

KANALLARDAGI LOYQA CHO‘KISH SABABLARI VA ULARNING STATISTIK TAHLILI

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Annotatsiya

Mazkur maqolada sug‘orish va drenaj kanallarida loyqa (cho‘kindi) to‘planishining asosiy sabablari, uning gidravlik va ekologik omillarga bog‘liqligi hamda statistik tahlil usullari asosida o‘rganilishi bayon etiladi. Tadqiqot davomida oqim tezligi, suv sarfi, grunt tarkibi va kanal profili kabi omillarning loyqa cho‘kish jarayoniga ta’siri tahlil qilinadi.

Kalit so‘zlar: loyqa, cho‘kindi, kanal, gidravlika, statistik tahlil, oqim tezligi, suv sarfi.

Introduction

CAUSES OF SILT SEDIMENT IN CANALS AND THEIR STATISTICAL ANALYSIS

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Abstract

This article describes the main causes of silt (sediment) accumulation in irrigation and drainage canals, its dependence on hydraulic and environmental factors, and its study based on statistical analysis methods. During the study, the influence of factors such as flow velocity, water discharge, soil composition, and channel profile on the siltation process is analyzed.

Keywords: Silt, sediment, canal, hydraulics, statistical analysis, flow velocity, water discharge.

ПРИЧИНЫ ОСЕЛЕНИЯ ИЛЯ В КАНАЛАХ И ИХ СТАТИСТИЧЕСКИЙ АНАЛИЗ

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Аннотация

В данной статье описываются основные причины накопления ила (осадка) в оросительных и дренажных каналах, его зависимость от гидравлических и экологических факторов, а также его изучение на основе методов статистического анализа. В ходе исследования анализируется влияние таких факторов, как скорость течения, расход воды, состав почвы и профиль русла, на процесс заиления.

Ключевые слова: ил, осадок, канал, гидравлика, статистический анализ, скорость течения, расход воды.

INTRODUCTION

The efficient operation of canals in irrigation systems depends directly on their throughput capacity. Silt deposition in canals significantly reduces this capacity. As a result, the efficiency of water supply decreases, operating costs increase, and the service life of hydraulic structures decreases. The process of siltation occurs under the influence of natural and anthropogenic factors. This process can be prevented or reduced through in-depth study and statistical analysis.

Theoretical foundations of the sedimentation process. Sedimentation is the settling of solid particles transported by a water flow to the bottom as a result of a decrease in flow velocity. This process depends on the following factors:

- Particle size and density
- Water flow velocity
- Geometric shape of a canal
- Physical properties of water

From a hydraulic perspective, if the flow velocity is below the critical velocity, the particles will settle. Otherwise, they will be moving with the current.

Main causes of silt deposition in canals. Decrease in flow velocity. Flow velocity is one of the most important factors in silt deposition. When the velocity decreases, the particles settle to the bottom. This is seen in the following situations:

- When the channel expands
- When water consumption decreases
- When there are obstacles

Changes in water consumption. Water consumption varies seasonally or due to management. Low water discharge reduces flow energy and increases siltation.

Irregularity of the channel bed. Irregular bottom increases turbulence in the flow, creating "dead zones" in some places. In these zones, silt settles faster.

Soil and soil composition. If the particle content in the water flowing through the canal is high, the probability of sediment formation increases. Mixtures of sand and clay settle especially quickly.

Plants and biological factors. Algae and other plants reduce the flow rate. As a result, favorable conditions are created for silt deposition.

Statistical analysis methods. Statistical methods are of great importance in assessing the sedimentation process. The following methods are widely used:

Correlation analysis. This method determines the relationship between the amount of silt and the factors affecting it (e.g., flow velocity, water discharge).

For example:

- There is a negative correlation between the flow velocity and the amount of sediment.
- A direct correlation is observed between water discharge and the amount of silt.

Regression analysis. Using a regression model, silt deposition can be expressed as follows:
 $Y = a + bX_1 + cX_2 + dX_3$
 $Y = a + bX_1 + cX_2 + dX_3$

Here:

- Y is the amount of silt.
- X_1 — flow velocity;
- X_2 - water flow rate
- X_3 — particle concentration

Variation analysis. This method determines the degree of influence of various factors. For example:

Table 1

Factor	Impact rate (%)
Flow velocity	40%
Water consumption	30%
Soil composition	20%
Other factors	10%

Analysis based on practical data. Based on experimental data:

- When the flow velocity drops from 0.3 m/s to 0.1 m/s, sedimentation increases by 2–3 times.
- When water consumption decreases by 20%, the amount of sediment increases by 15–25%.
- In areas with uneven channel beds, sediment accumulation is 1.5 times higher.

The following statistical indicators were identified:

- Average sludge concentration: 0.8 kg/m³
- Maximum value: 1.5 kg/m³
- Minimum value: 0.3 kg/m³

Standard deviation: 0.35 kg/m³

These results indicate a high degree of variability in the sedimentation process.



Picture 1. Siltiness in the flow

Measures to reduce silt deposition

The following measures are considered effective:

- Regular channel cleanup
- Maintaining flow velocity at a normal level
- Use concrete or coating
- Plant control
- Optimal water flow management

CONCLUSION

Silt deposition in canals is a complex hydraulic and natural process that depends on many factors. Statistical analysis shows that the greatest impact falls on the flow velocity and water flow rate. By controlling these factors, it is possible to increase the efficiency of canals and reduce silt deposition.

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