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Preface

Abstract Book of ICEER2026 & ICCIVIL2026 is composed of the abstracts of the 2026 11th International Conference on Energy, Environment and Resources (ICEER2026) and 2026 8th International Conference on Civil Engineering (ICCIVIL2026). According to the similarity among the topics of ICEER2026 and ICCIVIL2026, ICEER2026 is held in conjunction with ICCIVIL2026 on August 14-16, 2026.

ICEER2026 and ICCIVIL2026 serve as an optimal platform for specialists, scholars and researchers in the field related to energy, environment, resources and civil engineering to facilitate academic communications and exchange ideas. These abstracts demonstrate the richness of interdisciplinary approaches, theories, models and applied research presented.

Major themes of the conferences include:

Energy: Solar Energy, Kinetic Energy, Potential Energy, Mechanical Energy, Mechanical Wave Energy, Chemical Energy, Electric Energy, Magnetic Energy, Radiant Energy, Nuclear Energy, Ionization Energy, Elastic Energy, Gravitational Energy, Thermal Energy, Marine Energy, etc.

Environment: Geographical Environment, Geological Environment, Cosmic Environment, Regional Environment, Ecological Environment, Marine Environment, Investment Environment, Urban Environment, Native Environment, Secondary Environment, etc.

Resources: Renewable Resources, Biotic Resources, Resource Distribution, Resource Management, Water Resources Management, Resource Economy and Management, Resources Development, Resource Exploration, Resource Exploration Engineering, Resource Science and Engineering, Resource Information Engineering, etc.

Civil Engineering: Materials Science and Engineering, Coastal Engineering, Construction Engineering, Earthquake Engineering, Environmental Engineering, Geotechnical Engineering, Water Resources Engineering, Structural Engineering, Surveying, Transportation Engineering, Civil Engineering, etc.

We thank all authors for their scientific contribution to ICEER2026 and ICCIVIL2026 and look forward to having the opportunity to showcase and disseminate your research.

Sincerely,

ICEER2026 and ICCIVIL2026 Organizing Committees

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Intra-annual Spatiotemporal Migration of the Main-channel in the Braided Reach of the Lower Yellow River

Fujian Li^{1,2}, Qiang Wang^{1,2}, Fei Yang^{1,2}, Yanhui Liu^{1,2}, Like Li^{1,2}, Yuanjian Wang^{1,2,*}

¹Yellow River Institute of Hydraulic Research, Yellow River Conservancy Commission, Zhengzhou, China

²Key Laboratory of Yellow River, Ministry of Water Resources, Zhengzhou, China

Email address:

1152725056@qq.com (Fujian Li), 1041830131@qq.com (Qiang Wang), yangfeihaoyun@163.com (Fei Yang), iuyanhui_yrcc@163.com (Yanhui Liu), 421850593@qq.com (Like Li), wangyuanjian_yrcc@aliyun.com (Yuanjian Wang)

*Corresponding author

Abstract

Main-channel migration reflects the stability and adjustment of braided rivers, yet its intra-annual spatiotemporal variation remains poorly quantified in the braided reach of the Lower Yellow River (LYR). Using Sentinel-2 imagery from 2018 to 2022, this study developed a method based on the Euclidean Distance Transform (EDT) to extract the main-channel centerline and quantify its migration width in a multi-channel river. Results confirmed that main-channel migration was highly episodic and mainly concentrated during the flood season, with additional adjustment in some reaches after the flood period. Spatially, the most active migration was concentrated from Mayugou to Guanzhuangyu and from Heishi to Youfangzhai, where the channel was relatively wide and multi-threaded. Finally, an empirical model was established to predict reach-scale migration width from mean discharge, incoming sediment coefficient, and interval duration. Calibration with 2018–2021 data and validation with 2022 data yielded relative root mean square errors of 23% and 36%, respectively. This study provides a remote-sensing-based framework for quantifying short-term planform adjustment of braided rivers and improves a basis for river regulation and channel-stability assessment in the LYR.

Keywords

Euclidean Distance Transform, Main-channel Centerline, Migration Width, Lower Yellow River, Braided River

Stepwise Attenuation and Threshold Effects of Soil and Water Conservation Sediment-Reduction Benefits in the Middle Yellow River

Peng Zhang¹, Xiaoying Liu^{1, *}, Bisheng Zhu¹, Xinyue Bao², Mengxin Bai³,
Xinhui Ding⁴, Beyene Yilma Kidanie¹

¹State key Laboratory of Water Cycle and Water Security, China Institute of Water Resources and Hydropower Research, Beijing, China

²School of Soil and Water Conservation, Beijing Forestry University, Beijing, China

³Beijing Municipal Climate Center, Beijing Meteorological Service, Beijing, China

⁴College of Geography and Environment, Xianyang Normal University, Xianyang, China

Email address:

zhangpeng@iwhr.com (Peng Zhang), liuxy@iwhr.com (Xiaoying Liu), zhubs@iwhr.com (Bisheng Zhu),
Baoxinyue@bjfu.edu.cn (Xinyue Bao), bmengxin@163.com (Mengxin Bai), dingxh@xync.edu.cn (Xinhui Ding),
b.y.kidanie@edu.iwhr.com (Beyene Yilma Kidanie)

*Corresponding author

Abstract

Clarifying the regulatory mechanisms of soil and water conservation (SWC) measures on sediment load represents a fundamental scientific challenge for ecological management in the Middle Reaches of the Yellow River. This study integrates multi-source hydrological, meteorological, and SWC data (1950–2020) from the Helong Section and Sanchuanhe Basin, employing trend analysis, correlation methods, and a novel Sediment Reduction Benefit Index (SREI) to quantify erosion control efficacy. Our analysis demonstrates that large-scale SWC implementation after 1970 established human activities as the dominant driver of drastic reductions in runoff (−77.7%) and sediment load (−94.5%). The decoupling from precipitation variability confirms SWC's critical role in sediment reduction. Concurrently, SWC benefits exhibit progressive stepwise attenuation, transitioning through three distinct phases: a high-efficiency period (1970–1985; SREI > 790 t/km²), transitional period (1986–1999), and low-efficiency period (post-2000; SREI < 130 t/km²). Mann-Kendall (M-K) tests further revealed threshold behaviors, with abrupt changes occurring in 2008 for integrated watershed management. Vegetation measures (afforestation/grass planting) mirrored this timing, while structural interventions (terraces/check dams) reached critical points 10–15 years earlier (1990 and 2005). Although sediment load dynamics show significant time-scale dependencies that may bias decadal assessments of SWC efficacy, geographic-scale effects remain negligible. Collectively, these findings underscore the urgent need to transition regional SWC strategies from traditional areal expansion toward structural optimization paradigms to counter diminishing marginal benefits.

