2025

CAPITOL GRADUATE RESEARCH SUMMIT

March 25th, 2025

EMPORIA STATE UNIVERSITY

FORT HAYS STATE UNIVERSITY

KANSAS STATE UNIVERSITY

Pittsburg State University

KU THE UNIVERSITY OF KANSAS

KU MEDICAL CENTER The University of Kansas

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Welcome

The Capital Graduate Research Summit (CGRS) provides an opportunity to showcase the impactful research conducted by graduate students at universities across Kansas. Graduate students from across Kansas join their peers from the Kansas Board of Regents Institutions at the Capitol Building to present their to legislators and other members of state government.

The CGRS offers professional development through the enhancement of research presentation and communication skills for non-specialist audiences, and it provides valuable networking opportunities, allowing participants to connect with graduate students from other Kansas universities and engage with Kansas policymakers and representatives.

Thank you for joining us in showcasing the innovative research being conducted by Kansas graduate students.

Presenters

Emporia State University

MD Omum Siddique Auyon, Afroja Akther, Abdullah Al Adnan: **EVALUATING THE CYBERSECURITY CHALLENGES OF IMPLEMENTING CENTRAL BANK DIGITAL CURRENCIES (CBDCS)**

Eusha Azmain: **INVESTIGATING AMPHETAMINE STABILITY IN URINE**

Lauren Christie: **UNDERSTANDING THE RELATIONSHIP BETWEEN MINDFULNESS-FOCUSED ART THERAPY AND BURNOUT IN MENTAL HEALTH PROFESSIONALS: A PRE AND POST-TEST STUDY**

Mohammad Ikbal Hossain, Ayesha Arobee, and Anju Takahashi: **BLOCKCHAIN IN AGRICULTURAL SUPPLY CHAINS: ENHANCING TRANSPARENCY AND REDUCING FRAUD IN AGRICULTURE SECTOR**

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Zahirul Islam Saddam: **DEVELOPING NEXT GENERATION Li-S BATTERY BY TUNING THE ACTIVE SITES OF MoS2/rGO CATALYSTS**

Conrad Schelkopf: **ELECTRONIC NOSE DIFFERENTIATES HEALTHY CATTLE FROM CATTLE EXPERIMENTALLY INFECTED WITH BOVINE RESPIRATORY DISEASE**

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Pittsburg State University

Grant Howard: **THE EFFECT OF MECHANICAL RECYCLING ON THE PROPERTIES OF HDPE FOR COMMERCIAL APPLICATIONS**

Priyank Patel: **TRADE-OFF BETWEEN LIMONENE-BASED REPROCESSABLE AND NON-REPROCESSABLE EPOXY THERMOSETS: ROLE OF ALIPHATIC DIAMINES IN POLYMER NETWORKS DESIGN**

Jaymin Joshi: **DEVELOPMENT OF BIO-BASED POLYURETHANE ADHESIVES: INFLUENCE OF CROSSLINKERS ON MECHANICAL AND THERMAL PROPERTIES**

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University of Kansas

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Afeez Badmus: **LIFECYCLE BENEFIT-COST ANALYSIS OF WOOD-FRAME RESIDENTIAL BUILDINGS TO TORNADO HAZARD**

Mona Shaheen, **M.S: MONITORING AND MITIGATION OF WIND-INDUCED VIBRATION OF HIGH MAST ILLUMINATION POLES IN KANSAS**

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University of Kansas Medical Center

Bria Bartsch: **UNDERSTANDING THE RELATIONSHIP BETWEEN FTINESS AND COGNITIVE DOMAINS POST-STROKE**

Scotti Brackett: **EXPLORING THE INTERSECTION OF POLICY AND HEALTH IN PEOPLE WITH INTELLECTUAL AND DEVELOPMENTAL DISABILITIES: A NARRATIVE REVIEW**

Gentry Totta-Griese: **INVESTIGATING THE MECHANISM UNDERLYING DIABETIC PERIPHERAL NEUROPATHY**

Dylan T. Vance: **INTERDISCIPLINARY AIRWAY MANAGEMENT: A SURGICAL PRIMER FOR FIRST- AND SECOND- YEAR MEDICAL STUDENTS**

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Wichita State University

Adithya Melagoda: **POWER DISTRIBUTION SYSTEM RESTORATION DURING EXTREME EVENTS: EQUALITY OR EQUITY?**

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Eric Pereira: **A PHYSICS INFORMED MACHINE LEARNING FRAMEWORK FOR STATE-OF HEALTH ASSESSMENT OF LITHIUM-ION BATTERIES IN RESILIENT INFRASTRUCTURE APPLICATIONS**

Toomaj Amiri: **ASSESING TONGUE MOBILITY AND STRENGTH USING PARROT: AN ORAL DEVICE**

Nirasha Bataduvaarachch: **PREDICTION OF VOLUNTARY LOAD REDUCTION BASED ON HUMAN BEHAVIOURS DURING GRID EMERGENCIES**

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Demy Alexander: **REDUCING TRANSMISSION LINE IMPACTS CAUSED BY ROOFTOP SOLAR PANELS USING ELECTRICITY MARKET MECHANISM**

Poster Abstracts

Emporia State University

EVALUATING THE CYBERSECURITY CHALLENGES OF IMPLEMENTING CENTRAL BANK DIGITAL CURRENCIES (CBDCS)

MD Omum Siddique Auyon, Afroja Akther, Abdullah Al Adnan
School of Business, Emporia State University

As central banks around the world continue to develop and implement Central Bank Digital Currencies (CBDCs), cybersecurity has become one of the main issues. This paper examines a variety of cyber risks affecting CBDC systems, from denial-of-service attacks on the core infrastructure to ransomware attacks, from internal risks to the future implications of quantum computing on the current cryptographic methods. In response, a secure CBDC architecture must implement a layered system (defense in depth), adopt zero trust model, and include strong cryptographic features (including post quantum security) to secure transactions and privacy of users. It is also crucial to ensure the security of digital wallets and to enforce strict identity and access management controls, especially as user endpoints are prone to phishing and social engineering attacks. However, this paper will also look at the governance and regulatory aspects of CBDCs as well as standard setting, auditing and data protection. Finally, the systemic and operational risks that security breaches present in a digital currency environment, and the need for preparedness, resilience and trust are highlighted. Based on a review of the literature, case studies of existing CBDC pilots, expert interviews, and technical modelling, this research provides a comprehensive assessment of the cybersecurity issues facing CBDCs and recommendations for risk mitigation. The results show that cyber security is not just a technical feature that can be added to CBDCs but is rather a critical building block for the stable and effective implementation of CBDCs.

