

**Physicochemical Analysis of Water and Soil of
Darmalak Dam in South of Kohat, Pakistan,
With Special Reference to Their Influence on Fish Growth**

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Abstract: The research was carried out to analyze the physiochemical parameters of water and soil samples from Darmalak dam of district Kohat. The physiochemical parameters include electrical conductivity, temperature, pH, total dissolve solids, color, odor and elasticity of water and soil. The consequences of the present study revealed that all physiochemical parameter were found to be in permissible range and are non-lethal for culturing and growing fishes. Henceforth, our study will provide useful assistance to the aqua culturists and fisheries managers to further improve the conditions of dam for fish growth and survival. Moreover, the information might also be valuable for determining the growth rate and productivity of fishes.

Key words: Physiochemical Characteristics of Water and Soil • Darmalak Dam • For culturing and growing fishes

INTRODUCTION

Darmalak is a small dam located on Maryam ZaiTui, 15 miles south of Kohat, 1 KM West of Darmalak Village (Geographical coordinates are 33°23'37"N 71°13'36"E), KPK, Pakistan, Asia, as shown in Figure 1. The catchment area of dam is 41.5 sq miles and the estimated avg. annual runoff is 10020 AF, whereas the gross, live and dead storage of reservoir are 8662, 8209 and 453 AF respectively. The max conservation level is approximately 1760 ft. AMSL. The purpose of dam construction was to control flood, to provide better irrigation and last but not the least for cultivation of fishes.

The aquatic bionetwork is the world most complicated ecology anywhere water is the most imperative resource for aquatic life and is equally essential for the growth and survival of other living beings. Water is also necessary for domestic, irrigation,

industrialization, agricultural and fishery production. Consequently, for each necessity, physicochemical analysis of water is relatively necessary as contaminated or polluted water couldn't be used for any purpose. Therefore, its analytical study suggests the condition for fish production, agriculture and for other purposes [1].

Population of fishes extremely dependent upon the variants of physiochemical characteristics of their marine environment which help in maintenances of their biological function and also the Physicochemical properties of water play an important role in the maintenance of healthy environment alone with water soil is also an important factor which directly or indirectly effect the environment of ecology and survival of fishes [2-9]. Fish are motivated to the areas that are physiologically best by their physicochemical environment [10-12].



Fig. 1: Map showing Darmalak dam located south to Kohat, KPK, Pakistan, Asia

Numerous studies have been conducted on the physiochemical analysis of water with respect to their influence on fish's survival. Marshall and Elliot [13] studied the relation between different species of fishes and effect of water temperature, salinity, DO (Dissolve oxygen) on their survival. Additional studies determined that fishes migrate from alkaline water when pH level of water approaches 9.06 to 10.0 [14].

Therefore the present study was conducted for assessing the quality of water and soil of Darmalak dam for proper growth and easy survival of fishes by means of some selected physicochemical properties. The present study will provide useful information for monitoring the changes in the water and soil quality as a result of the dam's natural dynamics over time.

MATERIALS AND METHODS

Study Area: The present study is performed on Darmalak dam located on Maryam Zai Tui, 15 miles south of Kohat, 1 KM West of Darmalak Village (Geographical coordinates are 33°23'37"N 71°13'36"E), KPK, Pakistan, Asia shown in Figure 2.

Sampling: Six samples of water and soil were collected from different locations at Darmalak dam. Water samples were collected in properly washed plastics vessels, while soils were collected nearer the bottom of dam and then placed in air tight polyethylene bags for further analysis by using the methodology followed Rehman *et al.* [15].

Physiochemical Characteristics: The physiochemical characteristics such as total dissolve solids (TDS), conductivity (EC), temperature, color, odor, elasticity and pH of water and soil samples collected from Darmalak dam was analyzed. Features like color, odor were detected at the sampling site while the remaining features were studied in laboratory.



Fig. 2: Darmalak dam's view

Total Dissolve Solids & Electrical Conductivity:

Electrical conductivity of water and soil samples were determined using *Jenway* conductivity meter, (Model no 4520) 0.1 M solution of potassium chloride (KCl) was used for the calibration of conductivity meter. The electrodes were dipped into water and soil samples one by one in order to check the conductivity of samples individually. Electrodes were washed properly with distilled water and dried each time before dipping it in the sample bottles so as to reduce the chance of error. Same procedure was followed to analyze the TDS in all samples.

Temperature: Temperature is among those factors which greatly affect the ecosystem and the temperature of the region is responsible for the physiological behavior and distribution of life there. Consequently it is convenient to determine the temperature of the dam as it helps in understanding the behavior of life under water. For temperature measurement APHA method was followed [16, 17].

Hydrogen Ion Concentration: Electrical *Jenway* pH meter, model no 3020 was employed for the analysis of pH of water and soil samples. The analysis was carried out according to method followed by Torimiro *et al.* [18].

RESULTS AND DISCUSSION

Color, Odor & Elasticity: The wave length of visible light that reflect from an object determine its color. Although the color of water and soil varies from place to place due to number of factors, these colors indicate whether the water or soil is suitable for the proper growth and survival of aquatic organisms or not like Pale colored, light greenish and greenish colored water are suitable for the growth of fishes, light green water is satisfactory for their growth while dark green and dark brown colored water both are mortal for growth of fishes [19]. The presence of plankton was also confirmed by the help of water color. Bluish green, green and brownish green shows abundances of planktons, these creatures directly or indirectly affect the ecology system. They serve as a food supplier and also reduce the chance of deoxidation of water up to great extent [20]. Odor has aesthetics effect on aquatic lives. When agricultural or industrial wastes are drained into these natural water bodies they not only contaminate the water but also soil and produce odor in them. The color, odor and elasticity of samples collected from Darmalak dam is shown in Table 1.