Keywords

Yellow River, Soil and Water Conservation, Sediment Reduction, Threshold Effect, Stepwise Attenuation

Wind Farm Layout Optimization Considering Fatigue-induced Maintenance Costs to Drive Optimal Levelized Cost of Energy

Yuhang Jiang¹, Wenzhong Shen^{2,*}

¹College of Hydraulic Science and Engineering, Yangzhou University, Yangzhou, China

²College of Electrical, Energy and Power Engineering, Yangzhou University, Yangzhou, China

Email address:

yzdxyjh@outlook.com (Yuhang Jiang), wen_zhong_shen@outlook.com (Wenzhong Shen)

*Corresponding author

Abstract

Current wind farm layout optimization (WFLO) studies predominantly treat operation and maintenance (O&M) costs statically, neglecting the dynamic degradation of turbine components caused by complex wake-induced fatigue accumulation. To address this issue, this study aims to establish a novel WFLO framework optimized for the Levelized Cost of Energy (LCOE), utilizing turbine fatigue accumulation as the core engine driving O&M costs (OPEX) and downtime losses. First, a multi-condition fatigue load database is constructed via extensive aeroelastic simulations considering diverse inflow and wake interaction conditions, followed by the training of an Extreme Gradient Boosting (XGBoost) algorithm to efficiently predict Damage Equivalent Loads (DELs). Secondly, this advanced machine learning-based fatigue model is coupled with a refined LCOE economic model. Discarding traditional static cost assumptions, the framework leverages the fatigue prediction model to directly quantify structural damage, translating it into additional baseline-exceeding OPEX over the wind farm's lifecycle. Finally, the Random Search (RS) algorithm is employed to execute the fatigue-constrained layout optimization. Systematic evaluations indicate that XGBoost serves as the optimal fatigue prediction model, balancing high precision with computational efficiency, while the RS algorithm effectively navigates the complex nonlinear relationship between fatigue limits and spatial layout. Wind farm application tests confirm that, by imposing fatigue tolerance constraints to ensure operational safety, the optimized layout effectively mitigates severe wake superposition. Under full wind direction scenarios, while strictly limiting component fatigue and reducing OPEX, the framework still achieves an Annual Energy Production (AEP) increase of 0.39% to 3.89%. Cost-benefit analysis further validates that setting reasonable fatigue tolerance limits yields higher lifecycle economic returns compared to unconstrained designs. By deeply integrating fatigue assessment with LCOE, this study realizes the co-optimization of energy yield and lifecycle costs, providing a precise and novel paradigm for the cost-safety balanced design of wind farms.

Keywords

Fatigue Load, Wake Effect, Annual Energy Production, Wind Farm Optimization, Levelized Cost of Electricity

Unlocking the Value of Soil and Water Conservation Ecological Products: Insights from the Qingshui River Basin (Yellow River)

Peng Zhang^{1, *}, Zihui Yue², Mengxin Bai³, Sunxun Zhang¹, Jiali Jiang², Qiang Ma², Xinyue Bao⁴

¹State Key Laboratory of Water Cycle and Water Security, China Institute of Water Resources and Hydropower Research, Beijing, China

²Soil and Water Conservation Research Division, Ningxia Institute of Water Resources Research, Yinchuan, China

³Beijing Municipal Climate Center, Beijing Meteorological Service, Beijing, China

⁴School of Soil and Water Conservation, Beijing Forestry University, Beijing, China

Email address:

zhangpeng@iwhr.com (Peng Zhang), shuibaozyh@163.com (Zihui Yue), bmengxin@163.com (Mengxin Bai), zhangsx@iwhr.com (Sunxun Zhang), 549875927@qq.com (Jiali Jiang), 2479780887@qq.com (Qiang Ma), Baoxinyue@bjfu.edu.cn (Xinyue Bao)

*Corresponding author

Abstract

The value realization of soil and water conservation ecological products constitutes an important pathway for reconciling ecological protection with economic development in the Yellow River Basin. This study develops a four-dimensional analytical framework of “Environment–Institution–Technology–Market” (EITM). This paper takes the Qingshui River Basin in Ningxia—a typical tributary in the upper reaches of the Yellow River—as its primary research subject. Drawing on the “first transaction” of soil and water conservation carbon sinks in the Yellow River Basin (conducted in the Licha Small Watershed, Pengyang County) and Ningxia's first batch of large-scale contracted transactions of these products in 2025, we systematically analyze the evolutionary logic, practical constraints, and optimization pathways for their value realization. The findings show that the value realization of soil and water conservation ecological products in the Yellow River Basin is shifting from “single-point pilot projects” to “systematic integration”; however, no stable coordination mechanism has yet been established among environmental constraints, property rights governance, accounting accuracy, and market risks. Soil and water conservation ecological products in the Qingshui River Basin feature three attributes: ecological primacy, regional specificity, and significant externalities. Their value realization faces four major constraints: a strained ecological carrying capacity and narrowing room for incremental growth, poorly defined property rights and fragmented compensation mechanisms, insufficient accounting accuracy and lagging monitoring systems, and an imbalanced product structure coupled with a lack of green financial instruments. Accordingly, this paper proposes a systematic optimization pathway comprising four elements: environmental zoning and control, clarification and optimized allocation of property rights, standardized accounting and monitoring, and financial-market synergy. This aims to provide a theoretical reference and practical support for the value transformation of soil and water conservation ecological products in the Yellow River Basin and similar arid and semi-arid regions.

