Efficiency of decolorized textile waste water for fish culture (ie) growth, survival and feed utilization of edible fish *Tilapia Oreochromis mossambicus* (Peters, 1852).

1. **INTRODUCTION**

The textile dye effluent waste water treated with iron oxide nanoparticle become almost colorless and equal to drinking water quality in visibility as shown in previous chapter for the purpose of eco restoration further, used to test its efficacy in irrigation and aquaculture. Water needs increase and fresh water sources become taxed to the limit and as a result, many regions have been forced to reassess the long-term reliability of their water supply systems (Wright et al., 1995). In addition, there is a growing awareness of the need to restore and preserve our aquatic ecosystems by allowing larger volumes of water to remain within the banks of the streams. As stated by Wright et al., (1995) water resource and management issues are becoming increasingly critical. It is estimated that within the next fifty years the world population will increase by another 40 to 50%. The population growth, coupled with industrialization and urbanization, will result in an increasing demand for water and related consequences on the environment (World Water Council, 2010). Even now in many countries drinking water trade is a popular and roaring business.

The length-weight relationship is one of the standard methods employed to obtain authentic biological information. It is required in population dynamics of fisheries stock assessment (Gulland, 1983; Bagenal and Tesch, 1978; Entsna - Messab et al., 1995). It is also useful for a wide number of studies such as estimating growth rates, age structure and other aspect of fish and shrimp population dynamics (Tsoumani et al., 2006). It is important in fishery management for comparison of growth studies.
(Moutopoulos and Stergiou, 2002; Hossain et al., 2006). The relationship between length and weight of the fish is frequently used to compare the effect of biotic and a biotic factor on the health or well-being of a population (Cone, 1989). It is the direct way of converting logarithmic growth rates into weight and indicates the events in the life history such as metamorphosis and the onset of maturity (Venkataramanujam and Ramanathan, 1994). According to Allen (1938) during the growth period if the fish does not change its form or density the weight will be proportional to the cube of any linear dimension. If any morphological change occurs in the body shape of the fish, the co-efficient regression of logarithmic weight on logarithmic length deviates from ‘3’. If the fish maintain the same shape through its life without any change then ‘b’ is equal to ‘3’.

Food is the source of energy for fish carry out basic biochemical function such as growth, reproduction and movement. Fish growth is influenced by feed availability and intakes, genetics, age and size, environmental and nutrition. Among these factors, feed intake is perhaps the principal factor affecting growth rate of fish (Lee et al., 1997). The contribution of aquaculture to global supplies of fish, crustaceans, mollusks and other aquatic animals was growing at a rate of 3-4% in 2004. According to FAO (2006), production in capture fisheries is stagnating or dwindling and aquaculture output is expanding faster than any other animal-based food sector worldwide. The fast growing fish is widely accepted by fish farmers and consumers because of its moderate and range of price, taste and fast growing rate. A good feed must be cost efficient, palatable and must meet the nutrient requirement of the fish (Jamabo et al., 2015). The growth of fish and feed conversion rate are dependent on species, genetic strain, sex, stage of reproductive cycle, etc., and it leads different nutritional requirements. Growth also affected by quality of diet, energy content, nutrient balance and etc., as well as
environmental condition such as water temperature, oxygen content, water flow rate, etc (Shepherd et al., 1989).

The environment of aquaculture for fin fish, shell-fish are a complex system, consisting of several water quality variables, only a few of them play decisive role. The critical parameters are temperature, suspended solids and concentrations of dissolved oxygen, ammonia, nitrite, carbon dioxide and alkalinity. However, dissolved oxygen is the most important and critical parameter, requiring continuous monitoring in aquaculture production systems. This is due to fact that fish aerobic metabolism requires dissolved oxygen (Timmons et al., 2001).

