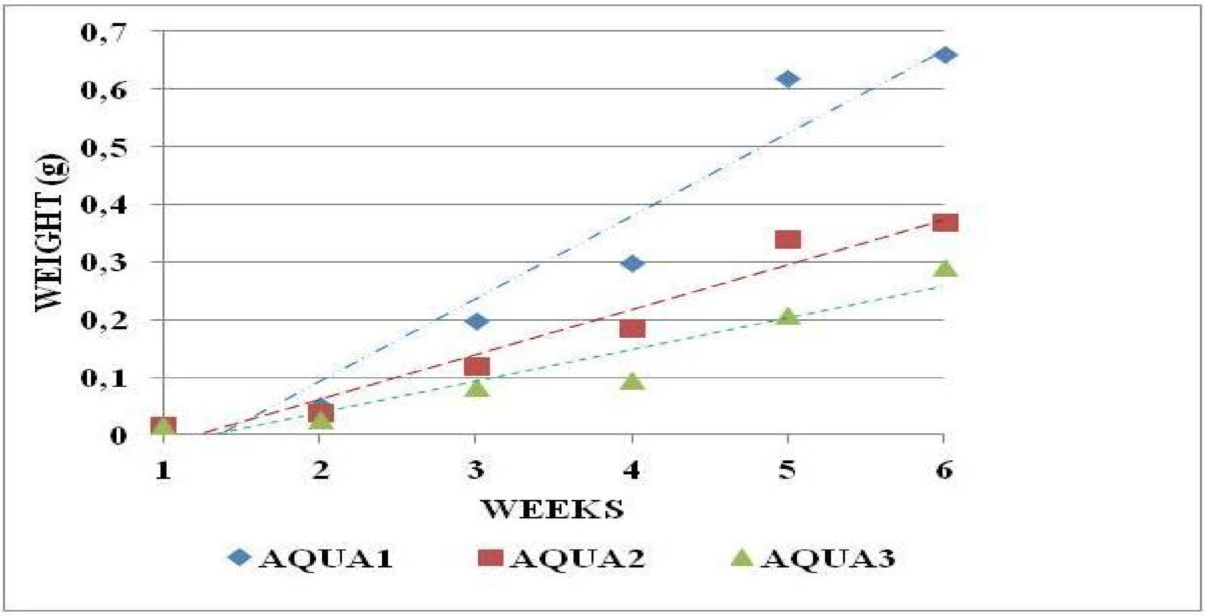

Figure 4: A comparison of the weight in treated and untreated aquariums.

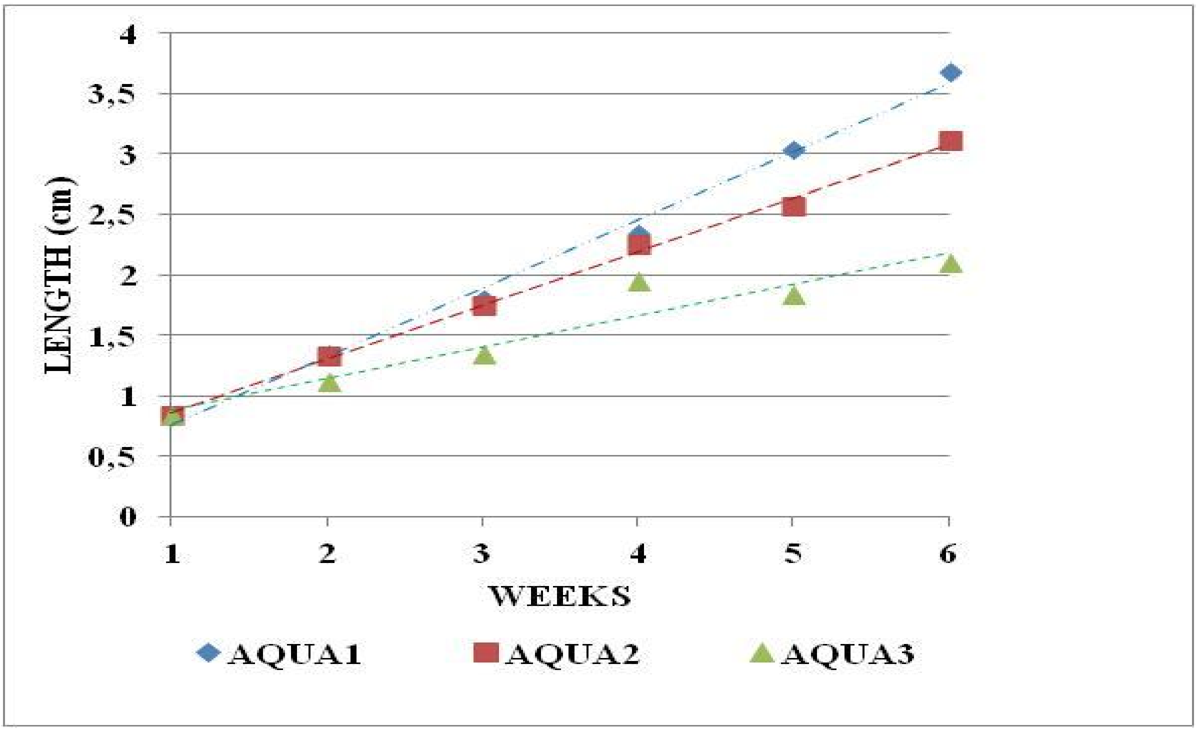

Figure 5: A comparison of the length in treated and untreated aquariums.

Conclusion

The effects of continuously applied evaporation reduction monolayer of Hexadecanol were evaluated using aquatic micro-system. The studies were carried out in the Ouargla University Aquaculture laboratory.

No significant pH changes occurred in the experimental ecosystem. The water temperature in the untreated aquariums was superior from those in the treated aquariums but the difference did not exceed 1 to 2°C.

The evaporation reduction monolayer reduced the oxygen diffusion rate by approximately 8% for the case of Hexadecanol at 0.09g/m^2 and 17% for the case of Hexadecanol at 0.15g/m^2.

Both treatments also reduced the growth of larvae of *Tilapia*; the difference between larvae in the untreated aquaria and treated aquaria at the end of experience was of about 40% to 50% for weight and 16% to 42% for length.

The physical and chemical values obtained are at the limits of tolerance of *Tilapia nilotica* at the embryonic stage [14].

The mortality which is registered in three aquariums during the experience is caused by:

- bad manipulation of larva during the measures of weight and length,
- thermal stress after the renewal of the water, and
- the phenomenon of cannibalism intra-specific which was observed.

This means that the film has no effect on the mortality of fishes. This last result is consistent with that of Mansfield who concluded that monolayers have no remarkable effect on the marine life but without giving nature of the tested marine beings. This confirms the result already obtained previously by Eaton (1958) [15], and Cruse and Herbeck (1960) [16] who found that monolayers including Hexadecanol have no toxic effect on the life of aquatic animals.

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