Keywords

Yellow River, Soil and Water Conservation Ecological Products, Value Realization, EITM Framework, Qingshui River

Research on Biomass Gas Carbon CO Production Based on Ectopic Catalysis Pyrolysis Gas Cycle Self Activation

Zhihong Lin, Jiahao Zhang, Yang Sun*

School of Energy and Environment, Shenyang Aerospace University, Shenyang, China

Email address:

3058749422@qq.com (Zhihong Lin), 1577724782@qq.com (Jiahao Zhang), 40791034@qq.com (Yang Sun)

*Corresponding author

Abstract

Traditional biomass pyrolysis technology suffers from problems such as difficult tar degradation, low quality of pyrolysis gas and severe pollution during activated carbon preparation. This paper innovatively proposes an ex-situ catalysis and circulating self-activation of pyrolysis gas coupled technology for co-production of biomass gas and carbon. Using giant reed as raw material, nickel-copper bimetallic catalyst is adopted to crack tar and upgrade pyrolysis gas, and the upgraded self-produced pyrolysis gas is used as the activation medium to prepare activated carbon. After optimizing the Ni-Cu/CaO catalyst and reaction parameters through experiments, the performance of products is greatly improved compared with the blank group. The volume fraction of hydrogen in pyrolysis gas increases from 3.9% to 36.5%, an increase of nearly 9 times. The as-prepared activated carbon possesses a specific surface area of 861.38 m²/g and a specific capacitance of 150 F/g at the current density of 0.5 A/g, with its pore structure and electrochemical properties significantly enhanced. This process requires no additional chemical reagents throughout the whole process. The high-value utilization of all biomass components is realized via the synergy of multiple reactions, which provides a new idea for the development of green technology for co-production of gas and carbon.

Keywords

Catalytic Cracking, Pyrolysis Gas Upgrading, Self-activation, Activated Carbon, Co-production of Biomass Gas and Carbon

Differentiated Hazard Mechanisms and Thresholds of Mouth Bars in Sediment-laden Reservoirs

Wang Qiang^{1,2,*}, Wang Ting^{1,2}, Ren Zhihui^{1,2}, Ma Huaibao^{1,2}, Jia Menghao^{1,2}

¹Yellow River Institute of Hydraulic Research, Yellow River Conservancy Commission, Zhengzhou, China

²Key Laboratory of Yellow River, Ministry of Water Resources, Zhengzhou, China

Email address:

1041830131@qq.com (Wang Qiang)

*Corresponding author

Abstract

Reservoir mouth bars are typical depositional landforms at confluences of main stems and tributaries. Their development occupies effective storage capacity and threatens flood control, beneficial uses, and sediment reduction. Current studies lack systematic cross-type comparisons and a unified risk assessment framework. Based on long-term field data (24–64 years) from three representative reservoirs on the Yellow River — Xiaolangdi, Sanmenxia, and Liujiaxia — this study reveals three differentiated hazard mechanisms from the perspectives of flood control, beneficial uses, and sediment reduction: tributary-type (Xiaolangdi), backwater-end type (Sanmenxia), and mid-reservoir type (Liujiaxia). A two-tier evaluation system consisting of a “specific hazard index + comprehensive risk index” is developed together with a four-level threshold system. The results show: (1) The tributary-type at Xiaolangdi exhibits a chain positive feedback of “development-sediment trapping-sedimentation reduction”, with a specific hazard index (bar height/10 m) >1.0 corresponding to high risk; (2) The backwater-end type at Sanmenxia is characterized by rising Tongguan elevation which backwaters the Weihe River flood level; the specific hazard index (elevation rise/3.5 m) >1.2 indicates extremely high risk; (3) The mid-reservoir type at Liujiaxia features “storage loss – multi-functional coupling damage”; after operation of the sediment flushing tunnel, the sediment delivery ratio increased from 0.2 to 0.6, effectively mitigating the risk. Based on the three mechanisms, a comprehensive risk index T (0–1) is constructed and a four-level threshold is established: low risk $T < 0.3$, moderate risk $0.3 \leq T < 0.5$, high risk $0.5 \leq T < 0.7$, and extremely high risk $T \geq 0.7$. This study provides a scientific basis for risk identification and targeted prevention of mouth bars in sediment-laden reservoirs.

Keywords

Reservoir Mouth Bar, Hazard Mechanism, Risk Threshold, Yellow River

Research on Recovery Process of Ultrafine Molybdenum Metal from Waterjet Cutting Molybdenum Waste Sand

Xu Yuanbo, Wang Ping*

Smelting Branch, Jinduicheng Molybdenum Co., Ltd., Weinan, China

Email address:

250099432@qq.com (Wang Ping)

*Corresponding author

Abstract

A resource recovery study was conducted on low-grade waste sand (Mo content 0.3%–0.6%, mainly composed of garnet and ultrafine molybdenum powder) generated from waterjet cutting of molybdenum plates. Process mineralogy analysis showed that molybdenum is primarily enriched in the ultrafine fraction below 30 μm . The recovery performance of a physical method ("gravity separation – electrostatic separation") and a chemical method ("water leaching – calcium precipitation") were compared. Results indicated that the physical method is limited by the "size effect," making it difficult for the concentrate molybdenum grade to exceed 3% in continuous industrial production. Based on the easy oxidation characteristic of ultrafine molybdenum powder, this study proposed a "physicochemical combined" process of "classification – calcium precipitation – gravity separation." This process achieved an overall molybdenum recovery rate greater than 85%, and the product (calcium molybdate) with a content of 67.92% was successfully prepared, which can be used as a blending raw material for ferromolybdenum smelting.

Keywords

Molybdenum-bearing Waste Sand, Gravity Separation, Electrostatic Separation, Molybdenum Leaching, Calcium Molybdate

Temperature, Salinity, and Oil-Water Competition Govern Shale Wettability at the Molecular Scale

Peixing Xu, Feng Yang*, Nong Kang, Sijia Nie, Jibin Fu

Hubei Key Laboratory of Oil and Gas Exploration and Development Theory and Technology, China University of Geosciences (Wuhan), Wuhan, China

Email address:

peixingxu@cug.edu.cn (Peixing Xu), fengyang@cug.edu.cn (Feng Yang), kangnongchina@163.com (Nong Kang), sijiaNie@cug.edu.cn (Sijia Nie), jibinf@163.com (Jibin Fu)

*Corresponding author

Abstract

Shale wettability is a critical interfacial property governing hydrocarbon distribution, multiphase transport, and fracturing-fluid flowback in unconventional energy reservoirs, yet its molecular response to temperature, brine salinity, and oil-water coexistence remains insufficiently resolved. This study elucidates the wetting mechanisms of representative organic and inorganic shale components using molecular dynamics simulations. Type II-C kerogen, hydroxylated alpha-quartz, and sodium montmorillonite surfaces were combined with SPC/E water, NaCl solution, and n-octane. Contact angles, molecular density and orientation profiles, hydrogen bonding, mean-square displacement, and fluid-solid interaction energies were evaluated over 278-353 K and in saline and oil-water-mineral systems. At 298 K, pure-water contact angles on kerogen, quartz, and montmorillonite were 86.73°, 25.45°, and 20.35°, respectively, establishing the hydrophilicity order montmorillonite > quartz > kerogen. Raising the temperature from 278 to 353 K strengthened water-mineral attraction and reduced contact angles by 12.55°-16.35°. In contrast, NaCl-induced hydration weakened mineral-water interactions and increased the angles to 98.54°, 56.21°, and 48.79°, with quartz and montmorillonite exhibiting greater salinity sensitivity than kerogen. The addition of n-octane further increased the three-phase water contact angles to 109.74°, 48.79°, and 39.80°. Interaction-energy analysis revealed competitive adsorption: kerogen preferentially interacted with oil, whereas quartz and especially montmorillonite retained stronger affinity for water. Oil restricted water spreading and increased water-water hydrogen bonding, while water orientation near mineral surfaces changed only slightly. These findings reveal the molecular origin of mixed wettability and provide a mechanistic basis for fluid management and hydrocarbon recovery from shale energy resources.