INVESTIGATING AMPHETAMINE STABILITY IN URINE

Eusha Azmain
School of Science and Math, Emporia State University

This research investigates the stability of amphetamine in urine to improve forensic and clinical drug testing reliability. Using gas chromatography-mass spectrometry (GC-MS), amphetamine concentrations were monitored in synthetic urine samples over time. Initial findings demonstrated that while GC-MS is effective for amphetamine detection, challenges such as low sensitivity at trace concentrations and degradation over time persist. Calibration curves for key ion fragments (m/z 91 and 118) exhibited high linearity ($R^2 > 0.995$), confirming method reliability. However, peak intensities significantly decreased at low concentrations (5 ppm), indicating potential detection limitations. Future research will focus on optimizing mass spectrometry parameters and expanding testing to biological urine samples to enhance detection accuracy and forensic applicability.

UNDERSTANDING THE RELATIONSHIP BETWEEN MINDFULNESS-FOCUSED ART THERAPY AND BURNOUT IN MENTAL HEALTH PROFESSIONALS: A PRE AND POST-TEST STUDY

Lauren Christie
School of Applied Health Sciences, Emporia State University

Mental health professionals are at an increased risk for burnout, compassion fatigue, and secondary traumatic stress. This quantitative study sought to identify if mindfulness-centered art therapy can help reduce symptoms of burnout in mental health professionals. A pre-test post-test method determined if there was a correlation between engagement in an art therapy directive and reduced burnout symptoms in participants. Seven mental health professionals participated in this study. Each participant was given a Maslach Burnout Inventory (MBI) before and after completing a scrape painting art therapy directive. They were also given a post-study survey at the conclusion of each session to gauge their satisfaction and perceived benefits of the experience. Each of the participants displayed a reduction in symptoms of emotional exhaustion after completing the mindfulness art therapy directive. The results gathered from this study support the hypothesis that art therapy can help reduce symptoms of burnout in mental health professionals.

BLOCKCHAIN IN AGRICULTURAL SUPPLY CHAINS: ENHANCING TRANSPARENCY AND REDUCING FRAUD IN AGRICULTURE SECTOR

Mohammad Ikbal Hossain, Ayesha Arobee, and Anju Takahashi
School of Business, Emporia State University

Agricultural supply chains face inefficiencies, fraud, and a lack of transparency, affecting farmers, distributors, and consumers. Blockchain technology offers a potential solution through a decentralized, immutable ledger that enhances traceability, trust, and accountability. This study evaluates the feasibility of implementing blockchain in the agricultural sector to improve supply chain visibility. Using a mixed methods approach, primary data is gathered from surveys and interviews with farmers, cooperatives, and distributors, while secondary data is sourced from blockchain-based agricultural projects. A blockchain simulation using Hyperledger or Ethereum smart contracts demonstrates the technology's ability to automate transactions, enforce rules, and minimize middlemen exploitation. The study applies the Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) Theory,

Supply Chain Transparency Theory, and Disintermediation Theory to analyze adoption factors. Findings reveal that supply chain inefficiencies, fraud risks, digital literacy, and perceived benefits influence adoption readiness, while high implementation costs and resistance to change pose challenges. Results indicate that blockchain can enhance instant tracing, ensure food safety, and prevent fraud, leading to more efficient supply chains. This research contributes to blockchain applications in agriculture and supply chain management. Policy recommendations include financial incentives, farmer education programs, and regulatory support to promote adoption. Future research should explore the scalability and long-term economic benefits of blockchain implementation.

ASSESSMENT OF DNA QUALITY IN *Sus domesticus* FEMURS AFTER HALF A DECADE OF SUBAERIEL WEATHERING WITH ULTRAVIOLET LIGHT

Hunter Springer
School of Science and Math, Emporia. State University

The subaerial weathering of bones is a gradual process involving degradation of biological material through factors such as sunlight exposure. Ultraviolet (UV) rays emitted by the sun are absorbed by bone, generating reactive oxygen species and photoproducts that damage DNA structure. Though research has shown that DNA degrades from sunlight exposure, little has been conducted on how it impacts DNA quality, particularly in bones. This study aims to reduce the literature gap by examining how DNA quality in Sus domesticus femurs is affected after five years of subaerial weathering with UV light.
The project consisted of two parts. Initially, a sterilization procedure was designed to remove exogenous DNA from bone surface. The method was tested by isolating and amplifying DNA from swabs of femur exterior before contamination, after contamination (with human, cow, and bacterial DNA), and after sterilization. The results revealed that the sterilization procedure successfully killed microbes and removed most contaminant DNA from bone surface. The second part of the project involved assessing porcine DNA quality. Bone powder was collected from anterior shafts (exposed directly to UV light) and posterior shafts (exposed indirectly to UV light) of sterilized samples before DNA was accessed by PCR. Larger amplification products were generated from posterior obtained DNA, signaling that DNA quality depends on collection location and, therefore, can be used to improve the likelihood of generating profiles for human identification.

Fort Hays State University

IMPLEMENTING STUDENTS' HAPPINESS WITHIN SCIENCE CURRICULUM WITH THE USE OF 360 VIDEOS

Cheyenne, Brannan
[1]*College of Education, Fort Hays State University*

The primary focus of education should be centered on fostering the happiness and well-being of students. When students are engaged and happy, they are more likely to be motivated, curious, and eager to learn. One of the most effective ways to nurture this happiness is by encouraging students to tap into their creativity, allowing them to explore new ideas and express themselves. Science education, in particular, offers a platform for students to engage their creative minds, as it not only builds knowledge but also fosters innovation and problem-solving skills.

This research highlights the integration of 360 videos and science workbooks as powerful tools for enhancing creativity and promoting an interactive learning experience. These innovative methods provide students with immersive and hands-on ways to engage with scientific concepts, making learning both enjoyable and meaningful. Additionally, the ideas of Nel Noddings on happiness within education serve as a foundational framework in this study. Noddings' emphasis on caring relationships and creating environments within the curriculum where students feel valued and supported is central to understanding how happiness can be fulfilled in educational settings. By combining these elements, this research explores how a focus on student well-being, creativity, and innovative teaching methods can lead to a more fulfilling and effective educational experience.

