



MONGOLIAN SOCIETY OF
ENVIRONMENTAL ENGINEERS AND
PROFESSIONALS



NATIONAL UNIVERSITY OF MONGOLIA



MINISTRY OF ENVIRONMENT AND
CLIMATE CHANGE



NATIONAL FOREST AGENCY



Erasmus+



GERMAN-MONGOLIAN
INSTITUTE FOR
RESOURCES AND TECHNOLOGY



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ENVIRONMENTAL RESEARCH
CENTER OF MONGOLIA



ENVIRONMENT-2024

MONGOLIAN SOCIETY OF ENVIRONMENTAL ENGINEERS &
PROFESSIONALS



ULAANBAATAR
2024

**“ENVIRONMENT-2024”
INTERNATIONAL CONFERENCE
MONGOLIAN SOCIETY OF ENVIRONMENTAL ENGINEERS &
PROFESSIONALS**

ABSTRACT BOOK

10 October 2024
Ulaanbaatar, Mongolia

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Abstract book of the First International Conference
“ENVIRONMENT”, Ulaanbaatar, Mongolia, 10 October
2024

Organizing committee:

Dr. Soyol-Erdene Tseren-Ochir
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Dr. Jambajamts Lkhamjav
Dr. Khasbaatar Dashkhuu
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FOREWORD

The Mongolian Society of Environmental Engineers and Professionals (MSEEP) is excited to announce the expansion of its annual "Environment-2024" conference into an international event, taking place on October 10, 2024. In collaboration with leading universities and research institutes specializing in environmental and engineering education, we aim to foster a global exchange of knowledge and solutions.

With rising environmental challenges, the contributions of international researchers are critical to advancing sustainable development. We warmly invite you to present your research, engage in insightful discussions, and collaborate with academics to shape the future of our industry. Join us in driving progress for a greener tomorrow!

Organizers:

Mongolian Society of Environmental Engineer Professionals

National University of Mongolia, School of Engineering and Technology

European Union, Erasmus+ program, TACMEE project

Climate change research and cooperation center

Environmental research center of Mongolia

Mongolian Association of Environmental Professionals

United Nations, Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia - ADAPT project

Supporting organizations:

National Forest Agency, Government of Mongolia

German-Mongolian Institute of Technology

Mongolian University of Life Sciences, School of Agribusiness of Darkhan

National University of Mongolia, School of Science and Art, Branch of Natural Sciences

UNESCO Chair on Environmental Sciences in Eastern Central Asia

SCOPE OF THE CONFERENCE

Air and climate adaptation technologies

Air quality, air pollution sources, air pollution control engineering, air pollution distribution, modeling and simulation, indoor air quality, climate change, atmospheric chemistry, greenhouse gas emission, risk mitigation

Water resources, pollution, and its solutions

Water resources, scarcity, solutions, water pollution, water quality, drinking water treatment, health-related issues, wastewater treatment, grey water usage

Soil pollution and solid waste management

Soil quality, pollution, sources of soil pollution, soil pollution and health, soil remediation and treatment, soil fertility, urban waste management and treatment, hazardous waste management and treatment, resource extraction, recycling and recovery, green technology

Clean production and advanced technologies

Energy efficiency, industrial ecology, smart technologies, environmentally friendly production, renewable energy

Program

“ENVIRONMENT – 2024” INTERNATIONAL SCIENTIFIC CONFERENCE

Date: 2024.10.10

Venue: Round Hall, Main Building, National University of Mongolia

8.30-9.00	Registration
9.00-9.20	Opening Speeches Dr. Oyunsanaa.B Director General, National Forest Agency of Mongolia Dr. Sonomdagva.Ch Dean, School of Engineering and Technology, National University of Mongolia
PLENARY SESSION: Moderator: Dr. Khasbaatar Dashkhuu, NUM	
9:20-9:40	Comprehensive multimetal isotopic model for regional-scale environmental management <u>Duk-Min Kim</u> , Department of New Energy and Mining Engineering, Sangji University, South Korea
9:40-10:00	Compound climate events in the eastern part of the Baltic Sea region <u>Egidijus Rimkus</u> , Laurynas Klimavičius Institute of Geosciences, Vilnius University, Lithuania
10:00-10:20	The results of the experimental/modeling study of the effects of climate change and grazing on the peatland <u>Sh.Anarmaa</u> , N.Sharkhuu, S.Vandandorj, J.Nyamdavaa, B.Ochirkhuyag, B.Nyambayar National University of Mongolia
10:20-10:40	Indication of Climate Change Effects on the Mongolian Environment <u>Michael Walther</u> First Chairholder and Founder of UNESCO Chair on Environmental Sciences in Eastern Central Asia, Germany
10:40-11:10	Coffeebreak / Poster presentation
SESSION I: AIR POLLUTION AND CLIMATE CHANGE Moderator: Dr. Javkhlan Ariunbaatar, NUM	
11:10-11:30	Sahara Dust Event in Lithuania: Assessment of CAMS Air Quality Forecast and Application for Early Warnings to Citizens <u>Justinas Kilpys</u> Vilnius University, Institute of Geosciences, Lithuania

11:30-11:50	Detecting spatial distribution of NO₂ by Sentinel-5 around Ulaanbaatar city <u>Batjargal B.</u> , Dorj U., Enkhbaatar D., Jambajamts L. Information and Research Institute of Meteorology, Hydrology and Environment
11:50-12:10	The challenges of phasing out and controlling the hydrofluorocarbons /HFCs/ have high global warming potentials /GWP/ values used in refrigeration and air-conditioning <u>Adiyasuren Ts.</u> , Dulamsuren D., Munkhbat Ts., Naranchimeg N. National Ozone Authority, the Ministry of Environmental and Climate Change of Mongolia, The Climate and Clean Air Coalition
12:10-12:30	Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia <u>Gunsmaa B.</u> Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia,, project, Mongolia
12:30-13:20	Lunch and poster presentation
SESSION II: WATER QUALITY AND HYDROLOGY Moderator: Dr. Gerelbaatar Sukhbaatar, NUM	
13:20-13:40	Climate variability and change in Altai-Dzungarian Region and its hydrological impact: past, present, and future <u>Oyunmunkh B.</u> Institute of Geosciences, University of Bonn, Germany
13:40-14:00	Gobi region irrigation, increasing Ongi river flow to restore Ulaan Lake <u>Nasanbayer N.</u> School of Civil Engineering Architecture, Mongolian University of Science and Technology MUST, SCEA Department of Engineering structure
14:00-14:20	Impacts of climate changes on Kherlen River <u>Enkhtuya M.</u> , Saranchimeg B., Uuriintuya G. ,Tumurchudur S., Khuslen B. Institute of Geography and Geoecology, Mongolian Academy of Sciences
14:20-14:40	The site selection analysis for Micro watershed water harvesting technology <u>Davaajargal Boldbaatar</u> Water Resource and Water Utilization, Institute of Geography and Geoecology, Mongolian Academy of Sciences.
SESSION III: SOIL POLLUTION AND DEGRADATION, WASTE MANAGEMENT Moderator: Dr. Anarmaa Sharkhuu, NUM	
14:40-15:00	Environmental effect of logging on forest soil properties and reproduction <u>S. Gerelbaatar</u> Dept of Environment and Forest Engineering, School of Engineering and Technology, NUM

15:00-15:20	Comparative Study of Electrokinetic Remediation for Lead-Contaminated Soil: Activated Carbon vs. Non-Activated Carbon Systems <u>B.Badamsuren</u>, D.Khasbaatar Dept. of Chemical and Biological Engineering, School of Engineering and Technology, National University of Mongolia
15:20-15:40	Organic carbon resources in Gobi soils <u>G.Uuganbat</u> Department of Geography, Mongolian National University of Education
15:40-16:00	Data Collection for Life Cycle Assessment of Medical Solid Waste Management: An Empirical Investigation in Ulaanbaatar, Mongolia <u>Ada Castellucci</u>, Enkhdul T., Francesco R. , Gianluca M., Marco R. Deptment of Economics and Management, University of Trento, Italy
16:00-16:30	Coffeebreak / Poster presentation
SESSION IV: CLEAN TECHNOLOGY Moderator: Dr. EnkhTUR Erdenebileg , NUM	
16:30-16:50	Fighting Air pollution with Heterogeneous Catalysis <u>Andras Sapi</u> University of Szeged, Institute of Chemistry, Hungary
16:50- 17:10	Research on improving the quality of drinking water by making an ash filter with animal bones <u>Darkhan-Erdene A.</u> MUST, School of Building Architecture, Department of Environmental Engineering
17:10-17:30	Research on the possibility of obtaining biodiesel products from animal fat oil Otgonzaya O., <u>Ariunbold E.</u>, Enkhtungalag S, Tugsuu Ts. Dept. of Chemical and Biological Engineering, School of Engineering & Technology, NUM
17:30-17:50	Study of macro- and microelements of <i>Nepeta sibirica L</i> cultivated in the open field <u>Amariargal A.</u>, N. Undarmaa Western regional branch of the National University of Mongolia
17:50-18:00	Award Ceremony (Master student's presentation) and Closing <u>Dr. A.Javkhlan</u>, Mongolian Society of Environmental Engineers and Professionals <u>Ms. L.Otgontsetseg</u>, Director of the Environmental Research Center of Mongolia, Ministry of Environment and Climate Change