Keywords

Shale Wettability, Molecular Dynamics Simulation, Hydrocarbon Recovery, Kerogen, Quartz, Montmorillonite, Salinity, Oil-water Interaction

Development and Application of Amphiphilic Adsorbent Materials for Monitoring Trace Emerging Contaminants in Water

Jiao Wei*

School of the Environment, Nanjing University, Nanjing, China

Email address:

Jiaowei1912@126.com (Jiao Wei)

*Corresponding author

Abstract

A novel amphiphilic porous adsorbent material was prepared via micelle-emulsion polymerization for use as a solid-phase extraction (SPE) sorbent. In parallel, a fully automated SPE sampling device (LVED) was developed for on-site large-volume enrichment of trace contaminants in water. Using this newly developed device, an LVED-HPLC-MS/MS method was established for the rapid determination of 40 trace emerging contaminants in environmental water samples. The large-volume SPE conditions were systematically optimized, and method validation demonstrated good linearity ($r^2 \geq 0.992$) and low limits of detection ranging from 0.002 to 0.10 ng/L. The method was applied to on-site enrichment and detection of emerging contaminants in real environmental water samples, with spiked recoveries for various contaminants ranging from 78.0% to 107%, and actual detected concentrations of some contaminants between 0.05 and 90.5 ng/L. This method represents a simple, rapid, and efficient approach for on-site large-volume extraction of trace emerging contaminants in environmental waters, showing broad application and promotion potential.

Keywords

Emerging Contaminants, Trace Enrichment, In-situ Solid-phase Extraction

Strategic Value and Practical Challenges of the Dismantling Industry in the Context of Circular Economy

Wenlong Fang^{1, 2, *}

¹Institute of Energy and Metal Industry, Gannan University of Science and Technology, Ganzhou, China

²School of Economics and Management, Gannan University of Science and Technology, Ganzhou, China

Email address:

13237696895@163.com (Wenlong Fang)

*Corresponding author

Abstract

Against the backdrop of increasing global resource constraints, rising supply risks of critical minerals, and the rapid transition toward a circular economy, enhancing waste resource utilization has become a critical issue for resource security and green transformation. As a key conversion link between waste resource recovery and recycled material utilization, the dismantling industry determines not only the efficiency of resource separation and value recovery but also the resilience of circular economy systems and industrial supply chains. However, existing studies have mainly focused on recycling models, recovery technologies, and environmental benefits, while the strategic role and development constraints of dismantling industries remain insufficiently explored. Based on circular economy theory and an industrial chain perspective, this study investigates the strategic value and practical challenges of the dismantling industry through literature review, industrial chain analysis, and regional case studies. The findings reveal three strategic functions of dismantling industries: first, improving secondary resource supply capacity to enhance critical mineral security; second, promoting the transformation of waste resources into recycled materials to strengthen industrial circularity; and third, realizing value reconstruction through high-value resource utilization to support green industrial development. Nevertheless, the industry currently faces several structural challenges, including the mismatch between rapidly growing waste resources and insufficient standardized dismantling capacity, the conflict between high-value utilization requirements and low-end processing modes, and inadequate industrial coordination and regional imbalance. This study demonstrates that the dismantling industry has evolved from a traditional environmental protection sector into a strategic gateway industry within circular economy systems. Promoting its sustainable development requires technological innovation, improved recycling systems, stronger industrial coordination, and regionally specialized development strategies. The study contributes to a deeper understanding of the strategic positioning of dismantling industries in circular economy transitions and provides theoretical and practical implications for building resource-secure circular economy systems.

Keywords

Circular Economy, Dismantling Industry, Critical Minerals, Resource Security, Industrial Chain, Secondary Resources

Carbon Emission Calculation, Eco-efficiency Evaluation and Green Transformation Path of Lithium Industry in Jiangxi Province Under the "Dual Carbon" Goals

Jinling Huang^{1, 2, *}

¹Institute of Energy and Metal Industry, Gannan University of Science and Technology, Ganzhou, China

²School of Economics and Management, Gannan University of Science and Technology, Ganzhou, China

Email address:

9320240016@gnust.edu.cn (Jinling Huang)

*Corresponding author

Abstract

Lithium is a critical energy metal underpinning the development of new energy vehicles and energy storage industries, and its low-carbon green production is directly tied to the carbon footprint of the entire new energy industrial chain. Taking Jiangxi's lithium industry as the research object, this paper adopts the IPCC carbon emission accounting method to calculate carbon emission intensities by production segment, applies the Super-SBM model to evaluate the eco-efficiency of the lithium industry, and identifies the core influencing factors of eco-efficiency via the Tobit regression model. The results show that: (1) The total carbon emissions of Jiangxi's lithium industry are rising rapidly, with the smelting segment accounting for over 60% of total energy consumption and constituting the primary source of carbon emissions; (2) The overall eco-efficiency of Jiangxi's lithium industry remains at a moderately low level, while the mineral resource exploitation segment records the lowest eco-efficiency, with technological maturity and energy mix acting as core constraints on eco-efficiency improvement; (3) Energy consumption in conventional pyrometallurgical smelting is 1.5 times that of hydrometallurgical smelting, coal accounts for more than 50% of total energy use, and the carbon emission intensity exceeds the advanced industrial benchmark; (4) Open-pit mining dominates the resource exploitation segment, posing arduous ecological restoration challenges. On this basis, this study establishes a four-in-one green transition framework featuring "resource recycling – technological empowerment – industrial chain coordination – policy guidance", and proposes implementation approaches including green mine renovation, cultivation of low-carbon benchmark enterprises, construction of low-carbon industrial parks, and cross-regional coordinated development, providing decision-making references for the low-carbon green transformation of Jiangxi's lithium industry.