NOT STRONG ENOUGH? THE ROLE OF RESILIENCE IN THE DEVELOPMENT OF PERSONALITY OF ADULT SURVIVORS OF CHILDHOOD TRAUMA

Erica, Treto
[1]*Department of Psychology, Fort Hays State University*

Childhood trauma is a significant and increasing problem in the United States, with research showing that two-thirds of children have experienced at least one traumatic event before reaching the age of sixteen (SAMHSA, 2023). These events can have severe consequences in adulthood, including impacts on personality. However, there are protective factors such as resilience that can help mitigate the negative effects of childhood trauma. Extensive research and discussion have focused on the relationship between childhood trauma and personality, particularly in terms of mental health. However, research has been limited to investigating all Big Five personality traits and childhood traumas along with an ungeneralizable sample. Thus, this study investigated the relationship between childhood trauma (physical neglect, physical abuse,

emotional neglect, emotional abuse, and sexual abuse), the development of personality traits (neuroticism, agreeableness, openness to experience, extraversion, and conscientiousness), and how resilience plays a moderating role. Participants (n = 392), primarily of the Midwest, completed a series of self-report questionnaires to assess the main variables of interest. Results indicate that resilience serves as a significant moderator for the traits of extroversion, agreeableness, and conscientiousness; for these three personality characteristics in particular, more resilience following childhood trauma enhances these traits. These results can be used to further understand the impact of childhood trauma on adult personality traits and to enhance the significance of equipping children with protective measures after experiencing childhood trauma, bolstering their resilience and potentially mitigating detrimental effects in their adult lives. Keywords: childhood trauma, Big Five personality, resilience, protective factors, adult survivors, child abuse and neglect

ASSESSING THE IMPACT OF TRAINING PROGRAMS ON PHISHING SUCCESS AND REPORTING RATES IN HEALTHCARE

Samuel Amoateng
[1]*Department of Informatics, Fort Hays State University*

Cybersecurity threats, specifically phishing attacks, pose significant risks to healthcare institutions. Phishing attacks typically use social engineering tactics to manipulate individuals into revealing confidential information or clicking on malicious links, leading to severe consequences, such as patient data breaches, which disrupt operations and are financially burdensome on healthcare institutions. This study aimed to evaluate how phishing awareness training can influence phishing success rates and employee reporting behavior in the healthcare setting. A purposive sampling method was employed in this study, where participants were selected from three healthcare institutions in Kansas: HaysMed, Russell Regional Hospital, and Rooks County Health Center. These institutions had implemented phishing awareness training and maintained comprehensive records of phishing incidents and employee participation. Data was then collected through internal security logs, network monitoring and incident reports from each institution. Findings indicate that the training significantly reduced phishing success rates and increased phishing reporting among employees. Participants demonstrated improved cyber threat recognition and response behavior post-training, with HaysMed showing the greatest improvement.

The benefits of this research extends beyond individual healthcare institutions. By implementing cybersecurity training, Kansas healthcare institutions can continually prevent costly data breaches, ensuring compliance with regulations like the Health Insurance Portability and Accountability Act (HIPAA). The study also serves as a model for other industries in Kansas, including education, finance, and government sectors, where phishing attacks persist. In conclusion, phishing awareness training is a proven and cost-effective strategy for reducing cyber risks in Kansas healthcare institutions where data security is a growing concern.

Kansas State University

STICKY SOLUTIONS: HEMP PROTEINS FOR SUSTAINABLE WOOD ADHESIVES

Roselle Barretto[1], Guangyan Qi[2], Christopher Jones[3], Xiuzhi Sun[2], Yonghui Li[2], and Donghai Wang[1]
[1]*The Carl and Melinda Helwig Department of Biological and Agricultural Engineering, Kansas State University;* [2]*Department of Grain Science and Industry, Kansas State University;* [3]*Department of Civil Engineering, Kansas State University*

The global wood adhesive market was valued at approximately USD 7.03 billion in 2023, with forecasts predicting an annual growth rate of 8.6% from 2024 to 2030. Formaldehyde-based adhesives currently dominate, making up over 70% of the market. However, these synthetic adhesives raise significant health risks, including respiratory issues and carcinogenity, driving the demand for eco-friendly alternatives. This study explores the use of hempseed protein, a relatively new bio-based material, as an adhesive for plywood applications. Hempseed flour was defatted and processed to extract hemp proteins. Adhesive slurries with 20% protein concentration were prepared by pH adjustment and controlled mixing. Chemical crosslinkers were incorporated to improve crosslinking and strengthen the resulting adhesive. The dry strength of the adhesives significantly improved with the addition of crosslinkers. Glyoxal-modified adhesives showed a marked increase in dry strength, reaching 5.69 MPa at 1.0% concentration, which was the highest improvement among all modifications. Similarly, $ZnCl_2$ -modified adhesives also showed significant enhancement in dry and wet strength. The combination of glyoxal and $ZnCl_2$ tends to provide intermediate strengths, suggesting that while both crosslinkers contribute to the overall adhesive properties, their simultaneous presence might not synergistically enhance performance as effectively as when used individually. Hemp protein has shown a great potential as a renewable and environmentally-friendly alternative source for plant protein-based adhesives. The significant improvements in adhesive strengths with the addition of Glyoxal and $ZnCl_2$ can be attributed to their ability to form covalent and ionic crosslinks within the hemp protein matrix. To date, this is one of the first studies demonstrating the potential of hemp proteins for bio-based adhesive application.

DRYLAND GRAIN SORGHUM FOR ETHANOL PRODUCTION: ESTABLISHING ACCURATE CARBON INTENSITY SCORES

Kathy Gehl[1], Sumit Sharma[2], Alan Schlegel[1], Lucas Haag[1], Jason Warren[2], and Peter Tomlinson[1]
[1]Department of Agronomy; Kansas State University; [2]Department of Plant and Soil Sciences, Oklahoma State University

Emissions of nitrous oxide (N_2O), a potent greenhouse gas emitted from the soil, is a critical research gap limiting the accurate calculation of Carbon Intensity (CI) scores for grain sorghum used in ethanol production. Biofuels produced from grain with lower CI scores are worth more in the marketplace. This research aims to document that the N_2O emissions factor (% of applied nitrogen fertilizer lost as N_2O) from dryland grain sorghum produced in these semi-arid regions is lower than the default estimate of 1% set by the Intergovernmental Panel on Climate Change. Field trials were conducted from 2019-2022 at two sites in western Kansas, with a third location in the Oklahoma panhandle, resulting in nine site years of data. The crop rotation was grain sorghum-wheat-fallow. Treatments consisted of varying nitrogen fertilizer rates applied at planting with four replications. Soil emission gas samples were taken every two days following fertilization for seven days, with weekly measurements until harvest. The highest daily N_2O emissions were observed in the 30 days when plant uptake was minimal, and the fertilizer was likely near the soil surface. The mean growing season emissions factor was not affected by fertilizer rate and was less than 0.5% for eight out of nine site years. Overall, the N_2O emissions factors for grain sorghum in the semi-arid Great Plains are well below the current default value of 1%. These results are promising for documenting lower Carbon Intensity scores and, thus, the sustainability of ethanol produced from grain sorghum in western Kansas.