POSTER PRESENTATION

Number	Presentation
P1	The impact of weather conditions on the biomass of pasture plants in Mongolia <u>Ganbold Boldbaatar</u> , Mungunchimeg Nasanbat, Jambajamts Lkhamja Dept. of Meteorology and Hydrology, National University of Mongolia
P2	Problems leading to environmental degradation <u>D.Dashzeveg</u> , T.Oyunchimeg University of Internal Affairs
P3	Ranking and sources of the soil microbiological contamination in Ulaanbaatar city <u>U. Bilguun</u> , E. Jargaldalai, Ts. Soyol-Erdene, R. Chinzorig Institute of Geography and Geoecology, Mongolian Academy of Sciences Dept. of Green Energy and Engineering, National University of Mongolia
P4	Organic carbon stocks in forest soil <u>Byambaa Ganbat</u> Institute of Geography, Geoecology, Mongolian Academy of Sciences
P5	Phytoremediation using nettle (<i>Urtica dioica</i>) to reduce heavy metals in soil <u>Elbegzaya G.</u> , Jargalbayer U., Batkhashig O., Enkhdul T. Division of Soil Research, Institute of Geography, geoecology, MAS
P6	Study on the quality of drinking water in the central settlements of Bulgan province <u>Enkhjargal Togtokh</u> , Purev-Erdene Erdemjargal, Odsuren Batdelger, Dalaijargal Sandag Division of Water Resources and Water Utilization, Institute of Geography and Geo-Ecology, Mongolian Academy of Sciences
P7	Adsorption Kinetics and Isotherm Study of Se(IV) Removal via Fe-Mn-Based Adsorbents <u>B.Badamsuren</u> , E.Otgonjargal, D.Khasbaatar Dept. of Chemical and Biological Engineering, National University of Mongolia Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences,
P8	Future projection of extreme precipitation in CMIP6 (Case study catchments areas) <u>Otgonsuren Shar</u> , Ganbold Boldbaatar Dept. of Meteorology and Hydrology, School of Arts and Sciences, National University of Mongolia
P9	Classification of fly ash and its application possibilities <u>Otgonjargal Ts.</u> , Elbegzaya G., Altantuya O., Enkhdul T. Dept. of Green Energy and Engineering National University of Mongolia
P10	Include the climate change and livestock pasture protection issues to the curriculum of the university and institute <u>Adivasuren Ts.</u> , Erdenetuya M., Chimed M. Erdenebayar A., Gunjee A., Tumur-Ulzii A., Eco Asia” department of the Ecology-Engineering school of “Ulaanbaatar-Erdem” University

MASTER STUDENT'S PRESENTATION

Venue: Num library Rm.502

Chair: Dr. Khasbaatar.D, NUM

Number	Presentation
14:00-14:20	Vegetation biomass forecasting using ARIMA models <u>B.Buvangerel</u> , Ch.Bolorchuluun Climate Change Research and Cooperation Centre
14:20-14:40	Environmental Sustainability indexing; A measure of the balance between anthropogenic pressure and ecological relevance; representative case study <u>Odbayar Otgonbaatar</u> , Sodgerel Pureevee School of Agroecology and Business, Mongolian Agricultural University of Life Science
14:40-15:00	The some application results of the soil and water assessment tool (SWAT) on the Selbe and Dund River basin <u>Dulguun Chinzorig</u> , Byambakhuu Ishgaldan, Jambajamts Lkhamjav Dept. of Meteorology and Hydrology, National University of Mongolia
15:00-15:20	A comparative study of the elemental contents of plants in different pollution environments <u>D. Erdenezaya</u> , Ts. Soyol-Erdene, Sh. Oyungerel Dept. of Green Energy and Engineering, National University of Mongolia
15:20-15:40	First measurement report for volatile organic compounds characteristics during winter in Ulaanbaatar, Mongolia <u>Misheel Sainjargal</u> , <u>Soo Ran Won*</u> , Yong Pyo Kim, Tseren-Ochir Soyol-Erdene, Ji Yi Lee* Dept. of Green Energy and Engineering, National University of Mongolia
15:40-16:00	Preparation of adsorbent materials from minerals to remove organic pollutants in water <u>Badamdorj Suvd-Erdene</u> , Tuuguu Enkhdul, Ochirkhuyag Altantuya Dept. of Green Energy and Engineering, National University of Mongolia
16:00-16:20	Study on heavy metal pollution in surface sediments in rivers of central Mongolia <u>Badamkhand Legjidmaa</u> , Soyol-Erdene Tseren-Ochir Dept. of Green Energy and Engineering, National University of Mongolia
16:20-16:40	The mechanochemical activation study of natural zeolite for the purification of groundwater <u>Ovundari Dandarbaatar</u> , Tamiraa Ganbold, Ochirkhuyag Bayanjargal, Amgalan Bor Dept. of Chemical and Biological Engineering, National University of Mongolia

Session I. Plenary session.

Comprehensive multimetal isotopic model for regional-scale environmental management

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Keywords: Metal isotopes, Erdenet mine, Water and soil contamination, Comprehensive model

Abstract

Major mining cities worldwide have been suffering from diverse contamination sources such as tailings, mine drainages, geology enriched with toxic metals, and other industrial and domestic sources. This study established a multi-isotopic comprehensive model for elucidating contamination sources and geochemical reactions in the city of Erdenet in Mongolia. The Erdenet city was contaminated with As, Cu, Mo, Zn, and SO_4^{2-} , and we used isotopes of Cu, Mo, Pb, Zn, and S–O in SO_4^{2-} . Contamination sources of groundwater and surface water were differentiated as tailings dump, excavated ore, heap leaching, ash pond of a power plant, and argillic alteration zone. Moreover, isotopic investigation and positive matrix factorization for soil revealed that the contamination source of the eastern part of residential area was the tailings dust. Furthermore, to assess oxidative dissolution of sulfides and adsorption, $\delta^{65}\text{Cu}$ and $\delta^{98}\text{Mo}+\delta^{66}\text{Zn}$ were found to be particularly useful, respectively.

Compound climate events in the eastern part of the Baltic Sea region

Egidijus Rimkus, Laurynas Klimavičius

Institute of Geosciences, Vilnius University, Lithuania

Abstract

This study investigates three major types of compound climate events in the eastern part of the Baltic Sea region – compound drought and heatwave events (CDHEs), false spring (FS) events, and compound precipitation and wind extremes (CPWEs) – from 1950 to 2022, with the goal of understanding their frequency, intensity, and impacts.

CDHEs, characterized by simultaneous drought and heatwave conditions, were identified using the 1-month Standard Precipitation Index (SPI) and daily maximum temperatures ($T_{\max}$). Ten CDHEs were recorded during the study period, eight of which occurred after 1994. While the number of drought days decreased, the number of heatwave days increased significantly. However, a statistically significant rise in CDHEs was only observed in a limited part of the study area.

FS events, which occur when a last spring frost (LSF) happens after the growing season has already started, were analyzed by comparing LSF and the start of the growing season (SGS) dates. The number of FS events increased across 85.9% of the grid cells, with the SGS advancing more rapidly than the LSF date. Although the frequency of FS events rose significantly, statistical tests showed significant changes in only 30% of the grid cells.

Finally, A CPWE was distinguished when precipitation and maximum wind speed values exceeded the 98th percentile values of the corresponding variable on the same day for at least one grid cell in the study area. A total of 797 CPWEs were distinguished (mostly in October), with a statistically significant increase in frequency over the years. These events were more common in western Lithuania during the cold season and in the northeastern and southeastern regions during the warm season.

These findings underscore the increasing frequency of compound climate events in investigated area and highlight their potential socio-economic and ecological impacts.

The results of the experimental/modeling study of the effects of climate change and grazing on the peatland

Sh. Anarmaa¹, N. Sharkhuu², S. Vandandorj³, J. Nyamdavaa^{3,4}, B. Ochirkhuyag³, B. Nyambayar³

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²Institute of Geography and Geoecology of the Academy of Sciences

³Mongolian Wildlife Science, Conservation Center

⁴New Mongolian Secondary School

Keywords: monitoring, modeling, reanalysis results, temperature change

Abstract: Climate change and grazing are key challenges not only in Mongolia but also in the world. Studying how these issues affect wetland ecosystems is important for protecting biodiversity, preserving ecologically significant areas, and predicting potential future changes. We aimed to investigate the effects of climate change and grazing on soil temperature and moisture in a permafrost-underlain peat bog using a combination of experimental and modeling approaches. This study was carried out in the research area located in the Khurkh valley of Batshireet soum, Khentii province. In the study, air temperature variation was experimentally increased using a passive chamber, while grazing was simulated by monthly mowing. The experiment was conducted in two different locations, with and without permafrost areas, and the effects of air temperature, soil surface temperature, and soil temperature at a depth of 20 cm were measured. According to the research results, the chamber increased the air temperature by an average of 1.0°C. As a result of this warming, the surface temperature increased by 1.2-1.5°C, and at a depth of 20 cm, the average temperature increased by 1°C. Compared to the permafrost-underlain area, the chamber warmed the air in the permafrost-free area more, but the depth effect was smaller. In accordance with the temperature change, the chamber slightly increased the depth of thawing. This experiment shows that air temperatures can affect soil surface and subsurface temperatures in relatively short periods. It also supports our initial hypothesis that warming may have different impacts on ecosystem and microclimate parameters, depending on the presence of the permafrost. Furthermore, we have compared how the surface temperature changes under the influence of climate change and how it affects the snow, using calculation methods and modeling methods. In order to use this calculation and modeling method even in the absence of data, the compatibility of observations and satellite data was evaluated and then included in the subsequent calculations. Furthermore, the calculation was improved by including the ratio of air and soil's total freezing degree (FDD) and total thawing degree (TDD).

Indication of Climate Change Effects on the Mongolian Environment

Prof. Dr. Sc. Michael Walther

First Chairholder and Founder of UNESCO Chair on Environmental Sciences in Eastern Central

Asia; mwalththerub@gmail.com

Key Questions:

1. How to understand Climate Change (CC)?
2. What are Climate Change indicators?
3. How have we to interpret CC indicators?
4. How is CC effecting environmental Units and natural Resources?
5. Which human impact must be regarded?

Climate and Environmental indicators to be assessed

- Change in Glacier distribution in High Mountain areas
- Change in Permafrost distribution and its decay
- Change in aquatic systems (Rivers and Lakes)
- Change in deposition of Sediments
- Change in Forest and Grassland distribution
- Change in long- and short-term weather and climate development

Result and Conclusion

Glaciers. Melting of glaciers leads to a positive water balance only if temperatures are not rising dramatically. This tendency will stop when the glaciers are totally melted. Then we have a real problem.

Permafrost. Decaying permafrost has mainly two effects: first damaging infrastructure and second setting CO₂ free from the frozen ground. Mongolia at the southern border of Siberian permafrost has Mountain Permafrost which is not widespread anyway, but is concentrated on basins and north-facing slopes depending on exposure.

Aquatic systems. Water quality and the quantity of rivers and lakes is directly linked with weather and climate change. Long-term forecasts also proved to be inaccurate in Mongolia. Compared to the long-term averages, a wet weather phase is imminent across the country.