During the past couple of decades genetically improved Tilapia (GIFT) has positioned itself as a low cost, high-yield profitable fish (Yosef, 2009). It has high level protein, amino acids, vitamin, and mineral food content (Qayyum et al., 2005). Tilapia is the second largest farmed fish group in the world next to carp (Workagegn et al., 2014). Tilapia is otherwise called “aquatic chicken”. Fish obtained from polluted water will deposit biochemical but at a different level of composure in fish species (Fafioye and Adebanto, 2013). These contaminations can be very toxic to the system of fish (Aziza and EL-Khaldi, 2010). However the unwanted waste water releases from several industries particularly textile dye industries produced undesirable and harmful effects on the environmental and cause problems in aquaculture. Textile dye effluent is usually treated partially by several methods including physical, chemical and biological methods. However, after decoloration the treated water is allowed to water system. That also cause harms to plant and animals along its course. Since, the aim of the present study was to find out a cheap and reliable decoloring method using Nano biotechnology and the use of textile decolorized water in the agriculture and aquaculture.
2. MATERIALS AND METHODS

Experimental fish

*Oreochromis mossambicus* (W.K.H. Peters, 1852) Mouth brooding fish was chosen for the present study, as a common commercial.

Classification

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Animalia</th>
</tr>
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<tr>
<td>Phylum</td>
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<tr>
<td>Class</td>
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<td>Order</td>
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<td>Cichlidae</td>
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<tr>
<td>Sub family</td>
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<tr>
<td>Tribe</td>
<td>Tilapiini</td>
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<tr>
<td>Genus</td>
<td><em>Oreochromis</em></td>
</tr>
<tr>
<td>Species</td>
<td><em>mossambicus</em></td>
</tr>
</tbody>
</table>


**Common Name** Tilapia

**Distribution**

Tilapia belongs to the species *Oreochromis mossambicus*, family Cichlidae and Order Perciformes. The *mossambicus* tilapia is native to coastal regions and the lower reaches of rivers in southern Africa, from the Zambezi River delta to Bushman River in the Eastern Cape. It is threatened in its home range by competition with the invasive Nile Tilapia.
Habitat and ecology

Occurs in all but fast-flowing waters; thrives in standing waters further south in its range it is most common in blind estuaries and coastal lakes where it tolerates brackish and marine water conditions.

Food

Feeds on algae, especially diatoms and detritus, large individuals also take insects and other invertebrates. Breeds in summer, females raising multiple broods every 3 to 4 weeks during season-males construct a saucer-shaped nest on sandy bottoms: the female mouth brood the eggs, larvar and small fry.

Age, size, lifespan

The maximum size of the *O. mossambicus* tends to vary based on its geographical location. Collections from within the native range indicate a maximum size of around 430mm. *O. mossambicus* are long-lived surviving to approximately 11 years.

Fish stock and rearing conditions

The experimental design used was randomized complete block design. The experiment was done in three times. The study was conducted in Aquarium facility, Department of animal science, Bharathidasan University, Trichy. Four tubs (17cm x 55cm) were taken. And then the tubs were filled with equal amounts of decolorized water in different concentration (25%, 50%, 100% and Control (0%) in each tub ten fishes were introduced. The fish growths were measured for 60 days.

- Control (0%) - Tap water
- 25% - 25% Textile decolorized water and 75 % tap water
- 50% - 50% Textile decolorized water and 50% tap water
- 100% - Textile decolorized water
2.1 Growth parameters

2.1.1 Body length (cm)

After the fish was sedated, the total length was measured. The total length is defined as the length from the anterior-most part of the fish to the tip of the longest caudal fin rays and is measured when the lobes of the caudal fin are compressed.

2.1.2 Body weight (g)

The body weight was measured using electronic balance. A paper towel was used to blot fish and immediately measure the weight. All the measurements were taken, gently and accurately and recorded in a data sheet.

The weight and length of the fish was measured three times during the whole experiment; in the beginning of the experiment, and at 10 days interval for 60 days. The weight of fish also has been measured in groups, to know the biomass. In the beginning the fry size is so small, the lengths of the fish were not measured but while growing handling the fish help to measure the length individually. After measurements, fish were placed into another bucket until recovery and followed by return to their tanks.

2.1.3 Length-Weight Relationship

Rearing fish were sampled by hand net in every 10 days and measured length & weight in all 10 fishes. The standard length was determined using a measuring wooden board scale from tip of snout to and of tail. Tilapia fish weight (g) was measured using an Electronic balance to 0.01g accuracy. The total length and total body weight of all fish captured were measured to the nearest 0.1cm . After using tissue paper to mop off water from the surface of the specimens, fish samples were the grouped in to various sizes for analysis. The method suggested by Le Cren (1951) was followed to compute the length and weight relationship.
Accordingly, the length-weight relationship can be expressed as:

\[ W = a L^b \]

Where \( W \) and \( L \) are weight (g) and length (cm) of the fish respectively and ‘a’ and ‘b’ are two constants (Initial growth index and regression constants respectively). When expressed logarithmically be above equation becomes a straight line of the formula

\[ \log W = \log a + b \log L \]

Where, \( a = \) intercept, \( y = \log W; \) \( x = \log L \) and \( b = \) slope.