EXPLORING THE IMPACT OF XYLANASE SOURCES AND DOSAGE ON DOUGH AND BAKED PRODUCT QUALITY

Pedro Souza and Elisa Karkle
Department of Grain Science and Industry, Kansas State University

Bread is a staple food in the United States, and enzymes like xylanase are often used to improve its quality. When xylanase breaks down wheat components called arabinoxylans, it may enhance dough extensibility, resulting in a bigger and softer bread. Moreover, it also benefits gut health by promoting healthy bacteria in the digestive system. Kansas is one of the top wheat-producing states in the country. So, this research could boost both health and the local economy by driving innovations in bread-making, benefiting consumers and the food industry. The study used bread wheat flour as a base, to which commercial xylanases from fungal and bacterial sources were added in varying dosages. The extensibility of the dough was measured, along with the softness and volume of the baked products. Both xylanases improved bread quality, with bacterial xylanase showing greater enhancement in dough extensibility. For fungal xylanase, dosage 4 shows the best balance between volume and softness, while dosages 1 and 2 excel in extensibility. For bacterial xylanase, dosage 3 yields the highest volume, and dosage 1 is ideal for softness and extensibility. This study underscores the benefits of xylanase for improving dough properties and bread quality. Optimizing its use can enhance production efficiency and create healthier bread options. Future research should explore the impact of xylanases in various wheat varieties and its implications on gut health.

RUNNING TO A BETTER LIFE, COMBATTING EXERCISE INTOLERANCE IN PULMONARY HYPERTENSION

Nathan J. Kenney[1], Kiana M. Schulze[1], Ramona E. Weber[1], Andrew G. Horn[1], Bradley J. Behnke[1], David C. Poole[1,2], and Timothy I. Musch[1,2]
[1]Department of Kinesiology, Kansas State University; [2]Department of Anatomy and Physiology, Kansas State University

Pulmonary hypertension (PH) is a class of lung diseases where high blood pressure occurs specifically in the blood vessels within the lungs, leading to difficulty breathing, fatigue, poor quality of life, and may result in right ventricular failure. Recent studies have found that in a rat model of PH, respiratory muscle blood flow is increased, limiting oxygen delivery to locomotory skeletal muscle, hindering its ability perform resulting in early onset fatigue. Aerobic exercise training has been shown to decrease pulmonary artery blood pressure, decrease inflammation, and increase the ability of locomotory skeletal muscle to generate sustainable energy for contractions. We hypothesize that regular aerobic exercise training in PH rats will increase exercise capacity and skeletal muscle blood flow compared to sedentary PH rats. Female rats were divided into three groups: healthy control (HC, n=6), pulmonary hypertension (MCT, n=6), and pulmonary hypertension with four-weeks of aerobic training (MCTEXT). Exercise capacity was measured via pre/post training VO_{2peak} testing. Respiratory and skeletal muscle blood flows were measured during exercise and at rest via fluorescent microsphere infusion. Preliminary data has shown MCTEXT to have VO_{2peak} values greater than PH, and less than HC (MCTEXT; 74.67 ml/min/kg, MCT; 60.36 ± 5.67 ml/min/kg, HC; 83.60 ± 3.57 ml/min/kg). PH limits exercise capacity, limiting individuals' ability to perform the activities they love. Exercise training is showing promise to improve exercise capacity possibly due to an improved blood flow balance between locomotory skeletal and respiratory muscles, providing a widely available and low-cost means of improving quality of life.

INFLUENCE OF ROW SPACING, PLANT POPULATION, AND VARIETY SELECTION ON SUDDEN DEATH SYNDROME OF SOYBEAN IN KANSAS

Madison Kessler[1], Nabin Dangal[2], Daren S. Mueller[2], and Rodrigo B. Onofre[1]
[1]Department of Plant Pathology; Kansas State University; [2]Department of Plant Pathology, Entomology and Microbiology, Iowa State University

Sudden death syndrome (SDS), primarily caused by the fungal pathogen *Fusarium virguliforme*, is a major threat to soybean production, leading to significant yield losses. SDS has been reported in 16 states, including Kansas, a major soybean producer. The disease is favored by cool, wet soils during planting and is exacerbated by post-planting rainfall. Currently, growers rely on pre-planting management strategies, such as resistant cultivars and seed treatments, with no control options after planting. This study evaluated the impact of agronomic practices, including row spacing, plant population, and variety selection, on SDS through on-farm trials in Kansas. The experiment, conducted in 2023 at two Kansas locations, used resistant and susceptible soybean cultivars planted at populations of 80,000, 120,000, 160,000, and 200,000 seeds per acre, with 15-inch and 30-inch row spacing. The plots were inoculated with *F. virguliforme* and irrigated to promote optimal conditions for high disease pressure. Data were collected on soybean cyst nematode egg counts, live plant counts at V2 growth stage, root rot severity at R4, foliar SDS symptoms at R6, and yield at R8. Results indicate that row spacing, plant population, and soybean varieties are important in managing SDS. The resistant cultivar and 30-inch row spacing reduced foliar SDS symptoms and achieved higher yields when compared to the susceptible cultivar and 15-inch row spacing, though neither cultivar nor row spacings affected stand count or root rot severity. Higher plant populations were associated with increased root rot. These findings will aid in making informed and optimal SDS management decisions.

AN EXPLORATION OF INTIMATE PARTNER VIOLENCE, DOG ABUSE, AND CAT ABUSE PERPETRATION

Noah Renken, Brooke Keilholtz, and Chelsea Spencer
Department of Applied Human Sciences, Kansas State University

Animal abuse and intimate partner violence (IPV) are forms of violence that warrant serious attention. Previous research has found a relationship between the perpetration of animal abuse and IPV; however, limited research has examined the type of animal abuse separately. Our study identified distinct classes informed by IPV (i.e., physical, psychological, sexual, severe) perpetration, cat abuse, and dog abuse. Using an online survey, participants ($N = 809$) responded to questions regarding IPV, animal abuse, and their current or recent intimate partners. Using a latent class analysis (LCA), we identified four distinct classes: 1) *severe IPV and animal abuse*, 2) *high IPV and high animal abuse*, 3) *high psychological IPV and no animal abuse*, and 4) *no violence*. The *severe IPV and animal abuse class* was characterized by the highest likelihood of physical IPV perpetration, sexual IPV perpetration, and severe IPV perpetration, and the second highest likelihood of cat and dog abuse perpetration. The *high IPV and high animal abuse class* was characterized by a high likelihood of physical IPV perpetration and the highest likelihood of dog and cat abuse perpetration. Our findings highlight that cat and dog abuse are serious risk markers for IPV perpetration. The likelihood of perpetrating cat abuse was slightly higher than dog abuse for the *severe IPV and animal abuse class*, highlighting the need for advocacy and education about cat abuse, specifically. Overall, our study highlights the importance of protecting the pets of IPV victims to prevent future harm to both humans and companion animals.