Keywords

Dual Carbon Goals, Jiangxi Lithium Industry, Carbon Emission Accounting, Eco-efficiency, Green Transition

Combustion Efficiency of Various Forms of Solid Biofuels in Terms of Changes in the Method of Fuel Feeding into the Combustion Chamber

Małgorzata Dula^{1, *}, Artur Kraszkiewicz², Stanisław Parafiniuk²

¹University of Life Sciences in Lublin, Lublin, Poland

²Department of Machine Operation and Production Processes Management, University of Life Sciences in Lublin, Lublin, Poland

Email address:

malgorzata.dula@up.edu.pl (Małgorzata Dula), artur.kraszkiewicz@up.edu.pl (Artur Kraszkiewicz), stanislaw.parafiniuk@up.edu.pl (Stanisław Parafiniuk)

*Corresponding author

Abstract

This article presents research in which four types of herbaceous waste biomass (wheat straw, rye straw, oat straw and hay) and one type of woody waste biomass (birch sawdust) were used. The basic chemical characteristics were determined for the raw materials. After appropriate preparation, the selected starting materials were subjected to briquetting and pelleting processes. Selected physical properties were also determined for the obtained biofuels. Biofuels made from birch sawdust had the lowest heat value ($16.34 \text{ MJ} \cdot \text{kg}^{-1}$), although biofuels made from wheat, rye and hay straw had a slightly lower calorific value, respectively: 16.29 ; 16.28 and $16.26 \text{ MJ} \cdot \text{kg}^{-1}$. However, the calorific value of oat straw biofuels was only $15.47 \text{ MJ} \cdot \text{kg}^{-1}$. Moreover, the ash content for herbaceous biomass was 2–4 times higher than for woody biomass. Similar differences between herbaceous and woody biomass were also observed for the nitrogen and sulfur content. To burn the prepared biofuels, a domestic grate-fired biomass boiler was used, periodically fed with portions of fuel in the form of pellets or briquettes (type A tests), which was then modified with a gutter burner enabling the automatic feeding of fuel in the form of pellets (type B tests). During the combustion tests with simultaneous timing, the concentration of CO_2 , CO , NO and SO_2 in the exhaust gases was examined and the temperature of the supplied air and exhaust gases was measured. The stack loss (q_A), combustion efficiency index (CEI) and toxicity index (TI) were also calculated. The research shows that the use of automatic fuel feeding stabilizes the combustion process. The combustion process is balanced between herbaceous and woody biomass biofuels. Disparities in CO_2 , CO and T_{gas} emissions are decreasing. However, during type B tests, an increase in NO emissions is observed. At the same time, the research conducted indicates that the combustion of herbaceous biomass pellets with their automatic feeding into the combustion chamber is characterized by an increase in combustion efficiency, indicating that when the combustion process is automated, they are a good replacement for wood biofuels—both pellets and briquettes.

Keywords

Pellets, Briquette, Combustion, Emission

Study on Hydrogen Production via Photothermal Synergistic Catalytic Reforming of Light Fractions from Lignin Hydrothermal Liquefaction

Jiachen Han, Haijun Zhang*

School of Energy and Environment, Shenyang Aerospace University, Shenyang, China

Email address:

1399647985@qq.com (Jiachen Han), zhanghaijun@sau.edu.cn (Haijun Zhang)

*Corresponding author

Abstract

The light components generated during the hydrothermal liquefaction of lignin are characterized by high water content, complex composition, difficult separation, and limited resource utilization, which have become major constraints on the high-value utilization of all lignin-derived fractions. In this study, the light components derived from lignin hydrothermal liquefaction were employed as feedstock for hydrogen production via photothermal synergistic aqueous-phase reforming, providing a promising route for waste-liquid valorization while alleviating the energy supply–demand imbalance and environmental pressures. However, systematic studies on photothermal synergistic reforming systems and the corresponding reaction mechanisms for lignin hydrothermal liquefaction-derived light components remain relatively limited. During the reforming process, these components undergo side-chain cleavage, and deep reforming reactions, ultimately producing gaseous products dominated by H_2 and CO_2 . To regulate the catalyst structure and enhance catalytic performance, three catalyst systems were rationally designed and systematically optimized, including the biochar-modified $Ti_{(5)}Ni_{(2)}-HT_{180}$ catalyst, the $TiO_2/g-C_3N_4$ heterostructured $TiO_2/Ni-g-C_3N_4$ catalyst, and the Ni–Co bimetallic synergistic $Ni/Co_{(3:1)}-TiO_2$ catalyst. The average hydrogen production rate increased from 7.60 to 14.04 $mmol \cdot g^{-1} \cdot h^{-1}$ and ultimately reached 74.48 $mmol \cdot g^{-1} \cdot h^{-1}$. These findings provide mechanistic insights and technical guidance for the comprehensive valorization of lignin-derived fractions.

Keywords

Lignin Liquefaction, Aqueous-phase Products, Photothermal Catalysis, Hydrogen Production by Reforming

LNG Cold-energy-assisted Onboard CO₂ Capture and Liquefaction for Dual-Fuel Marine Engines

To Thi Thu Ha¹, Lee Jinuk², Kang Hokeun^{1,*}

¹Department of Marine System Engineering, Korea Maritime and Ocean University, Busan, Republic of Korea

²Department of Maritime AI and Cyber Security, Korea Maritime and Ocean University, Busan, Republic of Korea

Email address:

hato20237132@g.kmou.ac.kr (To Thi Thu Ha), Julee88@kmou.ac.kr (Lee Jinuk), hkkang@kmou.ac.kr (Kang Hokeun)