2.2 Feeding

Ten fish were randomly distributed with commercial feed. The feed was provided for the fish only one time day. The amount of the feed was adjusted once in 10 days intervals based on the body weight of the fish (ration 5% of body weight/day).

3. RESULTS

In order to understand the possibility for aquaculture and growth parameters (survival rate, length (cm), weight (g), Weight gain (% /day), Specific growth rate (% day / fish), length & weight relationship and feed conversion ratio (FCR) of various textile dye decolorized water concentration like 25%, 50%, 100% & Control (0%) were used on the \((Oreochromis mossambicus)\). Among these water concentrations effluent water were found to be more effective in growth than control treatment.

3.1 Mortality

Textile decolorized waste water and control encountered, no mortality occurred during the 60 days experimental period, and fish in all treatment groups (Control (0%), 25%, 50% and 100%) look healthy and active. The results of survival rate showing no deformities or injuries amongst the individuals.
Plate 5. Fish growth experiment tubs with in different effluent water concentration (Control (0%), 25%, 50% & 100%)

3.2 Body length (cm)

An averages results of body length (cm) for experimental groups control (0%), 25%, 50% & 100% of decolorized water concentrations are outlined in (Table 16 & Fig.18 A &B). At the start of experiment averages of initial length had range between 20 ± 0.05 and 21 ± 0.05 cm. After the experiment period, it was noted that the fish length increased with 100% = 41 ± 0.10 cm decolorized water concentration when compared with the 25%, 50% & control (0%). The 25% = 37 ± 0.10, 50% = 39 ± 0.10 cm & control (0%) = 36 ± 0.10 cm decolorized water concentration fishes showed with significantly increased length.

Fig: 18A Before treatment the size of Oreochromis mossambicus in different decolorized (100%) water concentration at 1st day
3.3 **Body weight (g)**

An average body weight of Tilapia *Oreochromis mossambicus* for different decolorized water concentration Control (0%), 25%, 50% & 100% are presented in (Table 16 & Fig 18A&B). At the start of the experiment an average initial weight ranges between 0.06 ± 0.05mg and 0.061 ± 0.05mg were released in different decolorized water concentration. The fish weight in 100% decolorized water concentration was higher than other treatment. The higher growth of body weight were found in 100% = 121 ± 0.5mg followed by 25% = 110 ± 0.10mg, 50% = 115 ±0.15mg and control (0%) = 106 ±0.10mg respectively.

3.4 **Weight Gain (% day)**

Concerning the results of weight gain (WG) averages of weight gain during the experimental periods (i.e) 60 days for control (0%), 25%, 50% & 100% were found to be 46 ± 0.01, 50 ± 0.01, 55 ± 0.01 and 61 ± 0.02 respectively with significantly increased (Table 16). During the period 60 days after experiment 100% water concentration showed higher value than other treatment.
3.5 Specific growth (% day / fish)

Estimation of specific growth of *o. mossambicus* in different decolorized water concentration Control (0%) = 10.6 ± 0.01, 25% = 11.0 ± 0.01, 50% = 11.5 ± 0.01 and 100% = 12.1 ± 0.01 show the value obtained during the 60 days treatment period, and the results of specific growth rate showed temperature and other environmental factor not disturb each and every individual fish in different decolorized water concentration (Table 16). The maximum specific growth in 100% water concentration was obtained and minimum specific growth in control (0%) water concentration was recorded.

3.6 Feed conversion ratio

The feed conversion ratio of tilapia was carried out with different decolorized water concentration. Feed conversion ratio (FCR) was influenced the survival rate. Feed conversion ratio of 25% = 2.0 ± 0.05mg, 50% = 1.8 ± 0.05mg, 100% = 1.6 ± 0.00mg and Control (0%) =2.1 ± 0.05mg. Maximum feed conversion ratio was 100% water concentration achieved, followed by 25%, 50% and control (0%) (Table 16).
Table 16. Effect of different decolorized water concentration on of *Oreochromis mossambicus* in Aquarium