DEVELOPING NEXT GENERATION Li-S BATTERY BY TUNING THE ACTIVE SITES OF MoS_2/rGO CATALYSTS

Zahirul Islam Saddam, Kamalambika Muthukumar, Sabari Rajendran, and Jun Li
Department of Chemistry, Kansas State University

Li-S battery (LSB) is considered one of the next-generation rechargeable energy storage systems for its high specific capacity (1675 mAh/g) and high energy density. Being a cheaper and more abundant earth element, sulfur is more attractive than the metal oxides or phosphate materials in today's commercial Li-ion batteries (LIBs) which have almost reached their limits. However, the short cycle life and the low charge efficiency of the current LSBs are hindering them from commercialization. To mitigate these problems, we introduce two types of Molybdenum Sulfides, i.e., amorphous MoS_3 chains (a one-dimensional (1D) structure) and crystalline MoS_2 nanosheets (a two-dimensional (2D) structure, which is supported on reduced graphene oxide as electrocatalysts. We can systematically transform the 1D MoS_3 into the 2D MoS_2 via a 2-hour post-synthesis thermal treatment in a hydrogen atmosphere at temperatures varied from 250 °C to 600 °C. The battery capacity and lifetime were tested with incorporation of these catalysts and showed significant improvements The MoS_3 substantially enhanced the specific capacity, reaching 1300+ mAh/g at a 0.1C rate whereas the MoS_2 provides 1100 mAh/g, much higher than ~130 – 170 mAh/g of specific capacity in today's LIB cathodes. The 2D MoS_2 has been tested in recent years and was found to be a good catalyst. Our finding suggests that the 1D MoS_3 is better than its 2D counterpart in enhancing the capacity. Incorporating the 1D amorphous MoS_3 in the sulfur cathode is a promising approach for future LSBs if the stability and charge efficiency can be further improved.

ELECTRONIC NOSE DIFFERENTIATES HEALTHY CATTLE FROM CATTLE EXPERIMENTALLY INFECTED WITH BOVINE RESPIRATORY DISEASE

Conrad Schelkopf[1], Leslie Weaver[3], Michael Apley[3], Roman M. Pogranichniy[1,2], Lance Noll[1,2], Jianfa Bai[1,2], Raghavendra Amachawadi[3], and Brian Lubbers[3]

[1]Department of Diagnostic Medicine and Pathobiology, Kansas State University; [2]Kansas State University Veterinary Diagnostic Lab; [3]Department of Clinical Sciences, Kansas State University

Bovine respiratory disease (BRD) is the most prevalent and economically important disease impacting cattle in Kansas. Visual observation of respiratory signs by feedlot cattle caretakers is currently the primary method of detecting BRD. The study objective was to determine the ability of the electronic nose (eNose) to correctly differentiate cattle before and after BRD challenge to improve disease detection and promote proper treatment. Exhaled air and nasal swab samples were collected from 12 healthy cattle and analyzed on the eNose once daily for 3 days. Then, all animals were challenged with Bovine Herpes Virus-1 and *Manheimia haemolytica*, both of which are common BRD pathogens, on days 3 and 5, respectively. On day 6, daily sampling of exhaled air and nasal swabs with analysis on the eNose resumed and was continued until day 13. Results were reported as the percentage of samples correctly identified as pre-challenge (days 1-3) and post-challenge (days 6-13). In total, 122 exhaled air and 122 nasal swab samples were collected and analyzed by the eNose. In the pre-challenge period, the eNose correctly identified 30/31 (96.8%) exhaled air samples and 29/31 (93.5%) nasal swab samples. Correct post-challenge identification was lower for exhaled air (66/91; 72.5%) than for nasal swabs (89/91; 97.8%). The eNose correctly identified pre- and post-challenge samples with a high degree of accuracy. This study demonstrates the potential use of the eNose as a point-of-care BRD diagnostic tool. Future research to confirm these findings in naturally occurring BRD cases is warranted.

SOIL MICROBES AND BIOCHAR FOR SOIL WATER RETENTION

Nishadini Widanagamage, Kasuni Hiranthika Gamage, Ganga Hettiarachchi, and Gaurav Jha

Department of Agronomy, Kansas State University

Ogallala aquifer supplies 90% of irrigation water for Kansas agriculture is depleting rapidly thus, the available water resources for agriculture lessen daily. Therefore, soil moisture preservation under drought conditions is a challenge for agricultural practices in Kansas. Among the large soil inherent microbial community, there are some microbes which have the potential of preserving soil moisture in their surroundings for survival. *Bacillus subtilis* (*B.s.*) is a bacterial species that produces surfactant which alters the soil wetting properties thus, reduces evaporation to retain more moisture in the soil. The objective of the study is to understand the effect of B.s. population in soil water holding capacity by inoculating B.s. with biochar. S*ilty loam* soil from Ashland Bottoms, KS was mixed with two types of biochar (wood and oat hull) at 1% dry mass basis rate and inoculated with B.s. under laboratory conditions. Soil was packed into 15 cm height PVC columns by maintaining 1.35 g/cm^3 bulk density and soil moisture contents were recorded using soil moisture sensors (Teros 10 and Teros 21). Research underway is developing the soil water retention curves from sensor data to examine the effects of the treatments on soil moisture retention.

VR TRAINING FOR EDUCATORS: ENHANCING ENGAGEMENT AND PRACTICALITY IN CLASSROOMS

Nooshin Darvishinia

Department of Curriculum and Instruction, Kansas State University

The integration of Virtual Reality (VR) in education offers innovative ways to enhance student engagement and improve learning outcomes. This study focuses on understanding teachers' expectations, interests, and concerns regarding the use of VR in classrooms. By analyzing pre- and post-survey data from a professional development session, the research aims to identify shifts in perceptions and practical challenges, ultimately contributing to more effective VR adoption in educational settings. A thematic analysis was conducted on the responses from a pre-survey and post-survey administered to 39 educators participating in a VR training session. The analysis identified key themes related to learning outcomes, interests in VR, concerns, and feedback on the training. Comparisons between pre- and post-survey themes highlighted changes in teachers' perceptions and readiness to implement VR technology. Pre-survey data revealed that teachers were primarily interested in the potential for VR to enhance student engagement and classroom integration. However, concerns about equipment availability, cost, and practicality persisted. Post-survey findings showed a positive shift in perceptions, with teachers recognizing the ease of use, versatility, and realistic applications of VR. However, challenges such as classroom management and safety remained significant. The study underscores the importance of addressing both perceived usefulness and ease of use of VR as key constructs of the Technology Acceptance Model (TAM) in professional development. While the training improved teachers' confidence in using VR, concerns about practical implementation still need to be addressed for successful classroom integration. Future sessions should focus on solutions for these challenges, such as funding, equipment acquisition, and classroom management strategies.

