Research on Treatment Methods and Pollution Control of Construction Wastewater in Hydropower Construction Projects

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Abstract. Hydropower construction projects have the characteristics of large construction scale, short construction period, large wastewater discharge and difficult management, and the waters near hydropower stations may be close to environmentally sensitive areas such as scenic spots and historic sites and forest reserves. If construction wastewater is not treated and discharged, it will have great impact on the environment. Based on the engineering analysis of hydropower construction projects, this paper understands that the construction waste water mainly consists of stone aggregate washing waste water and concrete mixing system washing waste water. According to the principle of coagulation and sedimentation and the characteristics of engineering waste water, the construction waste water is treated by physical and chemical methods and combined with coagulation and sedimentation process, so as to reduce or eliminate negative environmental impact, avoid environmental risks and control pollution.

1. Introduction
On the one hand, water conservancy and hydropower projects can control the flow of water, prevent floods and water allocation, and meet the needs of the people for living and production water. However, on the other hand, the construction of water conservancy and hydropower projects is carried out on the sides of dams, embankments, sluices and rivers. Meteorological conditions and geographical location also have great constraints on the construction. The waste water discharged from such a difficult project has great impact on the environment and the national economy [1]. Therefore, weighing the gains and losses of the ecological environment, hydropower development benefits more than disadvantages, so hydropower projects should be built, but the proportion of impact on the ecological environment should be minimized.

China's water resources are unevenly distributed in the region. Many regions need to transfer water to meet the demand for water. Problems caused by shortage of water resources and serious water pollution are also gradually increasing. Therefore, wastewater treatment and pollution control are the things we need to do. Nowadays, environmental problems have also attracted much attention. The previous wastewater treatment measures during the construction of hydropower construction projects have been unable to meet the requirements of today's environmental protection and have many defects. This paper studies the existing problems in wastewater treatment during the construction of hydropower construction projects, puts forward some targeted ideas on pollution control of hydropower construction projects.
2. Impact of construction wastewater from hydropower construction projects on the environment

The main water pollution of hydropower construction projects is concentrated in the construction period, and the water pollution during the construction period is mainly composed of production wastewater and domestic wastewater [2].

2.1. Analysis of Influence Sources of Construction Wastewater in Hydropower Construction Projects

2.1.1. Sand and gravel aggregate washing wastewater.
In general, the SS concentration in the flushing wastewater is very high. The silt content of sand and gravel used in the material site is about 2.26% ~ 13.6%. Usually, 2.7 tons of water is needed to produce 1 ton of aggregate. The average silt content of sand and gravel is calculated at 8%. According to the principle of material balance or the measured data of analogy engineering, the SS concentration in the flushing wastewater of sand and gravel can be obtained to be about 3.0× 104 mg/L.

2.1.2 Washing Wastewater from Concrete Mixing System.
Concrete construction wastewater has the characteristics of high suspended solids concentration, small water volume and intermittent centralized discharge. According to the measured data of concrete washing wastewater concentration in analogy engineering, the concentration of wastewater pollutants (suspended matters) and pH value in concrete mixing system are calculated.

2.2. Specific Impact of Construction Wastewater of Hydropower Construction Project on Water Environment

2.2.1. Influence of Suspended Matter on Water Environment.
In the impact on the water body after the wastewater is discharged during the construction period is that it contains a large amount of solid particulate matter, which will have various impacts on the water according to the research of Karr and Schlosser[3], if the ss concentration exceeds 20,000 mg/l, the adult fish will die, thus directly affecting aquatic organisms. Other impacts are shown in figure1.

![Figure 1. Impact of Suspended Matter on Water Environment](image)

3. Principle and method of physicochemical treatment of construction wastewater from hydropower construction projects

3.1. Principle of Coagulation and Sedimentation for Wastewater Treatment
According to the engineering analysis of hydropower construction projects, sand and gravel aggregate washing wastewater is the most discharged waste water from construction. The main pollutant of sand and gravel aggregate washing wastewater is suspended solids, the concentration of suspended solids (SS) is very high, and the sediment content of sand and gravel used in material sites is about 2.26% ~
Generally, it takes 2.7 tons of water to produce 1 ton of aggregate, and the average content of sand and gravel is calculated at 8%, which shows that SS concentration in sand and gravel washing wastewater is about $3.0 \times 10^4$ mg/L. In a word, the main pollutant in sand and gravel aggregate washing wastewater is suspended solids with high concentration. At present, suspended solids are mainly treated by coagulation and sedimentation.