<table>
<thead>
<tr>
<th>Growth parameters</th>
<th>Control (0%)</th>
<th>Water concentration (25%)</th>
<th>Water concentration (50%)</th>
<th>Water concentration (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial body length (cm)</td>
<td>20 ± 0.05</td>
<td>20 ± 0.05</td>
<td>21 ± 0.05</td>
<td>21 ± 0.05</td>
</tr>
<tr>
<td>Final body length (cm)</td>
<td>36 ± 0.10</td>
<td>37 ± 0.10</td>
<td>39 ± 0.10</td>
<td>41 ± 0.10</td>
</tr>
<tr>
<td>Initial body weight (mg)</td>
<td>61 ± 0.05</td>
<td>60 ± 0.05</td>
<td>60 ± 0.00</td>
<td>60 ± 0.00</td>
</tr>
<tr>
<td>Final body weight (mg)</td>
<td>106  ± 0.10</td>
<td>110 ± 0.10</td>
<td>115 ± 0.15</td>
<td>121 ± 0.57</td>
</tr>
<tr>
<td>Specific growth (% day/Fish)</td>
<td>10.6 ± 0.01</td>
<td>11.0 ± 0.01</td>
<td>11.5 ± 0.01</td>
<td>12.1 ± 0.01</td>
</tr>
<tr>
<td>weight gain (g/fish)</td>
<td>46 ± 0.01</td>
<td>50  ± 0.01</td>
<td>55 ± 0.01</td>
<td>61 ± 0.02</td>
</tr>
<tr>
<td>Feed conversion ratio (FCR)</td>
<td>2.1 ± 0.05</td>
<td>2.0 ± 0.05</td>
<td>1.8 ± 0.05</td>
<td>1.6 ± 0.0</td>
</tr>
</tbody>
</table>

Values are expressed as Mean ± Standard deviation of three values

3.7 Length-Weight relationship of Tilapia

Decolorized water concentration Control (0%)

The length –weight relationship of control (0%) linear relationship between length and weight is shown in Fig 19. The 10 days interval data for 60 days was pooled and the regression equation obtained was,

\[
\log W = 1.294 + 0.349 \log L.
\]

The correlation co-efficient \((r^2)\) value was 0.997.
Fig. 19  Control (0%) water concentration 60 day growth in length-weight relationship of *Oreochromis mossambicus* fish

Decolorized water concentration (25%)

The linear relationship between length and weight in 25% water concentration was shown in Fig 20. The 10 days interval data obtained for 60 days was pooled and obtained the following regression equation.

\[
\log w = 0.322 + 0.875 \log L.
\]

The correlation co-efficient \((r^2)\) value for 25% water concentration is 0.991.

Fig. 20  Effect of 25% decolorized water concentration 60 day growth by length-weight, relationship in *Oreochromis mossambicus* fish.
**Decolorized water concentration (50%)**

The linear relationship between length and weight was shown at 50% decolorized water concentration in Fig 21. The 10 days interval data for 60 days was pooled and the regression equation obtained was,

\[ \log W = 0.329 + 0.647 \log L. \]

The correlation co-efficient \((r^2)\) value for 50% decolorized water was 0.996.

![Decolorized water concentration (50%)](image)

**Fig. 21** Effect of 50% decolorized water concentration on 60 day growth in length-weight relationship of *Oreochromis mossambicus* fish

**Decolorized water concentration (100%)**

100% decolorized water concentration linear relationship between length and weight is shown in Fig 22. The 10 days interval data for 60 days was pooled and the regression equation obtained was,

\[ \log W = 0.336 + 0.313 \log L. \]

The correlation co-efficient \((r^2)\) value was 0.997.
3.8 Aquaculture water analyses after treatment

Water quality parameters such as pH, Temperature (°C), Biological oxygen demand (BOD), Electric conductivity (EC), Dissolve oxygen (DO) and Chemical Oxygen Demand (COD) were measured in 10 days treatment water different concentration (25%, 50%, 100% and control (0%). Among these concentration 100% water concentration shows suitable than other treatment including control (0%).

The mean water pH of Control (0%) = 8.3 ± 0.7, 25% = 8.5 ± 0.5, 50% = 8.4±0.4 and 100% = 8.6 ± 0.3, highest water pH was recorded 100% decolorized water concentration, which displayed the lowest mean water pH as 0% water concentration groups were obtained with significantly increased (Table 17).