Pittsburg State University

THE EFFECT OF MECHANICAL RECYCLING ON THE PROPERTIES OF HDPE FOR COMMERCIAL APPLICATIONS

Grant Howard, Jacob Culross, Paul Herring, and Jeanne Norton
Pittsburg State University

Modern plastics manufacturing methods create significant waste including sprues, runners, flash, trim, and out-of-spec parts. To reduce the carbon footprint of the plastic industry, post-industrial waste materials are often reprocessed into new parts. This investigation centered on reprocessing HDPE materials and the effects of mechanical recycling on material properties. Specifically, we focused on the degree of mechanical recycling that HDPE can undergo before a degradation in key materials properties is observed. Virgin HDPE material was injection molded into test bars and subsequently reduced with a mechanical grinder. Injection molding was then repeated until the HDPE had been molded and ground ten times. Analysis was performed on virgin-, first cycle-, fifth cycle-, and tenth cycle-regrind, to determine if any degradation had occurred as a result of grinding and remolding. Reprocessed samples were analyzed for changes in thermal and mechanical properties. Degradation temperature was determined by TGA. Crystallization temperature and melting temperature were analyzed by DSC. Melt rheology was analyzed by melt flow indexing. The tensile properties and impact strength were analyzed by tensile and Izod impact testing, respectively. Slight changes in elongation, notched impact strength, and thermal stability were observed. We demonstrated the recyclability of HDPE without significant loss of properties.

TRADE-OFF BETWEEN LIMONENE-BASED REPROCESSABLE AND NON-REPROCESSABLE EPOXY THERMOSTATS: ROLE OF ALIPHATIC DIAMINES IN POLYMER NETWORKS DESIGN

Priyank Patel and Ram K. Gupta
Pittsburg State University

The growing demand for sustainable materials, driven by environmental concerns and the rapid depletion of fossil fuel, that garnered significant attention in bio-based thermosets fabrication. Petroleum-derived thermosetting polymers can be replaced with renewable alternatives such as limonene-derived epoxy prepolymers, which exhibit comparable mechanical strength, thermal stability, and chemical resistance for applications in films, composites, coatings, and adhesives. The present study focuses on synthesis and characterization of limonene-based epoxy prepolymers over two-step process and their thermally crosslinked thermosets using different aliphatic diamines. The incorporation of cystamine, a disulfide-containing diamine, introduced covalent adaptable network *via* disulfide metathesis, achieving a reprocessable thermoset with self-healing capabilities, recyclability, and extended lifespan. In contrast, traditional aliphatic diamines produced a permanently crosslinked thermoset with superior mechanical strength, thermal stability, and chemical resistance, ideal for high-performance applications requiring durability. Differential scanning calorimetry (DSC) elucidated the curing kinetics and crosslinking behavior, while thermogravimetric analysis (TGA) confirmed excellent thermal stability. Additionally, dynamic mechanical analysis (DMA) and tensile testing demonstrated competitive mechanical properties compared to petroleum-based thermosets. At a glance, this study underscores the potential of limonene-derived epoxy thermosets as sustainable alternatives, offering robust properties including reprocessability, self-healing and high-performance networks, while reinforcing the role of dynamic covalent chemistry in advancing bio-based materials within a circular economy framework.

DEVELOPMENT OF BIO-BASED POLYURETHANE ADHESIVES: INFLUENCE OF CROSSLINKERS ON MECHANICAL AND THERMAL PROPERTIES

Jaymin Joshi, Mayankkumar L. Chaudhary, Rutu Patel, and Ram K. Gupta
Pittsburg State University

The development of sustainable adhesives with enhanced mechanical, thermal, and chemical properties is essential for industrial applications. This study focuses on synthesizing polyurethane adhesives using soybean oil polyol (SOP) and methylene diphenyl diisocyanate (MDI), incorporating dimethyl terephthalate (DMT)-derived crosslinkers, DEA and DPA, to enhance mechanical performance. The influence of crosslinker type and concentration on adhesive properties was investigated by preparing adhesives with varying crosslinker weight percentages (wt.%) (5, 10, 15, and 20 for DEA and 5, 10, 15, 20 and 25 for DPA) and curing them at room temperature (RT). Fourier Transform Infrared Spectroscopy (FTIR) confirmed urethane linkage formation, while tensile strength testing on oak wood showed an increase in strength with crosslinker concentration up to an optimal level. The highest tensile strength for DEA-based adhesives was 6.77 MPa at 15 wt.%, decreasing to 4.1 MPa at 20 wt.%. Similarly, DPA-based adhesives exhibited peak tensile strength of 6.86 MPa at 20 wt.%, reducing to 4.26 MPa at 25 wt.%. The improved mechanical performance was attributed to noncovalent interactions between PU molecules and the substrate surface. Differential Scanning Calorimetry (DSC) analysis assessed thermal stability, while gel content and swelling degree confirmed crosslinking. These findings contribute to developing high-performance polyurethane adhesives for diverse applications.

OPTIMIZATION OF BIO-BASED POLYURETHANE COATINGS: ENHANCING MECHANICAL STRENGTH AND HYDROPHOBICITY

Kinal Chaudhari, Mayankkumar L. Chaudhary, Rutu Patel, and Ram K. Gupta
Pittsburg State University

Developing sustainable and high-performance coatings is crucial for replacing petroleum-based materials with eco-friendly alternatives. This study focuses on synthesizing bio-based polyurethane (PU) coatings using soybean oil polyol (SOP), glycerol (GLY) as a crosslinker, and methylene diphenyl diisocyanate (MDI). The research was conducted in two phases: first, optimizing the glycerol content to improve mechanical properties, and second, introducing hexamethyldisilane (HMDS) to enhance hydrophobicity and chemical resistance. In the first phase, PUs was prepared with varying weight percentages (wt.%) of glycerol (0, 5, 10, 15 & 20), and mechanical testing revealed that 10 wt.% GLY provided the best mechanical strength compared to other concentrations. In the second phase, this optimized formulation was further modified by adding HMDS in different wt.% (10, 20, 30, 40 & 50). The results showed that 10 wt.% HMDS provided the best tensile strength for the PU coating. However, as the amount of HMDS increased, it also shows how it affects the material crosslinks and homogeneity in the PU coating material, leading to a decrease in tensile strength, despite 10 wt.% HMDS improving the PU coating's mechanical and chemical resistance. FT-IR analysis confirmed the formation of urethane bonds, while DSC analysis validated thermal stability. Further to check the crosslinking degree of bio-based PU coatings, the samples are characterized for gel content and degree of swelling. These findings suggest that bio-based PU coatings with optimized glycerol and HMDS content can serve as a eco-friendly alternative for coatings.

DEVELOPMENT AND CHARACTERIZATION OF BIO-BASED POLYURETHANE ADHESIVES WITH SCHIFF BASE DIOLS AS CROSSLINKERS

Yashkumar N. Patel, Rutu Patel, Mayankkumar L. Chaudhary, and Ram K. Gupta
Pittsburg State University

Traditionally, polyurethanes (PUs) are typically synthesized using petroleum-based polyols such as urea or phenol formaldehyde, which are toxic to humans and harmful to the environment. As a result, in recent times, industries have been interested in developing bio-based PUs made of vegetable oil-based polyol and diisocyanate. In this study, PU-based adhesives are synthesized by using soybean oil polyol (SOP) and methylene diphenyl diisocyanate. To get better performance of synthesized PU adhesive schiff-based diols, named as VB and VH, have been introduced into the system as crosslinkers which are derived from butane diamine, hexane diamine, and vanillin. The successful synthesis of PU has been confirmed with Fourier transform infrared spectroscopy (FT-IT) spectra. The tensile strength of adhesive samples was tested on oak wood coupons. For VB-based adhesive samples, VB-10wt.% has shown the highest tensile strength of 4400 KPa among all the weight percentages (wt.%), whereas for VH-based adhesive samples, The highest tensile strength has been observed for VH-10wt.% (5000 KPa). In both cases, with increasing the wt.% of Schiff base diol, tensile strength is decreased to 3800 KPa and 2900 KPa for VB-15wt.% and VH-15wt.% respectively. Moreover, the synthesized PU adhesive samples are thermally stable which is confirmed with thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) analysis. In addition, gel content and degree of swelling test further reveal the crosslinking efficiency of the PU adhesive materials.