Sediments. Aquatic sediments (limnites) reflect the environmental and climatic history of the catchment areas very accurately but are very rarely used by scientists in Mongolia. The human impact, the geological environment and climate sections as well as the direct depositional environment are presented.

Forest and Pasture. Forests and pastureland are long-term indicators of the state of climatic effects, as they react with a delay to short-term weather changes and human utilization (overexploitation). As a conclusion, forecasts are not possible.

Session II: Air pollution and Climate Change

Sahara Dust Event in Lithuania: Assessment of CAMS Air Quality Forecast and Application for Early Warnings to Citizens

Justinas Kilpys

Vilnius University, Institute of Geosciences, justinas.kilpys@chgf.vu.lt

Sahara dust intrusions into Europe significantly affect air quality and public health. On 1-2 April 2024, Lithuania experienced a Sahara dust event that led to the increased particulate matter (PM₁₀) levels. This study assesses the accuracy of Copernicus Atmosphere Monitoring Service (CAMS) air quality forecasts in predicting the event and explores their use in providing early warnings to citizens.

A comparison between CAMS forecast data and ground-based air quality measurements in Vilnius revealed a strong correlation in both timing and intensity of the PM₁₀ levels. However, an evaluation of public communication efforts showed that no early warnings were issued, with information focused solely on current air quality conditions based on in situ data.

Findings suggest that integrating CAMS air quality forecasts into Lithuania's air quality monitoring and early warning system could help to provide timely public warnings, to reduce population exposure and minimize health impacts during the future dust events.

Detecting spatial distribution of NO₂ by Sentinel-5 around Ulaanbaatar city

Batjargal Buyantogtokh¹, Dorj Unurbat², Enkhbaatar Davaanyam¹, Jambajamts Lkhamjav³

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²*National Agency for Meteorology, Environmental Monitoring*

³*Department of Meteorology and Hydrology, School of Art and Science, National University of Mongolia*

Keywords: air pollution, satellite, topography

Air pollutant elements, which are emitted from a source, can effect on human health, climate, environment, etc. In the cold season, the concentrations of the elements are very high at the Ulaanbaatar city, which is surrounded by the four big mountains. Many studies used the observation data of 10 monitoring stations around Ulaanbaatar city to monitor and make research on air pollution. However, there is limited research and monitoring systems on the spatial distribution of the pollutants from a satellite. The Sentinel-5 satellite provides real-time data on the horizontal distribution of air pollutants and aerosol products. We aimed to show the spatial distribution of nitrogen dioxide (NO₂) around Ulaanbaatar city. This kind of study is important for the validation of model simulation and for policymakers to plan future city development. The total tropospheric NO₂ column concentration data, produced by a TROPOMI instrument on the Sentinel-5 satellite, was used in this study. Sentinel-5 is a polar orbit satellite with a swath width of 2,600 km. The ascending node of the satellite orbit crosses the Ulaanbaatar city at 11:00 ~ 13:00 local time. The field of view at Nadir produces ground pixels of $5.5 \times 3.5 \text{ km}^2$ (along-track $\times$ across-track). The distribution of the total NO₂ product from the land surface to the troposphere was processed using the SNAP 8.0 software. The distributions of NO₂ were visually interpreted during cloudless or low cloud days. The types of the distributions were divided into several types. Firstly, the emitted NO₂ from Ulaanbaatar city was mostly distributed to the southwest along the Tuul River valley when wind speed was low. Sometimes, NO₂ was reached to Lun Sum in Tov Province. Secondly, the emitted NO₂ was distributed to the southeast until Nalaikh district, and it sometimes reached Choir Soum, Gobi-Sumber province. Thirdly, NO₂ was transported to the northside of Ulaanbaatar until Batsumber as well as Tunkhel village. However, when the wind speed was high, it was spread along the direction of the wind, and NO₂ decreased at Ulaanbaatar city. However, we do not know the height of the NO₂ distribution from the land surface because the satellite product is only total tropospheric column concentration. It means that it is necessary to compare them with other instrument data, such as mobile measurements, Pandora, and Lidar, to know the far distributions reached to surface or not.

The challenges of phasing out and controlling the hydrofluorocarbons/HFCS have high global warming potentials /GWP/ values used in refrigeration and air-conditioning

Adiyasuren Ts, Dulamsuren D, Munkhbat Ts, Naranchimeg N

Researchers of the National Ozone Authority, the Ministry of Environmental and Climate Change of Mongolia, Researchers of "The Climate and Clean Air Coalition"

Keywords:

Short Lived Climate Pollutants, Climate change, Ozone layer, Global Warming (GW), Chlorofluorocarbons (XΦH/CFC), Hydrofluorocarbons (HFC), Ozone depleting substances (ODS), Ozone Depleting Potential (ODP), Global Warming Potentials (GWP).

Abstract

In the presentation, the results of the management work were studied, evaluated, analyzed and summarized carried out on the implementation of the "Montreal Protocol on Ozone Depleting Substances" in Mongolia. According to the research: Mongolia phased out 100% of the import of chlorofluorocarbons, which have a significant impact on the ozone layer, on 01 January 2010, and implementing the hydro chlorofluorocarbons (HCFC) Phase-out Management Plan until 2030, which are harmless to the ozone layer but have an effect on global warming by about 40%, and the development of a plan to reduce the production and consumption of hydrofluorocarbons and SLCP, which have a significant effect on global warming, and the promotion and introduction of natural refrigerants.

As a result, the team of researchers assessed the possibility of the refrigeration and air conditioning sectors making an appropriate contribution to the implementation of the Paris Agreement, which aims to prevent global warming from reaching 1.5 Celsius.

Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia

Gunsmaa Batbayar

Technical specialist at “Improving Adaptive Capacity and Risk Management of Rural Communities in Mongolia,, project

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Keywords: Climate change, adaptation, rural communities

Abstract: Mongolia has experienced a significant temperature increase of 2.1°C over the past 70 years, making it one of the countries most affected by climate change. This warming, alongside decreased precipitation, has led to a drying trend that is altering pastures, water sources, and natural zones. The changing climate has also increased the frequency and intensity of extreme events such as dzud (a combination of summer droughts followed by severe winters), droughts, snow and dust storms, flash floods, and temperature extremes. The responses by herders to these climate impacts have often lacked integration of climate information and consideration of the impacts on land and water resources. The continuation of unsustainable herding practices and overstocking has further weakened fragile ecosystems and their services, contributing to a decline in livestock productivity and quality.

Climate challenges have decreased livestock sector production by 26 percent compared to the 1980s, leading to a reduction in key income sources for the herders. Given their vulnerability to climate risks, targeted interventions for herder communities can help drive significant, sustainable transformations in land use practices and the livestock sector.

A 7-year project led by the Ministry of Environment and Tourism, with the Ministry of Agriculture and Light Industry as a key partner, aims to strengthen the resilience of herder communities in four vulnerable aimags (Khovd, Zavkhan, Dornod, and Sukhbaatar). With funding from the Green Climate Fund and support from UNDP, the project focuses on three outputs: integrating climate information into land and water use planning, scaling up climate-resilient water and soil management practices, and enhancing herders' access to markets for sustainable livestock products. This initiative is expected to contribute to achieving SDG1 (No Poverty), SDG12 (Responsible Consumption and Production), SDG13 (Climate Action), SDG15 (Life on Land), and SDG17 (Partnerships for the Goals).

Session III. Water quality and hydrology

Climate variability and change in the Altai-Dzungarian region and its hydrological impact

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Keywords: climate reconstruction, tree-ring proxies, teleconnections, climate change, hydrological impacts, bias-corrections, climate model projections

The Altai Mountains and also other mountainous areas of Central Asia experienced intermittent cold periods during the 20th-century warming of the Northern Hemisphere. Since the recent cold period in the 1980s, subsequent warm years in the Altai Mountains have accelerated the regional hydrological cycle. Previous studies found changes in snow cover duration, an acceleration of glacier recession, and permafrost degradation related to increasing soil temperatures. An improved knowledge of the long-term climatic variation and its drivers, and their hydrological impacts in the semi-arid mountainous Altai-Dzungarian region is required to better understand and predict impacts on regional agriculture and water availability.

Climate observations from this rather inaccessible region are limited; thus, alternative datasets are used in this study. Based on tree-ring proxy data, firstly long-term climate variations were reconstructed back to the Little Ice Age followed by a statistical examination of teleconnections with large-scale atmospheric circulation patterns in order to reveal the driving forces of the regional climate. Secondly, weather station observations and interpolated APHRODITE precipitation and temperature data were used to analyze runoff changes in the Bulgan catchment in response to climate change from 1985 to 2012. Finally, GCM (CanESM2 and HadGEM2-AO) and statistically and dynamically downscaled RCM (SD_CanESM2 and RegCM4) simulations were evaluated and used in estimating future climate and hydrological change from 2030 to 2050 under the RCP4.5 and RCP8.5 scenarios. The hydrological impact of climate change on the predominantly snow-fed Bulgan catchment was assessed by conceptualizing the seasonal melt of glaciers and permafrost in the HBV-Light model.

The analysis of tree-rings allowed for the reconstruction of long-term temperature (611 years) and precipitation time series (444 years) in the Altai-Dzungarian region. The results suggest that a cool and wet Little Ice Age was followed by warming in the 20th century, which was interrupted by short cool and wet periods caused by volcanic eruptions and intensified westerly and southwesterly winds connected with positive phases of the NAO, AO, and NINO3.4 variations. Since accumulated snow, summer rainfall and summer temperature significantly influence runoff variation in the Bulgan catchment, the +2.1°C temperature increase and 20% annual precipitation decrease from 1984 to 2015 resulted in a reduction of upstream river discharge in summer by 60%, but an increase in winter by 87%. Permafrost degradation might play a role in the increase in the winter baseflow since the glacierized area of the Bulgan catchment is only 0.13%. Compared to the reference period from 1985 to 2005, the temperature is projected to increase by +2.4°C (+2.9°C), and annual precipitation to increase by 13% (18%) under the RCP4.5 (RCP8.5) scenario from 2030 to 2050. Runoff is projected to increase in particular in spring (April and May) and even decrease in summer (June). An earlier snowmelt might make the intensified agriculture along the Bulgan River face water shortage during the growing season despite a projected precipitation increase in the 2040s.