The mean temperature of treatment water 25% = 29.40 ± 2.3°C, 50% = 29.52 ± 1.9 °C, 100% = 29.54 ±1.8° C, and 0% = 29.32 ± 2.7 °C. The higher mean temperature was recorded 100% decolorized water treatment to other treatment. Lowest water mean
temperature was observed by control (0%) (Table 17). The table showed that the temperature of water from different concentration was significantly increased.

The higher amount of EC were found in 100% as 4.4 ± 1.49 (m/S) decolorized water concentration followed by 25% = 4.0 ± 2.34, 50% = 4.0 ± 1.53, and Control (0%) = 3.9 ± 2.41 m/S respectively. The minimum EC value was observed control (0%) decolorized water concentration (Table 17).

The dissolved oxygen values were recorded 25% = 4.0 ± 1.35, 50% = 4.0 ± 1.4, 100% = 4.4 ± 2.05, 0% = 3.9 ± 1.31. The highest dissolve oxygen was recorded in 100% water concentration and the lowest DO value was recorded in control (0%). The result showed that the DO of water from different water concentration was significantly increased (Table 17).

The BOD values of water in the different water concentration are presented in (Table 17). It evidence from the results that the BOD of 25%, 50%, 100% and control (0%) water concentration were significantly increased. The highest BOD in the treatment was found to be 100% as 2.7 ± 1.32 mg/L followed by 25% = 2.4 ± 1.32, 50% = 2.5 ± 1.4, and 0% = 2.2 ± 1.30 mg/L respectively.

The highest COD of water concentration control (0%) = 1.4 ± 1.28, 25% = 1.3 ± 1.34, 50% = 1.2 ± 1.37 were observed and the lowest COD value 100% = 1.0 ± 2.05 was obtained (Table 17). The table showed that the COD of water from different concentration was significantly increased. The parameters such as pH, Temperature, EC, DO, BOD and COD were showed normal in 100% textile decolorized water followed by 50%, 25% compare to control (0%).
<table>
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<th>NO</th>
<th>Parameters</th>
<th>Control (0%)</th>
<th>25%</th>
<th>50%</th>
<th>100%</th>
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<td>pH</td>
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<td>2</td>
<td>Temp (°C)</td>
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<td>29.52 ±1.9</td>
<td>29.54 ±1.8</td>
<td>29.32 ±2.7</td>
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<td>3</td>
<td>EC (m/S)</td>
<td>3.9± 2.41</td>
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<tr>
<td>4</td>
<td>DO (mg/L)</td>
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<td>BOD (mg/L)</td>
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<td>2.5±1.4</td>
<td>2.7±1.32</td>
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<td>6</td>
<td>COD (mg/L)</td>
<td>1.4±1.28</td>
<td>1.3±1.34</td>
<td>1.2±1.37</td>
<td>1.0± 2.05</td>
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</tbody>
</table>

Values are expressed as Mean ± Standard deviation of three values

4. DISCUSSION

Aquaculture has a significant effect on the survival, body length (cm), body weight (g), weight gain (g/fish), specific growth (% day / fish), feed conversion ratio (FCR), length-weight relationship, and aquaculture treated water analysis in a different decolorized water concentration system. Survival studies of Oreochromis mossambicus with reference to the effects of different decolorized water concentration. During this experiment periods, no mortality was observed in the entire group.

This experiment aimed to evaluate the physical changes of Oreochromis mossambicus over 60 days between different decolorized water concentrations. Body length (cm) of Oreochromis mossambicus in this during the experimental period, in this trial period the average length increased for 100% decolorized water concentration than 25%, 50% and control (0%) water concentration (Table 16 & Fig. 18A&B).

Furthermore the length of the Oreochromis mossambicus also grew more in 100% decolorizes water concentration than other water concentration, after the 60 days trial period. Here also can be seen the fish in decolorized water concentration was significantly increased an expression of the operation of the energy system in an animal. In individual fishes, study of growth as a fact to biological production process
that can be related to the energy supply of food intake, the energy dissipation or total metabolism and the circumstances under which the energy exchange takes place (Paloheimo and Dickie, 1966). In the present study, 100% decolorized water concentration has better growth with other treatment (Table 16 & Fig.18 A&B).