*Corresponding author

Abstract

Onboard carbon capture and storage have emerged as a promising pathway for reducing carbon dioxide emissions from existing and future marine propulsion systems. However, the practical implementation of onboard carbon capture is strongly constrained not only by capture efficiency, but also by downstream CO₂ conditioning, liquefaction, vent control, and liquid CO₂ storage operability. This study proposes and evaluates an integrated onboard carbon dioxide capture and liquefaction system for a dual-fuel marine engine, with particular emphasis on CO₂ conditioning, multistage compression, deep cooling, phase separation, and liquid CO₂ storage. The process was developed and assessed using Aspen HYSYS V12.1 under steady-state conditions. A comprehensive sensitivity analysis was conducted to identify the effects of deep-cooler outlet temperature and separator pressure on CO₂ liquefaction yield, vent-gas formation, and system energy demand. The proposed system was investigated over an engine load range of 50-110%, corresponding to exhaust-gas flow rates of 1.288-2.863 kg/s and CO₂ concentrations of 3.65-6.67%. The model was evaluated at a CO₂ capture ratio of 90.3%, representing a deep-decarbonization operating condition for marine applications. The results reveal a distinct liquefaction threshold governed primarily by the deep-cooler outlet temperature. Near vent-free operation can be achieved when the deep-cooler outlet temperature is lower than approximately -24.58°C. The pressure-temperature feasibility analysis further indicates that near vent-free liquefaction requires a separator pressure above 190 kPa at -24.7°C, whereas operation at -22.45°C remains infeasible within the investigated pressure range of 1600-2200 kPa. These findings demonstrate that deep-cooling intensity is the dominant control variable for suppressing CO₂-rich vent slip and maintaining stable liquid CO₂ production. The pressure sensitivity analysis shows that increasing the compressor discharge pressure from 1500 to 2500 kPa raises the compression power from 34.8 to 80.23 kW at -21°C, without producing a corresponding improvement in liquefaction yield or vent suppression under throttled control. This indicates that compression pressure mainly acts as an energy-penalty parameter rather than a performance-enhancing variable under the investigated conditions. By identifying threshold-based deep-cooling setpoints, defining a separator pressure temperature feasibility envelope, and quantifying CO₂-rich vent slip as a system-level loss term, this study provides an operability-oriented design framework for onboard CO₂ liquefaction. The results highlight the importance of integrated downstream conditioning and liquefaction control in improving the feasibility of shipboard carbon capture and storage systems for dual-fuel marine engines.

Keywords

Onboard OCCS, CO₂ Liquefaction Operability, Deep Cooling Threshold, CO₂ Slip Minimization, Vent-flow Suppression

Funding

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Source-to-Hood Alignment Effects on Ammonia Dispersion and Capture Performance in an Engine-Room Test Bed

Cao Gia Minh, Kang Hokeun*

Department of Marine System Engineering, Korea Maritime and Ocean University, Busan, Republic of Korea

Email address:

minhcg@g.kmou.ac.kr (Cao Gia Minh), hkkang@kmou.ac.kr (Kang Hokeun)

*Corresponding author

Abstract

Ammonia is a promising carbon-free marine fuel, but accidental leakage in enclosed engine rooms can generate persistent toxic clouds and severe breathing-zone exposure. Conventional ventilation assessment based only on nominal exhaust capacity or air-change rate may not adequately represent hood capture performance, particularly when the leak jet is not aligned with the suction region. In this study, eighteen transient three-dimensional CFD simulations were conducted for a full-scale ammonia engine-room test bed by varying leak location, hood type, and hood height. The results show that source-to-hood alignment strongly controls early plume capture and long-term residual contamination. The well aligned IE-T3-H6 case achieved a removal efficiency of 98.77% with only 0.05 kg NH₃ remaining at 180 s, whereas the poorly aligned VALVE-T3-H6 case achieved only 38.30% removal and retained 2.51 kg NH₃. In the worst case, the 30 ppm toxic cloud expanded to nearly the full compartment volume, and the breathing-zone average concentration remained above 30 ppm until approximately 913.5 s. These findings demonstrate that hood ventilation performance should be evaluated using toxic cloud volume, breathing-zone exposure, residual mass, and capture delay even under an identical exhaust-flow basis.

Keywords

Ammonia Dispersion, Ventilation Hood Efficiency, Computational Fluid Dynamic, Toxic Cloud Evolution, Breathing-zone Exposure, Toxic in the Engine Room

Funding

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Metallogenic Mechanism of the Jianshan Fluorite Deposit, Henan Province, China

Bangyao Wang^{1,*}, Qingsong Zhang², Mingzhe Xia¹

¹School of Earth Science and Resources, Chang'an University, Xi'an, China

²Langfang Integrated Natural Resources Survey Center, China Geological Survey, Tianjin, China

Email address:

banyao@163.com (Bangyao Wang), 153671157@qq.com (Qingsong Zhang), zymzxia@chd.edu.cn (Mingzhe Xia)

*Corresponding author

Abstract

The Jianshan Fluorite Deposit is one of the representative large fluorite deposits within the southern Henan fluorite metallogenic belt, where favorable metallogenic conditions have resulted in the development of numerous medium- to large-sized fluorite deposits. This study focuses on the Jianshan deposit and is based on detailed field investigations integrated with whole-rock and single-mineral trace element geochemistry, fluid inclusion analyses, H–O isotopes, and zircon U–Pb geochronology. Particular attention is given to the geological characteristics, ore-controlling factors, metallogenic age, ore genesis, and exploration indicators of the deposit. Zircon U–Pb dating of the K-feldspar granite from the Tianmushan–Laozhaishan intrusive complex yields a concordia age of 120 ± 0.82 Ma, corresponding to the Aptian stage of the Early Cretaceous. The fluorite orebodies are mainly hosted within the Tianmushan–Laozhaishan pluton and along fault zones in the surrounding strata, occurring predominantly as veins and lenticular bodies. Major ore textures and structures include massive, brecciated, and banded structures, as well as anhedral granular, euhedral–subhedral, and zoned textures. Fluorite is the dominant ore mineral, whereas quartz and calcite constitute the principal gangue minerals. Hydrothermal alteration is well developed and mainly includes silicification, sericitization, chloritization, and kaolinization. Fluid inclusions in fluorite are dominated by aqueous inclusions with minor H₂S-bearing gas phases, indicating a NaCl–H₂O hydrothermal system. Homogenization temperatures range from 130°C to 170°C, with salinities of 1–5 wt.% NaCl equivalent. In general, homogenization temperatures of fluorite with the same color increase with depth, whereas purple fluorite exhibits higher homogenization temperatures than green fluorite at the same depth. In contrast, fluid densities of fluorite with similar coloration decrease with increasing depth. Hydrogen and oxygen isotope compositions indicate that the ore-forming fluids were derived from a mixture of magmatic water and meteoric water. Integrated evidence suggests that fluorine was mainly sourced from Early Cretaceous Epoch magmatic-hydrothermal fluids, whereas calcium was primarily derived from Ca-rich strata. The Jianshan deposit is therefore interpreted as a post-magmatic medium–low temperature hydrothermal vein-type fluorite deposit.