### 3.2. Treatment of Wastewater by Compression Sedimentation

When the concentration of particles in water is very high, they will adhere to each other. The gravity of the upper particles can squeeze out the water of the lower particles, causing the particles to be compressed. See Table 1 for specific instructions.

| Types of separation phenomena | Free precipitation | Flocculation precipitation |
|-------------------------------|--------------------|---------------------------|
| Explain                       | Suspended low-concentration solid particles are precipitated by gravity. | Removing Sand and Stone Particles from Wastewater |
| Occurrence rate               | The particles increase their own mass and speed up sedimentation through polymerization. | Removing part of SS in untreated wastewater in a sedimentation tank |

#### 3.2.1 Free Precipitation.

For particles with low concentration, such as iron filings and gravel, the settlement is not affected by the surrounding environment. Particles are affected by two basic forces in the water body: one is gravity $F_a$, The other is buoyancy $F_b$, the two forces are in opposite directions, so the force $F_c$ received by the particles is as follows:

$$F_c = F_a - F_b = (\rho_d - \rho_w)gV_d$$  \hspace{1cm} (1)

The acting force $F_c$ is the driving force of particle settling. When the particle sinks, it will immediately be affected by the resistance $F_h$ as follows:

$$F_h = C_{1h} \rho_d \frac{d}{2} u^2$$  \hspace{1cm} (2)

When the driving force and resistance reach equilibrium, the particles will sink at a constant speed. If the particle diameter is a homogeneous sphere with $d$, the settling velocity at this time is as follows:

$$u^2 = \frac{4(\rho_d - \rho_w)gd}{3C_{1h}\rho_d}$$  \hspace{1cm} (3)

#### 3.2.2 Flocculation and sedimentation.

In the process of flocculation and sedimentation, the particles collide with each other and aggregate together to make the size larger, and the sedimentation speed increases with the increase of depth. The deeper the water is, the more likely the larger particles will catch up with the smaller particles and collide and agglomerate. Therefore, the removal rate of particles depends not only on the precipitation speed, but also on the depth. Flocculation precipitation can be determined through experiments.

### 3.3. Wastewater Treatment Process

In the selection of sedimentation process, the main pollutants of sand and gravel washing wastewater are suspended solids and the wastewater has high sediment content. In the treatment process, sedimentation and clarification of wastewater can meet the requirements of recycling. Common treatments are as follows:
3.3.1 The combined process of horizontal flow grit chamber and horizontal flow (inclined plate) sedimentation tank is shown in Figure 2.

![Figure 2. Process flow chart of combination of advection grit chamber and sedimentation tank](image)

The amount of sludge produced by this kind of wastewater is relatively large, and it is difficult to discharge sludge when mechanical sludge discharging devices are not generally used. Therefore, the combination process of horizontal flow grit chamber and horizontal flow (inclined plate) sedimentation tank should not be adopted at this stage.

3.3.2 Complete set of sewage purifier.
High treatment efficiency, short process route, stable and reliable operation, simple management and operation, and realization of online rapid, continuous and efficient treatment; After the completion of this project, the complete set of treatment equipment can also be transported to other construction sites for further use to realize the purpose of recycling. After comprehensive analysis, the complete sewage purifier treatment plan is taken as the recommended plan for wastewater treatment at this stage.

4. Construction wastewater pollution control management

4.1 Layout of Monitoring Section
Monitoring points, water sample collection and sample analysis selection methods are set up at the water inlet and outlet before treatment of sandstone flushing wastewater, foundation pit wastewater and waste water from the left bank construction production and living area. See Table 2 for monitoring items, monitoring period, monitoring period and frequency.

| Object                     | Waste water from sandstone processing                                      |
|----------------------------|--------------------------------------------------------------------------------|
| Monitoring point           | Water inlet and outlet of waste water treatment facilities of sandstone processing system |
| Monitoring parameters      | SS, waste water flow                                                         |
| Monitoring frequency and time | The construction peak period and normal operation period shall be monitored for one year each. Monitor once a year and once a month. |
| Remarks                    | The peak period of sandstone processing is the second year of the construction period. |

5. Conclusion
During the construction of hydropower projects, "all parties participating in the construction should attach great importance to environmental protection" through optimizing the design scheme,
reasonable construction layout and strengthening management "to reduce the adverse impact of construction projects on the environment"; during the construction period, effective environmental protection measures shall be taken to prevent and control the adverse effects on the environment caused by the implementation of hydropower construction projects, so as to bring greater social and economic benefits to the project; optimization of design and construction layout should be conducive to environmental protection, and targeted environmental protection measures should be formulated while formulating construction technical measures and organizing construction. All parties participating in the construction should strengthen the construction management, improve the environmental protection network, perfect the system, implement the responsibility, take measures in place to achieve civilized construction; strictly take measures to do a good job in environmental protection to prevent production wastewater and domestic sewage from polluting the environment.

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