University of Kansas

SOIL FUNGI SUPPORT HEALTHY PRAIRIES: RELATIONSHIPS BETWEEN PLANTS AND FUNGI CAN IMPROVE RESTORATION EFFORTS

Reb Bryant and James D. Bever
Department of Ecology and Evolutionary Biology, University of Kansas; Kansas Biological Survey & Center for Ecological Research, University of Kansas

Tallgrass prairies represent cultural hallmarks that are foundational to the Kansas economy. These ecosystems are home to biodiversity that holds inherent value in itself but also provides key ecosystem services such as high-quality forage for cattle, habitat for pollinators, erosion prevention, flooding control, carbon storage, and more. However, this ecosystem today is one of the rarest in the world. Therefore, many organizations are working to restore tallgrass prairies primarily in retired crop fields. Because important relationships that supported these ecosystems have been disrupted, including relationships between the prairie plant community and animals, people, and soil organisms, many restorations cannot provide the same services as undisturbed prairies that have not been plowed. My research focuses on how we can improve the plant biodiversity and function of prairie restorations by restoring relationships between plants and native soil fungi called arbuscular mycorrhizal fungi. These organisms form connections with the roots of plants and provide soil nutrients that support plant growth and defense in exchange for plant-based carbon. We have found that desirable plants that are difficult to establish in restorations especially benefit from the reintroduction of these native soil fungi. This was found across a wide variety of plant species under different soil conditions in a greenhouse setting that supports our findings in realistic field conditions. Altogether, this research suggests that reintroducing native

arbuscular mycorrhizal fungi can help us establish flourishing tallgrass prairie restorations that will support communities and agriculture in Kansas.

A NOVEL HYPOTHESIS FOR ALZHEIMER'S DISEASE

Caitlin Libowitz[1], Brian D. Ackley[2], and Michael S. Wolfe[3]
[1]Graduate Program in Neurosciences, Department of Pharmacology & Toxicology, University of Kansas; [2]Department of Molecular Biosciences, University of Kansas; [3]Department of Medicinal Chemistry, University of Kansas

Alzheimer's Disease is the leading cause of dementia in the aging population. One subtype, Familial Alzheimer's Disease (FAD), is caused by genetic mutations in Presenilin protein and Amyloid Precursor Protein (APP). Presenilin acts in a complex with other proteins and contains the active site where protein cleavage occurs. Importantly, Presenilin cleaves APP to produce amyloid-β that deposits as plaques in the brain in Alzheimer's Disease. For over 30 years, much research has been focused on developing treatments that target amyloid-β plaques. However, this focus has yielded little in the way of effective medications, leading to concerns that amyloid-β may not be the real trigger of the disease process. A novel hypothesis from our lab posits that impaired cleavage by Presenilin due to FAD mutations leads to stalled interactions between Presenilin and its cleavage targets, like APP. My research focuses on analyzing FAD mutations in human Presenilin in the genetic animal model *Caenorhabditis elegans,* a small roundworm. In the roundworm, an FAD mutation in Presenilin led to reduced lifespan and age-related neurodegeneration, both of which are independent of amyloid-β or APP. Neither of these effects was observed in a model where a mutation eliminated Presenilin cleavage ability and protein binding. This observation supports our hypothesis that protein binding to, but not cleavage by, Presenilin is necessary for neurodegeneration. This innovative hypothesis can push the field towards better understanding of this disease and help develop more effective treatments.

HIGH SCHOOL MATHEMATICS: WHY IT'S CRITICAL TO EXPAND THE RESEARCH AT THIS LEVEL

[1]Natalie R. Patton, [1]Elizabeth A. Stevens, and [2]Jessica Mao
[1]Department of Special Education, University of Kansas; [2]Department of Special Education, The University of Texas at Austin

What comes to mind when you think about your own experiences in your high school math classes? Maybe you encountered a teacher that clearly explained the concepts and modeled the procedures and therefore you experienced success. Or maybe your experience was less successful, and you remember feeling frustrated and lacking confidence in your skills. Unfortunately, many students enter high school with weak math skills and continue to struggle through 12th grade (National Center for Education Statistics, 2022). Insufficient mathematics performance is especially concerning for students with disabilities: 75% of 12th graders with disabilities (compared to 40% of all 12th grade students) scored below basic on a 2019 national math assessment (National Center for Education Statistics, 2019). For these reasons, students may need supplemental math intervention to improve their performance. We know that success in algebra leads to success in the workforce after graduation (Bielby, 2013). Although recent research has focused on improving the math outcomes of students in the elementary and middle grades (Powell et al., 2021; Hwang et al., 2018), less is known about effective math intervention for students in Grades 9 through 12. This study reports a systematic review of math interventions for students with math difficulty (MD), in high school. We identified effective strategies such as goal setting, virtual manipulatives, practice with feedback, graphic organizers, video modeling, and strategy instruction. While this review provides guidance to schools on effective math interventions for high schoolers with MD, there is still much research to be done at this level.

A CLEAN FUTURE FOR KANSAS: CONVERTING SEWAGE SLUDGE INTO VALUABLE RESOURCES

João V. Poli[1], Daniel V. Tabaka[1], Belinda S.M. Sturm[2], and Susan M. Stagg-Williams[1].
[1] Department of Chemical & Petroleum Engineering, University of Kansas.
[2] Department of Civil, Environmental & Architectural Engineering, University of Kansas.

