Discharge of the sediment load and, its physical and chemical characteristics of Koudiat Errasfa Dam.

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Abstract:

Discharge of sediments load as well as its physical and chemical characteristics of Koudiat Errasfa Dam has been monitored for understanding the nature of the sediments quality its development, its effect of water. Composited samples are acquired from different depths, starting from the water surface down to 30 m depth and horizontally at distances from the dam.

Sediment load chemistry was monitored for (pH, Ec, Ca++, Mg++, Fe³⁺, Cl⁻) for the dam pool and Oued Lardjem suspended load. The results showed that the Koudiat Errasfa water would not adversely affect its quality for municipal or fishery use.

The physical studies which including organic content, load texture, grain-size analysis by mechanical and hydrometer methods.

Discharge of water and sediment load for Oued Lardjem (the main supplier of water to the dam) also including in this study during months of Mars, April and may, 1993. Specific erosion and the volume of sediments depositing in the reservoir also had taken big interest that to find the actual age of the dam.

Key word: Sediments, discharge, nutrients, physical and chemical characteristics.
1. Introduction

the discharge of sediment from uplands, into streams and subsequent transport of part of this material into sea are expected processes. The discharge of sediment from uplands will cause increased erosion of stream channels and banks because stream have certain capacities for transport of detritus, loss of an upland source will transfer the source of detritus to the stream channels and banks. The discharge increases drastically when the land is altered for agriculture and reaches greatest discharge from areas under going urbanization, and also the rainfall - runoff, temperature and wind as active forces affecting erosion and transportation of sediment from the land surfaces (wolman 1967 ; Guy 1964 ; Foster , Etal 1973 ; Likoms and Bormann, 1974 ; Loehr 1974 ; Omernik 1976 ).

The movement of water and sediment through a water shed is often visualized as a two phases process we call the first the « Land » phase because it covers those water and sediment processes which distributed over the land surface, e.g., rainfall and overland flow, detachment and transport. We call the second the « channel » phase which covers the processes taking place in well defined channels.

This paper deals with sediment discharge loading of streams to dam and its physical and chemical properties at Koudiat Errasfa dam.

2. Materials and methods

1. Sampling

A sample is pumped, from just below the notch in the weir, into to a 20 L bottle a predetermined flow through the weir. The composite of all of these samples is collected each week from each weir.

Analyses are run on aliquots of the composited samples if the discharge is so low that insufficient water was collected for analyses, a spot sample is taken at the time of sample pick-up.

2. Pre-processing preparation

Numbered membrane filters, MN 615, 0.45 um nominal pore-dia. 11cm φ are washed with approximately 300 ml of filtered, distilled water. The filters are dried in a dessicator, equilibrated to ambient conditions and weighed, over apolonium static eliminator, to 0.01 mg. Porcelain crucibles, used inferring, are washed in detergent, soaked overnight in chromic acid cleaning solution, rinsed, and air-dried. They are then fired to constant weight.

3. The methods

The chemical responses of the different ecosystems are documented by measuring nutrient concentrations of stream water and or by calculating the input and loss of nutrients for the watershed-stream flow is measured continuously at the base of reservoir. Samples for stream chemistry are collected weekly from the reservoir at different depths, water samples are routinely analysed, for pH by pH-meter method, Ec by conduct meter(LF4), Calcium and Magnesium by a complex (E.D.T.A), chloride by Mohr method, also determination of physical characteristics such as organic content by Ignition, texture by Hydrometer method, grain size analysis by mechanical method, bed load by trap plate method, the specific erosion by applying Gravilovic formula. The length of record varies by fraction, chemical constituent and watershed.

Result

Physical and chemical characteristics of suspended and bed load for Lardjem valley and the Koudiat Errasfa Dam.
3. Physical characteristics

Water temperature at different depths at the time of sampling was ranging from (17.5 - 21.2 °C), and for Lardjem valley between (20 - 22 °C) at the depth of (0 - 21 cm). The results shows that the temperature decreases with increasing depth [Table (1),(2)].

The organic material can originated from the uplands, from vegetation along the stream course, by generation in-situ by phytoplankton, and from the dissolved phase (Meyers and Quinn 1973). The study show that the organic matter for all samples less than 1% for particle size analysis by sieves show that the greater percents of sediments are sand that because sand precipitate at the upper layer of bed while silt and clay particles deposit between and under the sand particles.

The coefficient of homogeneity have the value greater than two, for all samples, so its values ranging from (2.72 - 4.8). For sediment texture of water samples indicate that sand percentage for Lardjem Valley equal to 88 % and for Dam around 95 % for different depths, which reflect the sandy nature of beds for the valley and the Dam.