Gobi region irrigation, increasing Ongi river flow to restore Ulaan lake

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Keywords: surface water, artificial lake, oasis, icing, recharge,

Abstract: Valley of lakes including Ongi river registered in Ramsar convention, but Ongi river not registered in convention due to dried out.

The Ongi River flows out of the mountain gorge in the lower part of the Ongi Monastery and losing a lot of water to groundwater recharge and evaporate while flows 115km through the steppe Ongi and Utgun Khuvuur, and cannot reach Ulaan Lake. However, in wet years, in the autumn, when the groundwater is fully saturated and the air temperature drops, evaporation decreases and then Ongi river reaches the Red Lake. The Ulaan Nuur Depression is rich in sludge, sediments, and fluffy sediments, which cause Yellow dust storm. In this paper considered study of water transport from the nearest surface water source Orkhon river to increase Ongi river flow and restore Ulaan lake. Water transport from the Tuul river to the Gobi region to reduce yellow dust storm will filled with water dry ponds during dry season. Dried ponds which are the sources of yellow storm, due to a lot of heat and dryness in Gobi region, if these filled with water transported from surface water, the problem of drying up will disappear.

The underground water resources of the Gobi region, where there is no rainfall or surface water recharge, are used for the water supply of the Oyutolgoi gold and copper and Tavantolgoi coal mines. The total flow volume of the Ong River alone is not enough to provide water supply for mining in the Gobi region, therefore additional flow from the Orkhon river will fully provide water supply for the mines. Two artificial lakes will be built at the source and downstream of the Ongi River to store water resources and support the production of mines in the Gobi region.

Impacts of climate changes on Kherlen River

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Abstract

Due to the influence of climate change and human activities, certain changes occur in river basin ecosystems and river water regimes. Recent studies have shown that the main reason for the deterioration of water resources and quality may be the reduction of water resources and volume and the change of natural regime due to climate change. However, there is currently no well-established methodology for assessing the impacts of climate change on surface water resources, and further research and development is required. The main aim of the study is to describe the hydrological regime of the Kherlen River.

To assess the impacts of climate change on surface water resources in the Kherlen River Basin, using the daily flow data, where from the Kherlen-Mengulmort, Kherlen-Baganuur, Kherlen-Ungokhaan, Kherlen-Choibalsan hydrological stations archives of the Institute of Geography and Geoecology of the Academy of Sciences and the Surface Water Research Department of the Information and Research Institute of Meteorology and Environment, the changes in the hydrological regime were included by the method of variable trend analysis. In performing this analysis, the parameter data of the period before the change of the flow regime is divided into three categories. Analyzes for each category are based on percentages for non-parametric analysis and standard deviation values for parametric analysis.

According to the hydrograph of the flow of the Kherlen River from 1978-2023, no major floods have been observed in the Kherlen River since 2000 (not included data for 2024), the number and size of minor floods have decreased, the number and frequency of low water periods have increased, and water resources have decreased.

In Kherlen River, the frequency of low flow values in April, and October increased, while the average flow volume and frequency in May and November increased. The average values of the low water period of the flow regime have increased, while all the flow values have decreased for the high-water period.

The site selection analysis for Micro watershed water harvesting technology

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Keywords: Micro-watershed, water harvesting, spatial analysis, multi-criteria analysis, livestock and crop irrigation

Abstract:

Warming in maximum and minimum daily temperatures is expected to be faster than the average rate, potentially amplifying the stress exerted on human health, livelihoods, and ecosystems. With higher temperatures, droughts and desertification are a growing concern and water sources important for livestock and food production are disappearing. Micro-watershed water harvesting technology could be a potential solution for livestock and crop irrigation. The methodologies and the criteria for selecting the site for water harvesting structure are available for micro-watershed. This study aims at selecting a suitable location of RWH structure for micro-watershed through all possible combinations of methodologies and criteria. For this, we developed a conceptual framework that integrates multiple criteria, encompassing rainfall intensity, land slope, soil type, and land use, to discern the most suitable locations for water harvesting structures. Hydrology characteristic were delineated using ArcHydro tools. Watershed delineation was carried out using Alos Palsar DEM (12.5 meter). Integrated approaches involving both biophysical and socioeconomic factors were followed for identifying the potential site for the RWH structure. The socioeconomic considerations were the number of population to be benefited, possibilities of expanding farming, and accessibility to the watershed reservoir in each micro-watershed. Thus, the results obtained from biophysical and socioeconomic determinants reveal that the micro-watershed (MWS)-2 and MWS-3 are most suitable for the same scores and recommended for constructing the RWH structure. However, various attempts need to consider regarding the choice of crops on hill slopes, conservation of soil, and management of the structure for getting full potential benefits from the watershed reservoir. This study proposed the exploration of socioeconomic variables in future research and urged for an in-depth examination of various aspects of environmental sustainability.

Session IV: Soil pollution and Degradation, Waste Management

Environmental effect of logging on forest soil properties and reproduction

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Abstract

Boreal forests in Mongolia are sensitive to logging regime and improper harvesting cause serious threats to soil fertility and forest regeneration. In this study, we assess the long-term effects of different logging intensities on soil properties and natural regeneration in a natural Scots pine forest in the West Khentii Mountains, 20 years after different logging intensities. Our experimental design included five treatments: clear cut (CC), treatments with high (HI), medium (MI), low (LI) intensities, and a reference parcel with no logging impact at all (RE). We described and quantified the harvest events and applied ANOVA and LMM modeling to analyze and explain the long-term impacts of logging intensities on soil properties and natural regeneration. We found that high intensive logging and clearcutting had a significant negative effect on physical and chemical properties of the soil because they increase soil compaction and reduce soil nutrients. The most critical impacts were linked to the soil bulk density and total porosity, content of soil organic matter, total nitrogen and phosphorus in the soil. The LMM modeling showed that organic matter (*OgM*), total nitrogen (*TN*), available K (*AK*) and pH values were affected by heavy logging. Our study revealed that the values for all of these variables show a linear decrease with increasing selective logging intensity and have a level of significance of $p < 0.05$. However, the selective logging with low and medium intensities can promote the natural regeneration of Scots pine to numbers above those of the reference site (RE). High intensity logging and clear-cuts, therefore limit the regeneration of Scots pine, reduce overall seedling numbers ($p < 0.05$), and create conditions that are suitable only for the regeneration of deciduous tree species. This underlines the risk of Scots pine forest degradation, either by replacement by broad-leaf trees or by conversion into non-forest ecosystems.

Comparative Study of Electrokinetic Remediation for Lead-Contaminated Soil: Activated Carbon vs. Non-Activated Carbon Systems

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Keywords: Electrokinetic remediation, Activated carbon, Lead contamination, Permeable reactive barrier, Soil remediation

Abstract:

The study examines the electrokinetic-permeable reactive barrier (EK-PRB) system for the remediation of lead pollution in soil, contrasting configurations with and without activated carbon (AC). The research was performed in severely contaminated regions adjacent to a lead smelting facility in Mongolia, where soil lead concentrations surpassed allowable thresholds by as much as 51 times.

Electrokinetic remediation, a cost-effective method, was enhanced by the incorporation of permeable reactive barriers made of activated carbon. Activated carbon was used due to its substantial surface area and capacity to adsorb lead. The findings indicated that the incorporation of an AC barrier significantly improved lead removal efficiency compared to designs without AC. In the absence of AC, lead reduction was 41.96%, but systems equipped with AC exhibited removal rates ranging from 45.01% to 95.2%, contingent upon the number of barriers employed. The data indicate that the EK-PRB system, especially when utilizing AC, is a viable and energy-efficient method for remediating soils polluted with heavy metals, resulting in substantial contamination reductions with minimal energy expenditure.

The results suggest that integrating EK with AC enhances heavy metal removal and offers a sustainable approach to soil remediation.

Organic carbon resources in Gobi soils

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Keywords: *Soil organic carbon, bulk density, stone content, Leptic Calcisols*

Abstract

Global warming and climate change are affecting our country twice as much as others. With a vast territory featuring significant differences in natural zones and boundaries, and an arid climate with extreme conditions, our desert and semi-desert steppe areas are heavily impacted by desertification. This has led to negative consequences such as a reduction in soil fertility and decreased carbon sequestration in the soil. Studying the characteristics of soil in desert regions and determining the organic carbon reserves in the soil are crucial for implementing adaptive measures to climate change and for restoration efforts. In this study, we examined the characteristics of desert brown, light brown, and rocky brown soils of the desert mountain and gravelly plateau. The study area contains brown, light brown, rocky brown, stony brown, rocky carbonate brown, and rocky light brown soil types. Organic carbon in the soil was calculated using the Walkley-Black method. The results showed that the organic carbon reserves in the various soil types were as follows: Leptic Calcisols (P1) 49.54 t/ha in the 0-75 cm, Leptic Yermic Caclisols (P3) 36.71 t/ha in the 0-80 cm, Mollic Calcisols (P5) 41.70 t/ha in the 0-80 cm, Mollic Yermic Caclisols (P7) 20.78 t/ha in the 0-75 cm, Mollic calcic Caclisols (P8) 28.84 t/ha in the 0-70 cm, Leptic Calcisols (P12) 48.41 t/ha in the 0-120 cm, Mollic Yermic Caclisols (P14) 20.10 t/ha in the 0-85 cm and Leptic Calcisols (P15) 27.61 t/ha in the 0-55 cm layer. The amount of organic carbon reserves varies depending on the thickness of the soil layers. Determining the reserves for each layer through soil profiles can serve as a fundamental unit for assessing the potential of the soil.

Data Collection for Life Cycle Assessment of Medical Waste Management: An Empirical Investigation in Ulaanbaatar, Mongolia

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Keywords: healthcare waste management, incineration, biomedical waste sterilisation, Life Cycle Assessment, Inventory Form, sustainable development.