Keywords

Metallogenic Mechanism, Hydrothermal Fluorite, Jianshan Fluorite Deposit

Digitalization Trends in North American Shale Development: A Case Study of Alberta Basin 2 Shale Play

Jing Ran*

Overseas Exploration & Project Evaluation Department, Sinopec Exploration & Production Research Institute, Beijing, China

Email address:

ranjing.syky@sinopec.com (Jing Ran)

*Corresponding author

Abstract

As the North American shale oil and gas industry enters a stage of high-efficiency development, many formations that were targeted during the early exploration phase have progressed into an era of high-resolution geological modeling and digital transformation. Advances in artificial intelligence have substantially improved the depth and breadth with which accumulated geological knowledge can be synthesized, while reducing the traditional dependence on complete field-development histories before reliable geological understanding can be achieved. This study presents an in-depth analysis of the exploration and development processes of two shale play in the Alberta Basin, Canada, Devonian Duvernay Formation and the Triassic Montney Formation. The technical workflows and corresponding outcomes are systematically reviewed to examine the evolution of shale oil and gas exploration and development methodologies, and to investigate the relationship between digital methods and geological knowledge-based construction. For Duvernay Formation, a resource-assessment model can be established through integrated geological mapping by well database. The most prospective target areas can then be identified by clustering the key geological and engineering controlling factors, performing analogue-based ranking against established high-productivity areas. This workflow provides a basis for automating the construction and iterative updating of a geological knowledge base. For the Montney Formation, depositional-facies models can be calibrated against historical drilling and production data, subsequently integrated with numerical simulation results and knowledge-base-derived expertise to predict previously unrecognized reservoir sweet spots. This approach supports the development of knowledge-based-driven engineering designs and operational strategies. By establishing an integrated geology–engineering workflow platform, this study further evaluates the potential to integrate paleo-geographic/modern-geographic mapping within a sequence stratigraphic framework and to assimilate large scale well log and seismic datasets. Such integration may facilitate the coupling of exploration and development workflows, as well as the integration of geological modeling and numerical simulation. On this basis, a unified Digital Earth framework incorporating environmental, social, and governance considerations is proposed to support the digital transformation and sustainable development of hydrocarbon resources.

Keywords

Shale Gas, Digital Earth, Sequence Stratigraphy, ESG, Canada

Vernacular Bioclimatic Principles as a Framework for Sustainable Mass Housing in Algeria Between Heritage and Contemporary Practice

Mohammed El Fatih Meknaci*

School of Architecture, Southeast University, Nanjing, China

Email address:

meknacimedelfatih@gmail.com (Mohammed El Fatih Meknaci)

*Corresponding author

Abstract

Algeria's post-independence mass housing production, dominated by imported standardized typologies and most notably the French grands ensembles model, has consistently failed to respond to the country's climatic diversity, producing thermally inefficient buildings with high energy demand and low occupant comfort. The disconnect is acute because Algerian territory ranges from a Mediterranean north to a hyper-arid Saharan south, while the public housing programme has applied broadly uniform construction standards across that range. This paper asks whether Algeria's own vernacular tradition offers a transferable framework for climatically adequate mass housing, and what currently prevents that transfer. It proceeds as a comparative review of two bodies of material: published architectural and bioclimatic studies of Algerian vernacular settlements, and the technical regulations governing contemporary housing production. The UNESCO-listed M'zab Valley settlements, established from the tenth century onward, are examined as a documented repertoire of passive cooling strategies, comprising compact urban morphology, narrow shaded streets, courtyard typologies and earth-based thermal mass construction in an environment where summer temperatures exceed 45 degrees Celsius. The Casbah of Algiers, also inscribed as World Heritage, is examined as a Mediterranean counterpart that adapts through introverted courtyard houses, cross-ventilation systems and high-mass construction buffering diurnal temperature fluctuation. From this material the paper identifies three design principles that are physical rather than culturally specific: thermal mass optimization, courtyard-based natural ventilation, and street morphology as solar control. It then examines the Algerian regulatory framework, comprising the Programme National de Construction and the DTR thermal regulations, which address winter heat loss and summer cooling loads through separate instruments, in order to establish whether these principles can be accommodated within contemporary construction constraints. The analysis finds that the regulations classify climate and govern envelope performance but do not require block orientation, street proportion or courtyard provision, so that climatic classification does not reach built form. The findings suggest that improved housing performance in Algeria depends less on imported technological solutions than on a critical reinterpretation of locally validated architectural knowledge and its embedding in procurement criteria. These implications extend to the wider North African and MENA region, where the same tension between standardized production and climatic diversity persists.

Keywords

Vernacular Architecture, Bioclimatic Design, Passive Cooling, Mass Housing, Housing Policy, Thermal Comfort, M'zab Valley, Algeria

Spatiotemporal Patterns of Residents' Access to Tertiary Hospitals in Megacities and Planning Implications

Chunyang Liu*, Chen Luo, Tianshun Ma, Xinrong Hu, Haoyuan Li

Civil Aviation Flight University of China, Air Traffic Management Institute, Chengdu, China

Email address:

luochenkun@cafuc.edu.cn (Chunyang Liu)

*Corresponding author

Abstract

Equitable access to tertiary hospitals is a critical concern in urban planning, yet conventional assessments often rely on static proximity assumptions and fail to capture the dynamic interplay between traffic conditions and residents' hospital-selection behaviour. This study proposes an improved two-step floating catchment area method that integrates a power-law probabilistic choice function to simulate residents' preferences beyond the nearest-facility rule, a continuous Gaussian decay to replace binary thresholds, and year-round real-time traffic data from routing APIs to measure dynamic accessibility across weekday/weekend, peak/off-peak periods, and multiple time thresholds (5, 10, and 30 minutes). Applied to Chengdu—a megacity with 59 Grade-A tertiary hospitals—the analysis reveals a three-tier spatial gradient from central urban areas to inner and outer suburbs. Notably, inner suburbs fall within the 30-minute catchment but exhibit severe functional insufficiency, with up to 90% of critical care relying on central-city referrals. Global spatial autocorrelation is significantly positive, intensifying with larger thresholds (Moran's I: 1.12–1.21 at 30 minutes), confirming that the concentration of 80% of top-tier hospitals within the ring road is the dominant driver of inequity. Residents' choice behaviour deviates markedly from the nearest-principle, and weekend leisure traffic further disrupts access in tourist hotspots, reflecting the city's “leisure-oriented transition”. These findings underscore the necessity of decentralising medical resources through regional sub-centres in accessibility blind zones and implementing adaptive traffic management, such as dynamic bus-lane policies, to enhance off-peak response efficiency. The improved method demonstrates high robustness across parameter sensitivity, data perturbation, and cross-validation. This study provides quantitative evidence for urban planners to reconcile resource agglomeration with transport dynamics, advancing spatial equity in medical service delivery.