Total Dissolve Solids: Habitually the total dissolved solids (TDS) of soil ranges between 5 to 1000 mg/L. In current study, the TDS values of water and soil samples as shown in (Tables 1 and Fig. 3) lies between the WHO and BIS permissible limit (i.e. 500-1000mg/l) [21, 22]. Henceforth it is also suitable for drinking purpose. As the TDS value of the soil and water samples lies in the range of low salinity. Thence, the TDS values of dam are suitable for the survival of aquatic organisms.

Temperature: As describe earlier that temperature is among those factors which greatly affect the ecology system. Being cold blooded the metabolic activities, growth factors; reproductive activities and also the feeding of fishes directly depend on the temperature of water. The optimal temperature required for the proper growth and reproduction of fishes lies between 26-32°C [23]. The temperature beyond the range may increase the growth of microorganism which then cause color change, unpleasant smell, bad taste and destructive issues in aquatic system [24]. The recorded temperature of (water and soil) Darmalak dam was much closer to the optimal range (Table 1 and Fig. 3). Hence from result of current research it can be concluded that the temperature of Darmalak dam is suitable for the appropriate growth and survival of aquatic organisms.

Electrical Conductivity: Electrical conductivity is the ability of an aqueous solution to convey electric current from it. Although conductivity of aquatic system don't affect growth and survival of fishes as much as other parameters. The sensible range of conductivity lies between 15-500 $\mu\text{S}/\text{ml}$, values afar this range indicates that the water is not suitable of the survival of aquatic organisms [25]. In present research the electrical conductivity of both water and soil samples of Darmalak dam was found to be in range i.e. 0.65 $\mu\text{S}/\text{ml}$ individually and is appropriate for the reproduction and survival of fishes.

Hydrogen Ion Concentration: Hydrogen ion concentration (pH) is another important factor which Affect the aquatic life. Both acidic and basic media can

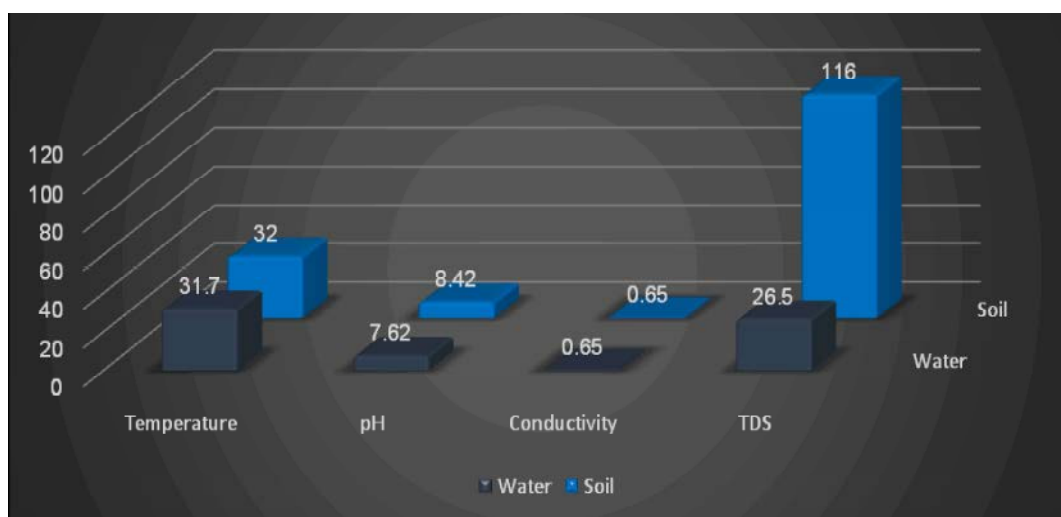


Fig. 3: Graph showing the comparative study of different parameters of water and soil from Darmalak dam

Table 1: Showing the physiochemical parameters of Darmalak dam

Samples	Temperature°C	pH	Conductivity	TDS	Color	Odor	Elasticity
			µs/ml	mg/100ml			
Water	31.7	7.62	0.65	26.5	colorless	odorless	Not elastic
Soil	32	8.42	0.65	116	red	odorless	Elastic

endanger the life of fishes such as acidic media consequences in the production of erosion and tuberculation while alkaline media results in incrustation, deposition and difficulties in chlorination for disinfections of water. The optimum pH of water and soil which favors the growth of fishes lies between 6.5-9.5 and 6.5 to 8.4 correspondingly [26, 27]. The pH of Darmalak dam's water and soil samples are in the above mentioned range favoring the growth and supporting the survival of fishes. Our results were in agreement of Pawar and Pulle [28] and Thunjai [29].

CONCLUSION

Physiochemical properties of water and soil of Darmalak dam were determined by analyzing some features like color, odor, temperature, TDS, EC etc. The analysis was done because both growth and survival of aquatic system dependent on the physical and chemical quality of water and up to some extent on soil of aquatic bottom. Contaminated water is responsible for deprived growth, poor feeding efficiency, death of fishes and also for the disease outburst. Consequently, it can be concluded from above given results that the water and soil of Darmalak dam is suitable in all respects for the growth, proper reproduction and survival of fishes as all parameters are under or within the permissible range.

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