Abstract

The safe and environmentally friendly management of healthcare waste (HCWM) is a significant concern in many low and lower-middle income countries. Despite recent and ongoing efforts to improve treatment technologies and waste disposal in Mongolia, the current HCWM system in Ulaanbaatar city still presents important margins for improvement. Currently, a private company manages the collection, transport, treatment, and disposal of HCWs from most of the hospitals in the city through a private-public partnership. The waste is transported to a decentralised site consisting of an autoclave, an incinerator, and a landfill, where some environmental concerns exist. As part of a UNICEF project, three electric sterilisers based on frictional heat technology “FHT” were installed in three hospitals in Ulaanbaatar to treat biomedical waste on-site in a more sustainable way than incineration and landfill. The sterilised output material is reduced in volume by 70% and is disposed of as common waste in landfills. Our study aims to conduct a preliminary Life Cycle Assessment (LCA) to compare the environmental impacts of the current HCWM system in Ulaanbaatar with the new on-site sterilisation. This paper aims to define the goals and scope of the LCA and the inventory analysis to understand all the input data required to conduct the LCA. The analysis is being carried out in a context of data scarcity, where only a few similar studies exist. Therefore, a combination of local data collection, literature, LCA databases, and previous LCA studies on the same steriliser must be used. Further research could combine the results of the LCA with an economic and social sustainability analysis to support key stakeholders in the health and environment sectors in decision-making processes to improve the HCWM system in Ulaanbaatar.

Session V: Clean Technology

Fighting Air pollution with Heterogeneous Catalysis

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Keywords: CCU, CCS, nanotechnology, flue gas, catalysis

Abstract: In our research, we are focusing on direct hydrogenation of carbon-dioxide with high activity and controlled selectivity of C1 as well as C5+ products using of designed nanoparticles and supports as well as interfaces followed by molecular level understanding of the reactions. In this talk, I will discuss our research on the field from the last 5 years evidenced by >20 scientific publications show plenty of results on the field of nanocatalysis and CO₂ activation reactions towards a new sight into green catalysis. Under the umbrella of RRF-2.3.1-21-2022-00009, titled National Laboratory for Renewable Energy by the Recovery and Resilience Facility of the European Union within the frame- work of Programme Széchenyi Plan Plus, we are scaling up Fe-catalyst based C5+ production to 5-10 kg liquid product/day based on solar power-motored H₂ generation. Also, I will speak about cheap ceramic supports for flue gas and C5+ production invented with collaboration of HK-Ceram Ltd. ceramic factory.

Study of macro- and microelements of *Nepeta sibirica* L cultivated in the open field

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Abstract: We have grown the *Nepeta sibirica* L with natural seeds and cultivated it in an open field, and for the first time, we determined the amount of macro, micro and ultra-micro elements contained in the cultivated samples, which is an innovative aspect of this research work.

Cultivated *Nepeta sibirica* L were collected in July 2024 from the garden of Amarasana's garden in Jargalant sum, Khov aimag, and the amount of trace elements was determined in plant ash by X-ray fluorescence quantitative analysis method.

In this article, the content of macro and micro elements of cultivated *Nepeta sibirica* L collected from Amarsana's garden park of Khovd aimag was determined by X-ray fluorescence. Samples of cultivated *Nepeta sibirica* L have relatively high concentrations of calcium oxide-32.67%, potassium oxide-18.61%, silica oxide-17.52%, phosphorus oxide-7.65% and magnesium oxide-5.08%. Elements such as zinc and tin in cultivated *Nepeta sibirica* L do not exceed the standard amount.

The samples of cultivated *Nepeta sibirica* L have a relatively high concentrations as antimony-2586 mg/kg, rubidium-57.67 mg/kg, cerium-28.20 mg/kg, neodymium-14.22 mg/kg, lanthanum-12.21 mg/kg and yttrium-12.73 mg/kg.

Antimony, rubidium, cerium, neodymium, lanthanum and yttrium elements were relatively high in the samples of our cultivated *Nepeta sibirica* L, and these results are in agreement with the values of researchers from other countries who determined the amount of elements in several species of *Nepeta* L.

The amount of cesium in cultivated *Nepeta sibirica* L meets the International Commission on Radiological Protection (ICRP) reference requirements.

Research on improving the quality of drinking water making an ash filter with animal bones

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Keywords: Phosphate, Fluoride, MNS 0900:2018, Economy, Processing, Environment

Abstract- This study aims to reduce soil pollution in Ulaanbaatar city and excess water fluorine in Gobi region. Due to the large amount of waste bones from processed animals that are dumped in the open or under the ground, the concentration of heavy metals in the soil increases to a certain extent, which affects the quality of groundwater in Ulaanbaatar city. Based on economic and environmental studies, an economically beneficial and environmentally friendly solution to the problem of water pollution, which is a major factor, is to use animal bone ash filters to remove fluoride content that exceeds the drinking water standards of the Gobi province. It is a research that has been conducted and tested in a laboratory environment to calculate how effective it is economically.

Research on possibility to obtain biodiesel product from animal fat oil

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Keywords: Animal fat oil, biodiesel, upper phase, transesterification, reaction time, rotation speed

Abstract

According to the results of the 2022 livestock census, our country has 71.3 million animals, and it is believed that one sheep can produce an average of 3-4 kg of fat. Also, we noticed that a lot of animal fat is discarded during the meat preparation and production, and most families separate the outer fat of meat when cooking. It is thrown away with garbage and pollutes the environment. This waste fat can be used to produce biodiesel fuel to replace imported products. Biodiesel can be obtained from waste fat oil by transesterification reaction, and biodiesel is released at upper phase. On the other hand, biodiesel (BD) can be produced from waste vegetable oil and mixed with commercial diesel fuel at a ratio of up to 20% by volume if it meets the requirements of biodiesel standards. We are working with the goal of processing this raw material and creating a technology for the production of products for fuel, including the possibility of obtaining biodiesel by transesterification reaction.

In this study, sheep tail fat (STF), yak visceral fat (YVF), goat visceral fat (GVF), mutton soup oil (MSO), and industrial oil (IO) were used as samples. Based on the chemical properties of each sample STF and GVF were low acid number (<3.0). The upper phase was isolated with a yield of 100% and 94.5% by one-step transesterification of those 2 samples. In the other 3 samples with a high acid number, two-step re-esterification was carried out, and the upper phase was successfully isolated from YVF and IO with yields of 90.1% and 103%, respectively. Unfortunately, the reaction wasn't complete and did not isolate the upper phase from the sample of MSO. This sample was probably polymerized during cooking. It was confirmed that a product with a low amount of the specific gravity, kinematic viscosity, and freezing temperature was obtained from the original sample, during the determining the chemical and technical properties of the biodiesel (upper phase) and fat oil samples. For example, density of the GVF and the biodiesel obtained from GVF were 0.936 g/cm³, 0.884 g/cm³, kinematic viscosity were 42.9 mm²/s, 9.66 mm²/s, and the freezing temperature was reduced from 33.5°C to 22.8°C, respectively. Optimum conditions were determined for each sample by

varying the reaction time and rotation speed, respectively, to obtain the biodiesel in maximum yield. The chemical and technical parameters of the obtained biodiesel were determined. Also, biodiesel was distilled under vacuum pressure to determine the content of gasoline and diesel fractions.

Poster Presentations

The impact of weather conditions on the biomass of pasture plants in Mongolia

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Keywords: Biomass, Air temperature, Precipitation, Statistical correlation

Abstract: The biomass of pasture plants varies depending on general conditions such as climate, soil type, ecological zone, and hydrological network. The amount of pasture biomass varies greatly depending on the drought conditions. According to our analysis, the correlation between pasture biomass and average air temperature during plant growth was 0.30 – -0.77, precipitation was -0.04–0.73. This shows that in 11 regions and 8 regions of the belt, the proportion of drought and semi-drought areas had a high correlation with yield, while in 2 regions, the air temperature and in 1 region, the precipitation were highly correlated in Mongolia. In a year with normal summer precipitation, the biomass of pasture plants is 2.3 q/ha in the high mountains, 6.2 q/ha in the forest-steppe, 4.8 q/ha in the steppe, 2.4 q/ha in the semi-desert steppe, and 1.5 q/ha in the desert. In a year with drought, the biomass is 2.3 q/ha in the mountains, 6.2 q/ha in the forest-steppe, 4.8 q/ha in the steppe, 2.4 q/ha in the semi-desert steppe, and 1.5 q/ha in the desert. On the other hand, the biomass in a semi-drought decreases by an average of 0.9 q/ha in the high mountains, 2.4 q/ha in forest steppes, 1.8 q/ha in steppes, 0.9 q/ha in semi-desert steppes, and 0.6 q/ha in deserts. But in drought, the biomass decreases by 1.7 q/ha in high mountains, 4.5 q/ha in forest steppes, 3.8 q/ha in steppes, 1.8 q/ha in semi-desert steppes, and 1.1 q/ha in deserts.

Problems leading to environmental degradation

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Keywords; Environment, Crime against the environment, objects of attack, legal environment

Abstract: In this study, the factors leading to the degradation and destruction of the environment are determined from the legal point of view.

Environmental degradation is understood by most scientists and researchers as a general action that adversely affects the nature of the environment due to air pollution and the direct dumping of harmful and non-toxic chemical waste into the environment.

On the other hand, researchers do not always study the fact that crimes against the environment have a strong influence on the degradation of the environment. Therefore, it is imperative to fight against environmental crimes and to protect the objects of attack and the environment. The purpose of the research work: To determine the damage caused to the environment caused by crimes against the environment, and to find out the state of compensation for it.

Ranking and sources of the soil biological contamination in Ulaanbaatar city

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Keywords: biological pollution, Coliform titer, Anaerobes

Abstract

Biological contamination in the soil of Ulaanbaatar, the capital city where over half of Mongolia's population resides, has emerged as a significant concern that may threaten public health. Recent years have witnessed an increase in the incidence of floods and heavy rainfall during the warmer months, a phenomenon attributed to global climate change, which exacerbates the risk of soil contamination. Notably, the presence of pit latrines in ger districts and the existence of open waste disposal sites have been identified as major contributors to this contamination. This research seeks to assess the extent of biological contamination and its origins within Ulaanbaatar by employing Geographic Information Systems (GIS) for analysis.

A total of 507 surface soil samples were collected from nine districts across the city, and critical sanitary indicators were evaluated, including the total biological count, *E. coli*, and anaerobes (*Clostridium perfringens*). The average total biological count, which serves as a vital measure of soil hygiene, was recorded at 8.0×10^6 , indicating varying levels of contamination at all sampling locations ($n=507$). In comparison to the Mongolian soil hygiene standard (MNS 3297:2019), the Bayangol district ($n=29$) exhibited the highest level of biological contamination at 31%, whereas the Bagakhangai district ($n=11$) showed no signs of contamination. The ranking of contamination levels by district was as follows: Bayangol (BGD) > Sukhbaatar (SBD) > Songinokhairkhan (SHD) > Chingeltei (CHD) > Bayanzurkh (BZD) > Khan-Uul (KHD) > Nalaikh (ND) > Bagakhangai (BHD).