Keywords

Urban Healthcare Accessibility, Tertiary Hospitals, Two-step Floating Catchment Area, Spatial Equity, Traffic Dynamics, Chengdu, Urban Planning, Spatiotemporal Heterogeneity

A Weak-form Quadrature Rigid-frame Element for Efficient Static and Dynamic Analysis of Large-span Transmission Towers

Kai Wang^{*}, Mengfan Wang, Guolei Shan

School of Architecture and Civil Engineering, Huangshan University, Huangshan, China

Email address:

Kai.wang@hsu.edu.cn (Kai Wang), 2066911252@qq.com (Mengfan Wang), 3379759129@qq.com (Guolei Shan)

^{*}Corresponding author

Abstract

This paper presents a novel three-dimensional weak-form quadrature rigid-frame element (WQRE) method for the efficient static and dynamic analysis of large-span transmission towers. Based on Timoshenko beam theory and a mixed variational principle, the proposed formulation employs Chebyshev-Lobatto differential quadrature and Gauss-Lobatto numerical integration to construct positive-definite, real-symmetric stiffness matrices and diagonal mass matrices at the element level. A key innovation is the element-level condensation of internal degrees of freedom, enabled by the positive definiteness of the stiffness matrix, which significantly reduces the global system size prior to assembly—a fundamental distinction from conventional weak-form quadrature elements and p-type finite elements. Numerical validations on simply supported and cantilever beams confirm shear-locking-free behavior and fast convergence. The method can be then applied to a 370 m high 500 kV Zhoushan long-span transmission tower, considering wind loads and seismic excitation. Results show excellent agreement with detailed finite element models and experimental data, while the structural stiffness matrix order can be reduced from 20,400 (FEM) to only 1,344, and computation time can be cut to approximately 8.5% of that required by conventional FEM. The WQRE method offers a compelling balance between accuracy, robustness, and computational efficiency, making it particularly attractive for large-scale frame structures in civil engineering practice.

Keywords

Weak-form Quadrature Element, Rigid-frame Element, Transmission Tower, Static and Dynamic Analysis, Element-level Condensation, Timoshenko Beam Theory, Wind and Seismic Response

A Multiphysics Digital Twin for 2D Chloride Transport Modeling in Cement-based Coastal Structures

Xuande Chen*

Department of Engineering, University of Quebec at Rimouski (UQAR), Rimouski, Canada

Email address:

xuande_chen@uqar.ca (Xuande Chen)

*Corresponding author

Abstract

Climate change is intensifying the physical and chemical loads on coastal and hydraulic concrete infrastructure, as more frequent wetting-drying, freeze-thaw, and temperature cycles interact with chloride ingress to accelerate reinforcement corrosion and structural degradation. Existing durability models often treat moisture transport, heat transfer, and ion diffusion as separate or weakly coupled processes, and are rarely formulated in a way that generalizes across the wide range of concrete and other cement-based porous materials used in practice. This study presents TransChlor, a multiphysics digital twin model for chloride ingress in cement-based materials, whose current module implements a two-dimensional (2D) coupled transport formulation for heat, moisture, and chloride ions within the material cross-section. The model is built on a general porous-media formulation, coupling transport equations with a hydration-dependent description of pore structure and ionic binding, so that it can be applied across ordinary and advanced concretes, mortars, and other cement-based mixtures without reformulating the underlying physics. The 2D formulation captures boundary effects, cracks, and geometric heterogeneities that one-dimensional models cannot resolve, and is calibrated and validated against laboratory exposure tests and long-term field monitoring data from coastal and hydraulic structures. Building on this 2D physics-based core, a digital twin architecture assimilates sensor and inspection data in near real time, allowing the model to be continuously updated and used for probabilistic remaining-service-life estimation and maintenance planning. Preliminary simulations show that the 2D coupled transport module captures localized chloride accumulation patterns around geometric discontinuities that simplified 1D approaches tend to miss, particularly under alternating marine exposure conditions. The digital twin prototype further demonstrates the feasibility of linking this 2D transport model with monitoring data streams for adaptive durability assessment across different cement-based material formulations. These results support the development of predictive, data-informed tools for the design, monitoring, and life-cycle management of coastal and hydraulic infrastructure built with concrete and other porous cementitious materials.

Keywords

Transchlor, Digital Twin, 2D Chloride Transport, Cement-based Materials, Multiphysics Modeling, Coastal Infrastructure, Durability

Research on Wave Force Calculation Method for Honeycomb-type Sea Sand UHPC Arc Crown Wall

Chuyi Zeng, Mingzhu Lu, Zhitao Xie*, Qinghui Liao

College of Harbour and Coastal Engineering, Jimei University, Xiamen, China

Email address:

3043232997@qq.com (Chuyi Zeng), lumingzhuui@163.com (Mingzhu Lu), xiezt@jmu.edu.cn (Zhitao Xie), 17501135699@163.com (Qinghui Liao)

*Corresponding author

Abstract

To address the insufficient wave overtopping resistance of traditional coastal protection structures, wave load experiments were conducted on a novel honeycomb-shaped sea sand ultra-high performance concrete (UHPC) arc crown wall. By comparing the force responses of different structural configurations under multiple wave conditions (wave height 0.1-0.3 m, period 1.0-2.0 s, water depth 0.4-0.6 m), this study revealed the force transmission mechanism, impact mechanical characteristics, and peak impact pressure distribution of the structure. Based on a finite element model validated with experimental data, a parametric analysis examined the influences of wave height, period, water depth, honeycomb opening ratio, and wall thickness on wave forces. Sensitivity analysis indicates that wave height and opening ratio are the dominant influencing factors, followed by water depth and period. An empirical wave force calculation method applicable to this new wave wall was subsequently proposed. These findings provide a theoretical basis for the wave impact resistance design of coastal protection structures and are of advancing innovative coastal engineering infrastructure in China.

Keywords

Honeycomb-shaped Breakwater, Sea Sand Uhpc, Arc Crown Wall, Wave Load, Numerical Simulation, Wave Force Calculation Method



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