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СОДЕРЖАНИЕ

ТЕХНИКА И ТЕХНОЛОГИЯ

- Жангалиев И.Т., Салагаев Е.А., Колесников А.А.** 5
СРАВНИТЕЛЬНЫЙ АНАЛИЗ КРИПТОГРАФИЧЕСКОЙ СТОЙКОСТИ И ПРОИЗВОДИТЕЛЬНОСТИ
ФАЙЛОВЫХ ШИФРУЮЩИХ СИСТЕМ: EXT4/CRYPTO, APFS ENCRYPTION И BITLOCKER

ЭКОНОМИКА И УПРАВЛЕНИЕ

- Nguyen Anh Hoa** 13
ASSESSING SURFACE WATER QUALITY IN THE MAIN RIVERS OF MINING DISTRICTS IN LAO CAI PROVINCE
USING CLUSTER ANALYSIS (CA) AND PRINCIPAL COMPONENT ANALYSIS (PCA)
- Nguyen Anh Hoa** 14
RISK MANAGEMENT PRACTICES IN VIETNAMESE ENTERPRISES IN THE CONTEXT OF DIGITAL
TRANSFORMATION

ФИЛОСОФИЯ

- Бучина Л.Д.** 19
ОБЪЕКТИВНАЯ РЕАЛЬНОСТЬ И СУБЪЕКТИВНОЕ СУЖДЕНИЕ. ДИАЛЕКТИКА ИСТИНЫ

ФИЛОЛОГИЯ

- Abdukarimova F.Sh.** 43
SOME THEORETICAL VIEWS ON MORPHOLOGICAL FEATURES OF THE TAJIK NOMINAL SUFFIX –GAP AND
ITS ENGLISH EQUIVALENTS

ПОЛИТОЛОГИЯ

- Akmyradov Sh., Charyyev D., Charyyeva A.** 49
THE 35-YEAR PATH OF INDEPENDENCE: TURKMENISTAN'S ECONOMIC MIGHT, INDUSTRIAL GROWTH,
AND DIGITAL REFORMS
- Jumayeva A., Altyyeva S., Yagshymyradova O.** 50
THE 35TH ANNIVERSARY OF TURKMENISTAN'S INDEPENDENCE: NATIONAL HERITAGE, ACHIEVEMENTS
IN SCIENCE AND EDUCATION, AND THE ENHANCEMENT OF THE COUNTRY'S INTERNATIONAL PRESTIGE
- Nurmedova G., Karayeva G., Annamyradova O.** 52
THE DEVELOPMENT OF EQUESTRIAN SPORTS AND THE EXPANSION OF INTERNATIONAL COOPERATION
IN MODERN TURKMENISTAN
- Paltayeva G., Akmedova G., Amansahedov D.** 53
THE PATH OF STATEHOOD OF INDEPENDENT, PERMANENTLY NEUTRAL TURKMENISTAN: THE ERA OF
DYNAMIC PROGRESS WITH THE STEED'S PACE

ЭКОЛОГИЯ

- Nguyen Hoang Nam, Nguyen Hoang Nam Anh** 57
RESEARCH AND EVALUATION OF IRON IN ACID MINE DRAINAGE REMOVAL EFFICIENCY BY SUBSURFACE
FLOW CW SYSTEMS IN VIETNAM
- Nguyen Hoang Nam, Nguyen Hoang Nam Anh** 62
RESEARCH EVALUATING THE EFFECTIVENESS OF SULFUR REMOVAL IN WASTEWATER USING THE SSF-
CW SYSTEM

Nguyen Hoang NamLecturer at University of Mining and Geology,
Hanoi, Vietnam**Nguyen Hoang Nam Anh**Student at University of Mining and Geology,
Hanoi, Vietnam**RESEARCH AND EVALUATION OF IRON IN ACID MINE DRAINAGE REMOVAL EFFICIENCY
BY SUBSURFACE FLOW CW SYSTEMS IN VIETNAM****Abstract**

This study evaluates the effectiveness of subsurface-flow constructed wetland (SSF- CW) treat iron in acid mine drainage (AMD) in the laboratory. Mean inflow loads of the main contaminants were 4.6 and 2.6 g m⁻² d⁻¹ for iron for summer and autumn, respectively. The mean removal rates were 58 and 38% (2.7 and 1.74 g m⁻² d⁻¹) for Fe. The treatment performance for AMD was generally efficient in the SSF system. In the SSF-CW, the decrease in iron load was mainly caused by the precipitation of Fe-oxyhydroxysulfates and hydroxides, such as schwertmannite etc., and adsorption of iron ion on plant root and sediment surfaces.

Keywords:

Fe, sulfate, CW, SSF, treatment.

1. Introduction

Acid mine drainage (AMD) in Quangninh Vietnam generated has a low pH value and high concentration of Fe. It is a significant environmental problem in Vietnam, wherever mining activities occur (Anand and Devi 2025; Qi et al. 2024).

AMD can be treated (neutralized) applying various physical, chemical and biological methods and various combinations (Yuan et al. 2020; Nguyễn Hoàng Nam 2023). The choice of a specific method depends on a number of factors such as mass flows, pollutant loads, specific environmental laws, climatic conditions, local availability of limestone, infrastructure, financial and land use issues, subjective aspects, etc. In addition to conventional treatment methods, biological methods such as constructed wetlands are increasingly employed today, especially if the financial resources are very limited in Vietnam (Nguyễn Hoàng Nam 2023).

It has long been known that natural constructed wetlands can be employed as a cheap, simple remediation technology that requires little maintenance once upstream construction costs have been met (Younger et al. 2002; Pietsch and Schötz 2004; Wiessner et al. 2006a; Nguyễn Hoàng Nam 2023).

Although the various basic mechanisms that can lead to the removal of heavy metals from the water phase in natural and constructed wetlands are well known in general, their interactions and mutual interdependence in the very complex wetland system are to date still not fully understood (Buddhawong et al. 2005; Nguyễn Hoàng Nam 2023).

Various plants are used in wetland systems, for example *cattail* (*Typha sp.*), *sedge* (*Carex sp.*), *bulrush* (*Schoenoplectus lacustris*), *flutter rush* (*Juncus effusus*), *water iris* (*Iris pseudacorus*), *sweet flag* (*Acorus calamus*) etc. The most common in Vietnam plant is the common reed (*Phragmites australis*).

The active zone in wetland systems is the root zone as the habitat for microorganisms. Resulting from the interaction of plants, soil and microorganisms living in the root zone, both organic and inorganic substances can be transformed or degraded, or eliminated from the waste water by adsorption to the sediment (Zhao et al. 2026; Anand and Devi 2025).

The wetland root zone is characterized by a mosaic structure of aerobic and anaerobic zones, enabling