4. Chemical characteristics

Concentrations of suspended and bed particulate material are estimates based on spot samples or on flow average concentration, the chemical characteristics for particulate of Lardjem valley and Koudiat Errasfa Dam shows a variety in values of the data with the depth of water samples, for pH the values ranging of (7.30 - 8.25) and (7.55 - 8.50) for suspended load for dam and Lardjem valley, and between (8.4 - 10.2) for bed loads at different stations [Table (3),(4)] and that indicate that the water depth is alkaline and this agree with the results of Arrognon 1976. The amount of particulate minerals in suspension depend, in a very large part, on the amount of material delivered to the stream by overland flow and to the amount of material eroded from the stream channel and banks. Suspended particulate concentrations for Koudiat Errasfa Dam ranging between (2010 - 19073.8 PPM), the results show that the concentration increase with the increasing of depths as illustrated in [Table (1),(2)]. Ec of Dam were (1211.6 - 1817.4 µs/cm) and for Lardjem valley ranging of (256.7 - 924.4 µs/cm) for suspended load and a maximum (of 2892µs/cm) for bed samples for different stations, the results shows that salinity increasing with the water depth [Table (1),(2)].

Chloride is derived almost entirely from rain unless there are local anthropogenic sources or evaporate deposits, the results indicate that Chloride concentrations lying within (134 - 204 mg/l), and decreases with depth [Table (3)] so that the waters of Lardjem valley and Koudiat Errasfa Dam depending on this results and according to international health organization suitable for human consumption. Concentration ranging between (137 - 168 mg/l) and this less than the critical value of 200 mg/l so the consider suitable for consumption by human. The results that shows calcium increasing with the depth and its concentration greater than 100 mg/l for all samples and that reflect the nature of calcite soils of the valley and the dam. Magnesium and ferric shows concentrations of (2.5 - 14.4 mg/l) and (0.002 - 0.0024 mg/l) for magnesium and ferric ions respectively. So from the view of international health organization, waters consider suitable for human consumption.

The ammonium ion sorbs to clay soils and is less likely to streams until its conversion to Nitrate, so the results show the concentration of ammonium ions ranging from (0.126 - 0.572 mg/l) and increasing with the depth of water, so that the concentration at the water surface is less than below depths because of its oxidation to nitrate. Nitrate, in particular, is very high due perhaps to the high leaching of NO₃ - N, compared to the NH₄ - N, the values ranging from (8.36 - 21.16 mg/l). For nitrate (NO₂ - N) the concentration ranging between (0.03 - 0.055 mg/l) and increasing with depth because of its oxidation to nitrate at the surface of the dam water.
5. Discharge

The amount of particulate material discharge by a stream depends not only on concentration of material in the water but also on the amount of water discharge (Shen, H.W., Fehlman, H.M., etal, 1990; Nnadi, F.N. and Wilson, K.C. 1992; Van Rijn, L.C., and Havinga, F.J.C. 1995).

Both water discharge and discharge of solids show a seasonal variability and are dependent upon the form of precipitation which appear to have a cyclical pattern not entirely consistent with the seasons (Fig.2) a peak occurs in the February. The distribution of water discharge sediment and solids volume discharge (monthly total) for Lardjem valley illustrated in (Fig.2) below which show the peak value occurs in the February 1994. For specific erosion of the water sheds and Lardjem valley for the period from (1985 - 1992) accompanied by its volumes of solids accumulated in Ton/Km²/an by applying formulas of Sogreah, Fournier and Qrovilovic illustrated in (Fig.3) below which the highest values for specific erosion got by applying Fournier formula, but the results obtained by Sogreah and Qrovilovic approximately equal, and same trend showed for volume of solids accumulated in reservoir. And depending on dead volume of the dam which in our study equal to $30.10^6$ m² with our knowledge of the annual average sediments we calculated the active age of the dam by dividing the dead volume to annual average /sediment

The result show that the active age of Koudiat Errasfa Dam equal to 95 years.

Future outlook

We shall now pose and discuss some questions which are important to our topic and which should affect the direction of future work we need more information on the deposition on fine materials. We know that many streams periodically deposit fine sediment on their banks and flood plains. Presumably, these channels often have relatively clean, sandy beds. This means that there must be radical variation in sediment transport capacity across the cross section. In our case we emphasis on grazing the up lands to reduce erosion and scouring of the bed, and using contour mulching to lowering the surface runoff, establishing of trap pools for big sediments deposition, removal of deposit from the valley and reservoir by mechanical equipment and at the end we have to treat the water for the suitability of consuming by humans.
Sogreah: \[ E_s = \frac{1}{36} (p_m^2)^{2.65} \frac{D^2}{A} \] (T/Km².an)

Fournier: \[ E_s = aR^{0.15}T \] (T/Km².an)

Qravilovic: \[ E_s = 3.14 \cdot T \cdot p_i \cdot z^{1.5} \] (T/Km².an)

Figure 1: A comparison among formulas of Qravilovic, Fournier and Sogreah for specific erosion for Koudiat Errasfa watershed.
Figure 2: Relation between sediment discharge and water discharge (monthly total) for Lardjem valley

Figure 3: Bar graph of cyclical pattern of rainfall, water discharge ($Q_W$), and sediment discharge ($Q_S$) For Koudiat Errasfa watersheds
Bibliography