A total of 19.1% (97 sites) of the surveyed locations exhibited contamination by coliform bacteria, specifically *E. coli*, whereas 3.9% (20 sites) were found to be contaminated with anaerobic bacteria, namely *Clostridium perfringens*. Within the coliform-contaminated sites, two locations displayed high levels of *E. coli* contamination, three sites showed moderate levels, and 92 sites were categorized as having low levels of contamination. In contrast, all sites

with anaerobic contamination were characterized by low levels. The Sukhbaatar district (N=52) recorded the highest incidence of *E. coli* contamination at 26.9%, while the Bayangol district (n=29) reported the highest levels of anaerobic contamination at 20.7%. These findings suggest a rising trend in microbiological contamination of soil, attributed to factors such as the density of pit latrines, as well as the elevation and slope of residential areas.

Organic carbon stocks in forest soil

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Keywords: Soil, forest soil, organic carbon stock, Mongolia

Abstract: Studied soil organic carbon (SOC) stock of major forest soils of Mongolia. In forest areas of the country dominated Umbrisols (Gelic), Leptic Umbrisols, Gleyic Umbrisols, Mollic Umbrisols, and Podzols (Arenic) soils. For soil organic carbon stocks calculation, we used existing soil data plus additional soil sampling analysis results for some data lack area. Totally used 1071 soil profiles data. Soil analysis data was converted to constant horizons using weighted average method. The most widespread forest soil of Mongolia is Leptic Umbrisols and average SOC stock for 0-30 cm soils is about 66.9 Mg C ha⁻¹; for 30-60 cm of soils 14.1 Mg C ha⁻¹ and 0-100 cm soil 86.3 Mg C ha⁻¹ respectively. Gleyic Umbrisols is formed on the lower part of the north-facing taiga forest slopes. Average SOC stocks of Gleyic Umbrisols is high up to 136.0 Mg C ha⁻¹ in 0-100 cm of soils. For 0-30 cm SOC stock is 86.9 Mg C ha⁻¹ and for 30-60 cm of soil 38.6 Mg C ha⁻¹. The average SOC of Umbrisols (Gelic) is 8.0%, Leptic Umbrisols is 4.1%, Gleyic Umbrisols is 3.8%, Mollic Umbrisols is 5.7% and Podzols (Arenic) is 0.65% consequently. Podzols (Arenic) distributed in the sandy forest area and topsoil organic litter is comparatively less than other soils. The mean value of SOC of Podzols (Arenic) for 0-30 cm soils was 28.8 Mg C ha⁻¹, for 30-60 cm of soils 18.5 Mg C ha⁻¹ and for 0-100 cm soil 55.0 Mg C ha⁻¹, respectively. Up to 52-78.9 % SOC resource in forest soils accumulated in the upper 30 cm of soils. Further needed more forest soil study work to fully coverage the forest area of Mongolia. Especially high mountain taiga area, remote area of Khentei, Khovsgol mountain area not sufficiently studied.

Phytoremediation using nettle (*Urtica dioica*) to reduce heavy metals in soil

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Keywords: metals pollution in soil, nettle, bioconcentration factor

Abstract: In Ulaanbaatar, the capital city of Mongolia, recent years have seen rapid urbanization and population growth, leading to an increase in environmental degradation. As a result, the population's health and their comfortable living environment are deteriorating. This study was conducted to determine the extent of heavy metal pollution in the soil around factories in urban areas of Mongolia and to mitigate and neutralize the pollution using phytoremediation technology. The total amount and geochemical fractions of Cr, Cu, Mg, Ba, Li, Ni, As, and Pb in the soil were analyzed. The study area included the surroundings of a wastewater treatment plant at a leather processing facility and a waste accumulator recycling plant. All soil samples (n=27) were included in the analysis. For the phytoremediation experiment, Nettle (*Urtica dioica*) plants were selected, and the experiment was conducted with two repetitions over 90 days. The concentration of heavy metals in the soil was compared before and after planting. It was found that the lead (Pb) content at a depth of 0-5 cm was 52.6 times higher than the soil standard (MNS 5850:2019) in Mongolia, while the chromium (Cr) concentration was 33-45 times higher than the standard at depths of 0-50 cm. Nettle (*Urtica dioica*) reduced the heavy metal content in the soil by 8.3% to 54.7%. The chromium (Cr) content in the soil around the wastewater treatment plant of the leather processing facility decreased by 54.7%, and the lead (Pb) content in the soil around the Waste Accumulator Recycling Plant decreased by 14.8%. Stinging nettle (*Urtica dioica*) roots absorbed a maximum of 3360 mg/kg of chromium (Cr) with a BCF (Bioconcentration Factor) of 1.28. Contaminated soil in the industrial area poses a high risk of serious harm to the local ecosystem.

Study on the quality of drinking water in the central settlements of Bulgan province

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Keywords: Groundwater quality and composition

Abstract

This research work, conducted within the framework of the contracted project "Study, assessment, and recommendations on the quality of drinking water in the center and rural settlements of Bulgan province" in 2022, has been incorporated into this article following processing of the results. The chemical composition of groundwater was overall dominated by the hydro carbonate ions prevailed over anions (97.8%). In case of cation, showed that 69.6% of all water points were determined as Ca-HCO_3 , 17.4% % mixed, 10.9% was Na-HCO_3 , and the remaining 2.2% was SC-CaMg . In terms of total mineralization, 21.7% is classified as freshly and 78.3% as fresh. The hardness of the water varies from soft to hard (hardness 2.52-8.4 mg-eq/L). Out of all the samples, only 2.17% are hard, 10.9% are moderately hard, 80.4% are softish, and 6.5% are soft. About 15.2% of the samples were dominated by magnesium and magnesium consent exceeded the standard of drinking water in the 4 samples (8.5%) which was 1.1-2.3 times higher than the permissible level of the standard "Environment. Health protection, Safety Drinking water. Hygienically requirements, assessment of the quality and safety" MNS 0900:2018. The calcium ion and total hardness levels exceed the standard in only 2.17% of the samples. Nitrate ions were predominantly detected in the nutrient pollutions, with 6.4% of the samples not meeting the drinking water standards, and 39.1% have low fluoride content, while 26% have high fluoride levels. Microbiological analysis showed that 8.7% of the water points have total bacterial and intestinal group bacteria exceeding the standard requirements. Microelement analysis found uranium (U) in 8.7% (4 wells), strontium (Sr) in 6.5% (3 wells), and manganese (Mn) in 2.2% (1 well) of the samples. Radon (Rn) levels in 13 wells were 1.01-1.92 times higher than the standard, accounting for 28.3% of the total samples.

Adsorption Kinetics and Isotherm Study of Se(IV) Removal via Fe-Mn-Based Adsorbents

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Keywords: Selenium removal, Layered double hydroxides (LDHs), Double oxides

Adsorption kinetics, Water treatment

Abstract:

In this study, Fe-Mn layered double hydroxide (LDH) and Fe-Mn double oxides (DOs) were synthesized using a co-precipitation method to evaluate their effectiveness in removing Se(IV) from aqueous solutions. The adsorption kinetics and isotherm behaviors of Se(IV) on these adsorbents were analyzed using various models such as pseudo-first and second-order, Elovich, and intraparticle diffusion for kinetics, and Langmuir, Freundlich, Temkin, and Dubinin-Radushkevich for adsorption isotherms.

The results indicated that Se(IV) adsorption followed the pseudo-second-order kinetic model, suggesting chemisorption as the dominant process, while the Freundlich isotherm best described the multi-layer adsorption. The adsorption capacities of Fe-Mn LDH and DOs were 52.5 mg/g and 55.3 mg/g, respectively. Thermodynamic analysis showed the adsorption process to be spontaneous, and repeated adsorption/desorption experiments demonstrated the regenerability of the adsorbents with a slight decrease in capacity after multiple cycles.

These findings highlight the potential of Fe-Mn LDHs and DOs as cost-effective materials for industrial Se(IV) removal applications.

Future projection of extreme precipitation in CMIP6 (Case study catchments areas)

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Keywords: Probable maximum precipitation, future trends, river basin, CMIP6-models.

Abstract: The particular study covers estimation of daily maximum rainfall amount, namely by estimating the probable maximum precipitation, by some selected methods and prediction of future trends of rainfall amount and location. The daily maximum rainfall amount with different return period is one of the key inputs for any flood estimation studies. The study also contributes to reduction of risk of flood disasters in river basins with high density of population and infrastructural facilities. Goal of this study was to evaluate spatial distribution of the PMP within the catchment areas. In this research, we also have used the CNRM-CM6-1-HR (France) model which initiated and developed by World Climate Research Program (WRCP) with the highest spatial resolution of 0.50x0.50 for estimation of rainfall amount during period of 1991-2014 and the analysis showed reasonable high values of correlation coefficient as 0.60. The data series of 1991-2014 is recommended and used in The Sixth Assessment Report-AR6, developed by the Intergovernmental Panel on Climate Change (IPCC) of the United Nations Framework Convention on Climate Change. Finally, the results of the analysis by CNRM-CM6-1-HR (France) model showed that probable maximum precipitation (daily maximum rainfall) is expected to be around 110 mm in the basin for period of till 2099.

Classification of fly ash and its application possibilities

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Keywords: waste ash, lightweight block

Abstract: It is estimated that more than 20% of the total weight of the improved briquette coal used in Ulaanbaatar city contains non-combustible inorganic compounds. However, the ash quality of raw coal from any mine, including briquette coal ash, is the same as above. Suppose the ash can be turned into wealth and used as an essential raw material for producing final products such as cement, extruded blocks, plain and decorative tiles, tiles, eco-tiles, road curbs, building plaster, and many others. The life-cycle of fly ash can be extended and be helpful.