The specific growth rate of fish is size dependent and also strongly influenced by factors such as feed availability, temperature, photo period and other environmental conditions (Brett et al., 1979; Austreng et al., 1987; Saunders and Harmon, 1998). The specific growth rate decrease with increasing body mass, the mass exponent being 0.3 to 0.4 (Brett et al., 1979; Jobling 1994). In the present work revealed that the different decolorized water concentration (Control (0%), 25%, 50% & 100%) had a significantly different on specific growth rate (Table 16).

The values obtained for feed conversion ratio (FCR) were expected since the fish in 100% water concentration was lower feed conversion ratio expressed in good growth performance. This is in line with the finding of Jamabo et al., (2008) who recorded low FCR in their study in dietary protein requirement and growth performance of *Clarias gariepinus*. This enhancement in FCR suggests efficient food utilization through the extraction of more nutrients from the food and converting in to flesh (Bhijkajee and Gobin, 1997). Feed conversion ratios will vary among species, sizes and activity levels of fish as well as the environmental conditions and culture systems used. In the present study, the FCR (<2.0) values obtained in 25%, 50% and 100% the treatment indicate good growth for the textile decolorized water concentration with control (Table 16).

The fishes continue to grow throughout their life. Rapid growth indicates abundant food supply and other favorable conditions, whereas slow growth is likely to indicate non-availability of food or stress factor. The weight of the fish increased logarithmically with an increase in length, with the value lying between 2.5 and 3.5 but
usually close to 3.0 (Carlander, 1969). The ‘b’ value was calculated to find out whether the fish is growing allometrically or isometrically. If the ‘b’ value is 3.0 the growth is isometric and it holds well only when the density and form of the fish are constant. If it is allometric, the fish grows with weight increasing at slower (b < 3.0) or faster (b > 3.0) relative to the increase in length (Tesch, 1968). The regression line indicated a close relationship between males, females and juveniles. The exponent values for males, females and juveniles were around the hypothetical value (3) and the correlation coefficient (r) was greater than 0.9. During the present study, in the length-weight relationship of *Oreochromis mossambicus* the weight increased proportionately to an increase in length in different decolorized water concentration. Thus it is clear from the present study that the fishes maintain its body shape throughout its life.

Qasim (1973), Bal and Rao (1984) indicated that the values of ‘a’ and ‘b’ different not only between different species but also within the same species depending on sex, stage of maturity and food habits. In fishes, generally the growth pattern follows the cube law (Lagler, 1957). Beverton and Holt (1957) stated that major deviations from isometric growth are rare. Such cubic relationship for fishes will be valid when fish grows isometrically. But in reality, the actual relationship between the variables, length and weight, may depart from this, either due to environmental conditions or condition of fish (Le Cren, 1951). Hile (1936) proposed that the ‘b’ value for an ideal fish may range between 2.5 to 4.0. In the present study, the ‘b’ values obtained for control (0%), 25%, 50% and 100% are 1.294, 0.875, 0.647, and 0.313 respectively (Fig. 19, 20, 21 & 22). The ‘b’ value was less than 3 for all the water concentration. Growth exhibited negative allometry in all the water concentration treatment negative allometric growth indicated that the weight increases at a slower rate than the body length. Several factors such as sex, age, stage of maturity, food availability, fishing ground and environmental conditions effect on growth (Ama-Abasi, 2007). The 100% & 50% textile decolorized water concentration was higher
because of their fast growth than 25% & control treatment. The ‘b’ value was 3.12 in the pipefish *Syngnathus leptorhynchus* (Bayer, 1980), 2.66 in *S. pelagicus* (Valle *et al.*, 1997).

The regression value was greater than 0.9. During the present study, in the length-weight relationship of *Oreochromis mossambicus* the weight increase in length-weight relationship in different decolorized water concentration, thus it is clear that these fishes maintains its shape throughout its life. Similar observations were recorded in the parrot fishes from Great Barrier Reef: *S. frenatus*: 3.06 ($r^2$ 0.990) *S. niger*: 3.09 ($r^2$ 0.993) *S. psittacus*: 2.90 ($r^2$ 0.981) *S. rivulatus*: 3.14 ($r^2$ 0.982) and *S. schlegeli*: 3.12 ($r^2$ 0.992) (Chot and Axe,1996).