In this study we have studied the fly and bottom ash from Oyutolgoi coal heat plant to identify the classification of ash and determined the possible application usage. Fly ash has a content of silicon dioxide (SiO₂) plus aluminum oxide (Al₂O₃) plus iron oxide (Fe₂O₃) - 87.90%, Calcium oxide (CaO) - 4.66%, Sulfur trioxide (SO₃) - 1.3%, Moisture content - 1.45%, Loss on ignition - 3.26% or N class ash. Bottom ash has a content of Silicon dioxide (SiO₂) plus aluminum oxide (Al₂O₃) plus iron oxide (Fe₂O₃) - 56.30%, Calcium oxide (CaO) - 11.73%, Sulfur trioxide (SO₃) - 8.04%, Moisture content - 0.28%, Loss on ignition - 0.42% or F class ash. The concentration of heavy metal fraction of fly ash Al, Ba, Mg, Cd, Sn, Pb, etc., and bottom ash contains metals such as Al, Ba, Mg, Zn, Co, Ni, Cd, Sn, and Pb, residual fraction is more than 50% which does not have a negative impact on the environment and human health. But fly ash metals such as As, Fe, Zn, Co, and Sr are 50-85%, and bottom ash metals such as As and Fe are mobile or in aluminosilicate and other mobile forms 50-80% in mobile form, but their total concentration is average, not exceeding the standard concentration.

When comparing the flexural strength of lightweight block with ash and cement in the ratio of 30/30 and 20/40 for 28 days, compared to the technical requirements of MNS 5771:2007 Polystyrene concrete, the flexural strength limit of the standard was twice exceeded. From this, it is believed that it can be used as a heat and sound insulation material.

Include the climate change and livestock pasture protection issues to the curriculum of university and institute

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Keywords: Climate change, adaptation, student-trainer, university curriculum

The objective: The student-trainers will focus on changing the public mindset about climate change, and further training and practicing of others to adaptation of climate changes.

In this paper, we are focusing more on the issue of adaptation to the climate changes. It is one of the main problems of today's development to provide the society with the correct understanding of climate change, to make university students understand the issue of climate change, and through them to change the psychology and attitude of society.

As a result of the research and development of the European Union ERASMUS project, which is implementing in the school, the idea of improving the quality of the environment by being able to protect and sustainably use the pasture land, how the herdsmen and pasture users can properly use their pasture land in the era of Climate changing is reflected in this paper.

Scope of the research: Give the lectures as, the basic concepts of climate change, the effects and consequences of climate change, the impact of climate change on pastures, the possibility of reducing climate change intensity, approaches to adaptation to climate change, new approaches to pasture management, the creation of specialized herdsmen, ways to manage the animal husbandry in the conditions of climate change, sustainable use of pasture land, and making the triangle "Livestock-Herdsmen-Pasture area" the main 3 directions of sustainable development.

Main results: After successful implementation of the university curriculum will be expected the following results.

- Creation of human resources with a new approach of climate change education
- Educated a student-teachers
- Creation of a society and herders with the mentality to adapt to the climate change.

Master Student's Presentations

Vegetation biomass forecasting using ARIMA models

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Keywords: *Normalized Difference Vegetation Index, Vegetation Biomass, Deep Learning, ARIMA, Google Earth Engine*

Vegetation is an important type of land cover. Long-term, large-scale and high-precision monitoring of vegetation is of great importance for the study of the ecological environment of protected areas, the estimation of greenhouse gas absorption and concentration, the sustainable development of a region, and the development of general and detailed plans. In this work, Google Earth Engine (GEE) online platform based on Google's cloud technology, the Javascript programming language and the Landsat series satellites' data from 1993-2022 was used to calculate the Normalized Difference Vegetation Index (NDVI) to investigate the distribution, density and biomass of vegetation, and developed long-term monitoring and prediction.

Spatial and temporal distribution of NDVI was mapped and its trends were determined using Deep Learning in Javascript programming language and Landsat long-term satellite images on the GEE cloud platform. Then, the biomass was calculated using the value of the normalized vegetation index, and ARIMA analysis was performed in relation to the daily total precipitation and average air temperature from May when plants would start growing to when the next satellite image would be taken, and the average trend of the NDVI and biomass was determined, and future predictions developed.

When making a prediction, 6 years or 20% of the time period was predicted due to it having the highest probability on the time period data. The normalized difference vegetation index and vegetation biomass calculated from the real data of Landsat 9 satellite in 2023 were verified and matched by deep learning Support Vector Regression (SVR) method to compare the value of 2023 predicted by ARIMA model.

Environmental Sustainability indexing; A measure of the balance between anthropogenic pressure and ecological relevance; representative case study

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Abstract

Land use change is one of the biggest drivers of biodiversity loss. Deforestation, increase in urbanization, agriculture expansion, and other human activities have substantially altered and fragmented our landscapes [1]. Such disturbance of the land changes the global atmospheric concentration of carbon dioxide, and affect local, regional, and global climates by altering the energy balance on Earth's surface. [1,2]. Approximately, 1.24 million sq km of grassland or natural areas disappears every year in Mongolia, as it is converted into artificial land [3]. Current efforts to combat global warming focus on reducing the emission of heat-trapping gases, but they do not fully address the substantial contribution of land use change and degradation to climate change in Mongolia. Mitigating climate change could be better achieved by regulating land use change and neutralizing land degradation, rather than relying solely on emissions reduction alone [6]. Even small changes of 100 square kilometers in urban development or deforestation can change local rainfall patterns and trigger other climate disruptions. To address these issues, it is necessary to implement environmental protection measures aimed at developing sustainable land management (SLM) practices to promote ecosystem health.

This study employs the Environmental sustainability Index (ESI) [2,14] of land use (stability of the ecosystem), a recently developed index for analyzing environmental value based on land use. The ESI facilitates the quantification of a specific area's environmental value by considering its land use characteristics. This index is particularly advantageous for land use assessments which can be used to evaluate the effectiveness of corrective measures implemented through territorial, urban, or environmental planning instruments. Objects with selected land cover categories are multiplied by individually selected reduction coefficient intended to diversify the ecological importance ('quality') of various land cover categories. The ESI range from 0 (for heavily anthropogenic areas) to 1 (for ecologically most valuable areas). Therefore, the higher the ESI, the greater the ecological relevance in the area.

The same methodology was applied to analyze land use change in Darkhan-Uul province across different time periods. Using data from years like 2008, 2023, and 2030, the methodology demonstrated its ability to analyze past trends, assess present conditions, and predict future shifts in land use.

The assessment of the environmental sustainability of Darkhan-Uul province shows a moderate sustainable trend. However, the sustainability index scores decreased from 0.65 in 2008, to 0.63 in 2023. The assessment results showed that it is expected to decline further to 0.55 in 2030. The presence of diverse land use in this region probably have affected ecological sustainability, but the main reason for decline in sustainability index value is the increasing human-induced transformations of Darkhan-Uul province ecosystems and landscapes, leading to changes in land cover.

The human induced land use index for Darkhan-Uul province, suggests that human footprints are expected to increase significantly until 2030 in the province. The decline over periods indicate declining ecological sustainability in the province.

The some application results of the soil and water assessment tool (SWAT) on the Selbe and Dund river basin

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Keywords: Selbe, Dund river, SWAT, climate, land use

Abstract: There have limited research results on water availability and variety in the Selbe and Dunn River basins related to climate and land use changes. Climate change, population growth, and urbanization are a major factor in the circulation of surface water in the river basin, as well as its processes. The groundwater recharge regime at the base flow and basin level is greatly impacted by the reduction of natural infiltration, which increases the amount of direct flow and reduces the natural infiltration process. The SWAT modeling used in the study is a model that is recognized internationally and can be utilized in various fields. Such as studying and evaluating the effects of surface water resources, regimes, water quality, sediment transport, and the impact of land use change and climate change on the water balance at the basin level. Based on 15 years of data from the Ulaanbaatar Meteorological Station, which has been continuously monitored for multy years, between 2009 and 2022, the climate conditions around the research area were determined. Spatial data, such as Digital Elevation Model (DEM), soil classification, and land use classification data, were created and utilized for surface water SWAT modeling. SRTM data on the USGS Earth Explorer website provided the data for DEM with a spatial resolution of 90 m. The model results show that the surface water balance of the Selbe and Dund rivers, including actual evapotranspiration (ET), direct runoff (SurQ), base runoff (lateral runoff (LatQ) +groundwater runoff (GwQ)), soil moisture (SW) and WYLD Approximate values were obtained for several important components of the surface water balance. Further analysis of sensitivity, calibration, and validation are in the works.

A comparative study of the elemental contents of plants in different pollution environments

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Keywords: Ulaanbaatar city, air pollution, heavy metal, plants

Abstract

In recent years, due to the population density in Ulaanbaatar city, the number of cars, buildings, and households has increased rapidly, and with it, solid waste, air pollution, and heavy metal pollution have increased. Which has a significant negative effect on the living conditions of the people and living plants. Plants are the most important living organisms for reducing environmental pollution. Heavy metals affect the growth and development of plants by disrupting green structures and plants, inhibiting the activity of enzymes, and slowing down the increase.

In this study, we measured the content of heavy metal in nine types of plants (Larix sibirica, Pinus Sylvestris, Betula platyphylla, Populus laurifolia-Улиас, Ulmus pumila, Rosa acicularis, Spiraea media, Taraxacum officinale, Plantago depressa). Samples were collected in ten locations (Gunt, Botanik, NUM, Zuun durwun zam, 13th district, 1st district, Yarmag, Power plant, Bayankhoshuu, 5,6th bus station) of Ulaanbaatar city from June to September 2021. This work focuses on the compare how it affects their physiological functions under different pollution conditions.

First measurement report for volatile organic compounds characteristics during winter in Ulaanbaatar, Mongolia

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Keywords: Volatile organic compounds, Ulaanbaatar, winter, source apportionment, health risk assessment

Abstract

In this study, 34 volatile organic compounds (VOCs) were measured using an online VOCs instrument at 30-minute intervals from November 16 to November 23, 2023, in Ulaanbaatar (UB), the capital of Mongolia for the first study. The average concentration of the 34VOCs was 13.0 ± 11.1 ppb, with the top 10 compounds, such as benzene, toluene, ethylbenzene, and xylenes (BTEX), constituting 80% of the total. The concentrations of species such as n-hexane, n-heptane, and undecane tended to increase significantly at high concentrations. Compared to other studies, the concentration levels of BTEX in UB were higher than those in Seoul and Beijing but lower than in Bangkok, Kuala Lumpur, Hanoi, and other Southeast Asian cities. The positive matrix factorization (PMF) modeling identified four sources of VOCs, with vehicular emissions being the highest contributor at 33.8%, followed by industrial and coal combustion at 25.3%, secondary formation precursors at 21.3%, and solvent usage at 19.6%. Vehicle emissions, industrial, and coal combustion sources tended to increase in concentration during peak hours and were highly correlated with NO and NO_x when compared to gas-phase components measured during the same period. Solvent usage appeared to be affected by building materials and paint on building exteriors as relative humidity increases. Secondary formation precursors tended to increase in concentration during daylight hours and was highly correlated with O₃. During the high concentrations period, low mixing depth layers and wind, and low ratios of xylene to ethylbenzene, a stagnant air mass with a stable atmosphere was formed. This led to an increase in the contribution of industrial and coal combustion sources relative to other sources. Among the measured constituents, benzene was evaluated for lifetime health risk

assessment of UB, indicating a high risk to the health of the adults. Based on the concentration levels of VOCs and the health risks associated with benzene, a policy on VOCs is necessary in UB, even during winter when temperatures are low. This indicates the need for local source control in UB.

Preparation of adsorbent materials from minerals to remove organic pollutants in water

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Keywords: organic water pollution, zeolite, perlite, basalt, expanded clay

Abstract:

In our country, water quality analysis is carried out regularly, but the actual work of purifying and reducing water pollution that exceeds the tolerance level is insufficient. The biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), ammonium, and nitrite nitrogen in the water treated by the central treatment plant are 9–10 times higher than the permissible levels, and this polluted water is directly discharged into the Tuul River. Surface water pollution continues in the Tuul, Selbe, and Dund Rivers near Ulaanbaatar due to unauthorized waste dumping and industrial wastewater discharge. Additionally, research has shown that the mineralization and hardness of deep well water are caused by soil pollution. These emerging pollutants continue to have a negative impact on the environment and human health. Therefore, in our country, we have decided to use volcanic rocks such as zeolite, perlite, basalt, and expanded clay, which are widely available, to produce blocks with absorbent materials and to conduct research on reducing organic water pollution. To determine the suitable procedure for extracting strong and absorbent materials using expanded clay, zeolite, perlite, basalt, and cement in the production of base materials for blocks, various mixtures were calculated, base materials were prepared, and more than 60 types of blocks with different compositions were obtained. The physical adsorption capacity of the derived blocks was tested using an organic pollutant (methylene blue). To observe how organic water pollution is reduced, samples were taken from the highly polluted section of the Tuul River, near Songino Bridge, where treated water from the central treatment plant flows, and tests on reducing the chemical and biological pollutants in the water were conducted. The absorption capacity of the blocks was also tested. Additionally, the elemental composition of the raw materials, images of the crystal structure, and the physical properties of the blocks were analyzed in a professional laboratory. From the overall test results, blocks such as All-1, All-3.5, or zeolite-based blocks demonstrated the best physical properties, including high pollutant absorption, strength, and water absorption.

Study on heavy metal pollution in surface sediments in rivers of central Mongolia

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Keywords: surface sediment, heavy metal

Abstract:

Among the pollution of soil, water, and air, which are components of the environment, pollution by sediments accumulates over a long period and becomes a source of water pollution for the next 80-120 years. By conducting research along the rivers located in the areas of intensive agriculture, livestock, industry, and mining in Mongolia, it will be possible to monitor the state of the habitat in a healthy and safe environment for the people and species. This will play an important role in solving problems such as expanding the scope of targeted research, introducing new monitoring, and using multiple research directions. Therefore, this work focused on determining the heavy metal pollution in sediments, comparing it with the baseline values of the earth's crust, assessing the environmental risk from the pollution state, and determining the spatial distribution of metals in sediments. We aim to study a river in central Mongolia to evaluate the present condition of heavy metal pollution in surface sediments. Sediment metal (Zn, Pb, As, Cu, Cr, Ni, Co, and Mn) concentrations were sampled and analyzed. Results showed that metal concentrations are much higher in areas near the mining sites and agriculture operations, with pollution load index values exceeding 1. Higher PLI results were found near the Gatsuert River, where many mining sites dig in. Insufficient sewage outlets due to the mining and agriculture operations were major sources of metals leaking into the rivers. The content of As, V, Cr, Mn, and Mo in most samples is relatively high. It is found that the areas near factories and mines, such as the Gatsuert, Sharyn, and Boroo rivers, have high and serious pollution levels. These findings indicate that alternative methods should be enforced and might see further regulations and compensations. Expertise in sandblasting, electrochemical treatment, and flotation techniques for effective remediation of heavy metal-contaminated surface sediments. These methods are more feasible, effective, and low-budget to implement in our study area.

The mechanochemical activation study of natural zeolite for the purification of groundwater

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Keywords: Zeolite, Mechanochemical process, Hardness water, Adsorption

Abstract

Natural zeolites are versatile minerals with a range of applications due to their unique properties, such as ion exchange, adsorption, and molecular sieving. Natural zeolites have been increasingly used in various application areas such as industry, environmental protection, medicine, and agriculture. Mongolian Gobi region groundwater has high hardness, heavy metal pollution, and high salinity. This research studied the possibility of purifying the hardness and heavy metal-polluted water of the Gobi region by mechanochemical activation of natural zeolite. We mainly explored the effect of experimental conditions, such as rotation speed, ball diameter, milling duration as well as ball to powder ratio and ball filling ratio, on the activation of natural zeolites. Natural zeolite activation by the mechanochemical method was determined with minimal energy consumption and optimal conditions at rotation speeds of 100, 150, and 200 rpm, milling times of 3, 5, and 10 minutes, and ball sizes of 1, 3, 5 mm using a planetary ball mill. When carrying out absorption at the optimal mechanochemical value, standard hardness water was calculated from the measurement values of Ca^{+2} and Mg^{+2} in plant A, and batch absorption was performed for 30-1440 minutes and the mass of absorbent material was 1, 5, 10 g, the hardness decreased as the mass of the absorbent material and the time of absorption increased. The initial Ca^{+2} ion concentration was 580-600 ppm, after 780 minutes it reached the standard content of 100 ppm, and after 1440 minutes it became 75 ppm, which was included in the drinking water standard. We explored the potential of mechanochemical activation as a viable method for enhancing the utility of natural zeolites in groundwater purification applications, contributing to more sustainable water management practices.



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Tackling the **C**limate change through **M**odernizing **E**nvironmental **E**ngineering program”- **TACMEE**

ХҮРЭЭЛЭН БҮЙ ОРЧНЫ ИНЖЕНЕРЧЛЭЛИЙН ХӨТӨЛБӨРИЙГ ШИНЭЧИЛЖ
УУР АМЬСГАЛЫН ӨӨРЧЛӨЛТИЙГ СААРУУЛАХ НЬ

Төслийн зорилго:

1. “Хүрээлэн буй орчны инженерчлэл” бакалаврын түвшний хөтөлбөрийг хөдөлмөрийн зах зээлийн шаардлагад нийцүүлэн шинэчлэн сайжруулах
2. “Хүрээлэн буй орчны инженерчлэл” ахисан түвшний хөтөлбөрийг хэрэгжүүлж эхлэх
3. “Хүрээлэн буй орчны инженерчлэл” –ийн лабораторийг байгуулж, сургалт, судалгаанд ашиглах
4. Хөтөлбөр дэх хичээлийн хөтөлбөрийг шинэчлэх
5. Багш, суралцагч, олон нийтийг чадавхижуулах

Төслийн баг:



Холбоо барих:

Мэйл: sapia@chem.u-szeged.hu ; enkhdul@seas.num.edu.mn

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Вебсайт: tacmee.eu ; Twitter: <https://twitter.com/TACMEE2>

Facebook: <https://www.facebook.com/Tacmee-106709554998133> ;



Хүрээлэн буй орчны инженерчлэл



Хөтөлбөрийн индекс: D071201



Элсэлтийн талаарх мэдээллийг:

<https://burtgel.num.edu.mn/bachelor/> хаягаар орж аваарай.

Бүртгүүлэгч нь хэдэн ч салбар сургуулийн хөтөлбөрт бүртгүүлж болох бөгөөд бүртгэлийн хураамж 10800₮ (2023) байсан.

Ямар шалгалт өгөх вэ?



Суурь шалгалт 70%	Дагалдах шалгалт 30%	Босго оноо
Математик	Физик	480
Математик	Англи хэл	480
Математик	Хими	480
Хими	Физик	480
Хими	Англи хэл	480

Хөтөлбөрийн тухай:

Хүрээлэн буй орчны үндсэн бүрэлдэхүүн болох ус, агаар, хөрс, техноген орчны бохирдлыг бууруулах технологи боловсруулах арга, аргазүйг эзэмшсэн чадварлаг боловсон хүчин бэлтгэнэ.

УС, АГААРЫН БОХИРДОЛ

Бохирдлыг эх үүсвэрт бууруулах
- Хаягдал ус
- Хаягдал хий
- Ундны ус
- Уур амьсгалын өөрчлөлт

ХОГ ХАЯГДЛЫН МЕНЕЖМЕНТ

- Шинж чанар, ангилал
- Хоргүйжүүлэх
- Булшлах
- Бууруулах
- Нөөцийг сэргээн авах

ГЕО-ОРЧНЫ ИНЖЕНЕРЧЛЭЛ

- Хөрс
- Газрын доорх ус
- Хурдас
- Гадаргын усны систем
- Уул уурхай

Ажлын байр, Хөрвөх чадвар

- Шинжилгээний лабораториуд
- Төрийн захиргааны төв байгууллага
- Олон улсын төсөл хөтөлбөрүүд
- Уул уурхай болон бусад ААН
- Нөхөн сэргээлтийн компани
- Судалгаа, эрдэм шинжилгээний байгууллага
- Төрийн болон нийтийн байгууллага
- Байгаль орчны үнэлгээний компани



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Тэтгэлэг сайн дурын ажилд хамрагдах :

Хүрээлэн буй орчны инженерчлэл хөтөлбөрийн оюутнууд хөтөлбөрийн дэргэдэх "Ногоон инженерчлэл клуб"-д шууд хамрагддаг тул сайн дурын ажил, олон улсын төсөл хөтөлбөр, эрдэм шинжилгээний хурал зэрэгт оролцох бүрэн боломжтой.