pH effect (acid water) on the survival, behavior and growth of nile tilapia fingerlings and adults. Tilapia is less tolerant to water pH and many develop physiological changes following transfer from natural water to acidic water. Yada and Tio (1997) studied the effects of transferring *Oreochromis niloticus* and *Oreochromis mossambicus* from neutral water to acidic water with a pH of 4.5, 4.0 and 3.5. pH may lead to behavioral changes, damage of gill epithelial cells, reduction in the efficiency of nitrogenous excretion and increased mortality. Chen *et al.*, (2001) found that *Oreochromis mossambicus* exposed to high pH for 7 days decreased ammonia nitrogen, excretion but increased urea nitrogen excretion. Van Ginneken *et al.*, (1997) exposed *Oreochromis mossambicus* to water gradually acidified to pH 4 for 27 days. The fish successfully with stood this low pH without any mortality or significant changes in energy-rich compounds and plasma $\text{Na}^+$, Cl, cortical and glucose between the control and acidified groups.

Temperature is one of the most important factors affecting the physiology, growth, reproduction and metabolism of tilapia. Normal develop, reproduction and growth were recorded the temperature range 20 to 35 °C reported by (Balarin and
Haller, 1982; Cherviski, 1982; Philippart and Ruwet, 1982). Longer exposure of tilapia to this low temperature will certainly lead to mass mortality and also feeding was reduced and feeding stop below 20 ºC. In the present study 100% decolorized water concentration lower than other water concentration treatment.

Conductivity is a good and rapid method to measure the total dissolved solids and is directly related to total solids. An analysis of decolorized water revealed that there was some resistance to the passage of electric current depending upon the concentration of the ions present in the water. Electrical conductivity is the measure of the ability of water to conduct electrical current. All the present EC values were desirable for tilapia fish growth (Boyd, 1979; Bhatnagar and Pooja Devi, 2013).

Dissolve oxygen is one of the limiting environmental factors affecting fish feeding, growth and metabolism and also fluctuation affected by photosynthesis, Respiration and dial fluctuation (Tsadik and Kutty, 1987). Demonstrate that the ambient DO range give best fish performance, while low DO levels limit respiration, growth and other metabolic activities of fish. Franklin et al., (1995) found that the rate of oxygen consumption in tilapia increased from 0.74 to 0.97 mg/L /h with increasing water temperature from 37 to 42 ºC. Similar result reported that a number of tilapia species and their hybrids (Becker and Fishelson, 1986). In the study, decolorized water treatment was higher DO compared to control treatment.

Biochemical oxygen demand (BOD) is a measure of the quantity of oxygen consumed by micro-organisms during the decomposition of organic matter. It was reported that a high BOD generally indicates the presence of excessive amounts of organic matter (EPA, 1987). This high BOD level may cause acceleration in bacterial growth and consumption of oxygen level in the river (Fafioye, 2011). In the present study 100% decolorized water treatment was less compare to control (0%) treatment.
The chemical oxygen demand (COD) is a measure of the total quantity of oxygen required to oxidize all organic materials into carbon dioxide and water (Barnes et al., 1998; Fafioye and Adebanto, 2013). It does not differentiate between biologically available and inert organic matter. Baitfish Notemigonus crysoleucas (Bodary et al., 2004) and channel catfish ponds (Boyd and Gross, 1999) reported that the BOD value has 9 mg/L in the pond treatment. In the present study, the different decolorized water treatment BOD has between 1 to 2. Chemical oxygen demand (COD) was used as an index of organic matter concentration and to estimate oxygen consumption by planktonic communities (Boyd, 1979). Mean values between 1 to 1.5 mg/L were found, which are low, when compared to ponds with channel catfish (Seo and Boyd, 2001). In the present study decolorized water can free from absent toxic organic and inorganic chemicals.

The growth of tilapia is a function of many environmental factors and water parameters. From the above results growth parameter was evidence that due to the presence of textile decolorized waste water, better growth of tilapia was seen when compared with control. And moreover aquaculture treatment water parameter like pH, temperature, EC, DO, BOD and COD shows well for the aquaculture. Therefore, objective of this research was achieved by utilizing the decolorized water for the tilapia in aquaculture efficiently by its well survival rate, body length (cm), body weight (g), average weight gain (g/fish), specific growth (%day/ fish), feed conversion ratio (FCR), length-weight relationship, and treated water analyzed. Through this experimental it is evident that the iron oxide nanoparticles treated 100%, 50% and 25% water concentration were better with tap water (control), thus the decolorized water can be used for aquaculture safely.