Conventional wastewater treatment combines physical and biochemical methods to reduce organic matter and pathogens from wastewater, producing sewage sludge as a byproduct requiring disposal. Many technologies are

available to perform wastewater treatment, and facilities are designed based on local regulations, resources, and wastewater characteristics. This creates unique infrastructures with variable processes, resulting in the production of sludge with distinct characteristics. The variability directly impacts downstream management strategies and resource recovery opportunities. In Lawrence, Kansas, two wastewater treatment plants (WWTPs) illustrate this variability. The Kansas River WWTP, an older facility, uses traditional methods to remove contaminants, while the Wakarusa River WWTP, completed in 2018, employs advanced biological nutrient removal (BNR). Our research examines how these treatment routes influence sludge composition and its conversion into valuable products using hydrothermal liquefaction (HTL), a waste-to-energy technology. HTL results reveal significant differences between the two plants. Sludge from the BNR plant shows greater phosphorus-species variability, which enhances the quality of the product, if used as a fertilizer. In contrast, sludge from the Kansas River plant produces a char with enhanced phosphorus (P) retention, but mostly inorganic P. The addition of lime (calcium oxide) in traditional treatment methods also impacts biochar yields and improves biofuel quality by reducing the oxygen content in the fuel. These findings emphasize the importance of understanding local treatment processes to optimize HTL strategies for sustainable sludge management. By tailoring waste-to-energy approaches to the unique characteristics of WWTPs, Kansas can lead in resource recovery, address PFAS contamination, and reduce landfill dependency.

REMOVING FOREVER CHEMICALS FROM WATER: *Adsorption* OF *PFAS* USING *Zeolites*

Charles Ponge, Mark Shiflett
Department of Chemical and Petroleum Engineering, University of Kansas; Wonderful Institute of Sustainable Engineering, University of Kansas

Per- and Polyfluoroalkyl substances (PFAS) widely produced since the 1940s have a broad range of uses in consumer and industrial products. The persistence of PFAS in the environment, and the associated health risks, have called for monitoring and remediation of PFAS in drinking water in the US and around the world. Zeolites have been shown to be effective sorbents. While traditional sorbent materials such as activated carbon and ion exchange resins are being used to remove PFAS from municipal drinking water, the materials are not easily regenerated in situ. Zeolites have been identified as sorbent materials with the potential to be regenerated on location and demonstrate selectivity for sorbing PFAS. Zeolites have a wide range of pore openings and tunable properties, making them ideal for removing both short- and long-chain PFAS from the environment. Currently, there is minimal research investigating zeolites for sorption of PFAS. In this poster, experimental adsorption data for seven PFAS on zeolite CP814E is shown.

LIFECYCLE BENEFIT-COST ANALYSIS OF WOOD-FRAME RESIDENTIAL BUILDINGS TO TORNADO HAZARD

Afeez Badmus and Elaina Sutley, Ph.D.
Department of Civil, Environmental and Architectural Engineering, University of Kansas

This research evaluates the benefit-to-cost tradeoffs of expanding tornado load provisions to wood-frame residential buildings. Recent updates to ASCE/SEI 7-22 standards, incorporated into the 2024 International Building Code, require critical and essential in tornado-prone areas to withstand tornado loads. However, wood-frame residential buildings, which account for two-thirds of structural damage and most tornado-related fatalities, remain excluded.

Focusing on light frame wood buildings, we use tornado hazard probability models and building performance data to predict how different home designs respond to tornado winds. A lifecycle cost analysis, including initial construction cost and expected cost due to tornado damage over a building's lifetime for various types of housing, including single-family, multi-family, and manufactured housing, using data from tornado-prone U.S. cities.

Our results provide clear cost-benefit numbers and damage estimates that can help policymakers and communities decide whether extending tornado-resistant design requirements to homes is a wise investment. Future work will broaden the analysis to both community and national scales.

MONITORING AND MITIGATION OF WIND-INDUCED VIBRATION OF HIGH MAST ILLUMINATION POLES IN KANSAS

Mona Shaheen, M.S., Jian Li, Ph.D., P.E., Caroline Bennett, Ph.D., P.E., William Collins, Ph.D., P.E.
Department of Civil, Environmental, and Architectural Engineering, University of Kansas

This research aims to enhance the safety and longevity of high-mast illumination poles (HMIPs) in Kansas and beyond. These 100 to 150-foot-tall HMIPs are commonly installed near highways and rest areas and pose a significant hazard if they develop cracks and collapse due to excessive wind-induced vibrations. The Kansas Department of Transportation (KDOT) identified premature

cracking near the handhole of several newly installed HMIPs caused by a bomb cyclone in 2019. This event underscored the vulnerability of these structures, leading KDOT to remove 30% of the 1,427 HMIPs in Kansas and replace them at an unplanned cost of $30 million. This study utilized a wireless smart sensor network for three months of field monitoring to assess wind-induced vibration patterns, revealing that wind causes these HMIPs to sway with a maximum displacement of 1 ft at the top, exacerbating structural fatigue and increasing the risk of failure. To address this issue, a novel constrained layer damper (CLD) was designed to retrofit these HMIPs, which absorb and dissipate vibrational energy, reducing HMIP movement at the top by 57%. The proposed CLD offers a cost-effective alternative to full replacement, as installing the damper costs only $7,500 per pole—just 11% of the $70,000 replacement cost. This study presents a practical solution for mitigating excessive wind-induced vibrations in HMIPS, extending their service life, reducing maintenance cost, and enhancing public safety. The study provides a scalable, cost-effective solution to prevent HMIP failures, ensuring safer highways and more resilient infrastructure.

HARNESSING MACHINE LEARNING TO ADVANCE SAFETY-CRITICAL BATTERY MANAGEMENT FOR ELECTRIC AIRCRAFT

Hao Tu and Huazhen Fang
Department of Mechanical Engineering, University of Kansas

The aviation industry is among the major contributors to global warming, producing approximately 1 billion tons of CO_2 annually and accounting for 2.5% of global energy-related emissions. Zero-carbon flights have thus been the Holy Grail of aviation yet still remaining beyond reach. Electric aircraft are emerging as a promising and transformative solution, as rapid technological advances are making lithium-ion batteries closer to the energy density threshold needed to power aircraft. The explosive growth in electric aircraft developments have led to a new market that will exceed $35 billion by 2030 with an annual growth of nearly 20% between 2022 and 2030, of which the U.S. represents the largest share. Unlike electric cars, electric aircraft require to discharge onboard lithium-ion batteries at very high current and power levels, especially in the takeoff and landing phases. In this unique operating condition, lithium-ion batteries will demonstrate highly complicated electrochemical behaviors and fast temperature rise. These factors make difficulties to determine the real-time energy level and power capability of the batteries, which are crucial for safe flights. To overcome this challenge, we have explored using machine learning to capture the intricate characteristics within lithium-ion batteries during the operation of electric vertical takeoff and landing (eVTOL) aircraft. Through many validations, our novel approaches can provably track the remaining energy and power limit of eVTOL batteries with high accuracy and fast computation. This advancement is among the first battery management methods to ensure the safety and reliability of eVTOL and enhance their future development and deployment.

University of Kansas Medical Center

UNDERSTANDING THE RELATIONSHIP BETWEEN FTINESS AND COGNITIVE DOMAINS POST-STROKE

Bria Bartsch[1,2], Amanda Britton-Carpenter[2], Amanda Engler[2], and Sandra Billinger[2,3,4,5]
[1]Department of Physical Therapy, Rehabilitation Science, and Athletic Training, University of Kansas Medical Center; [2]Department of Neurology, University of Kansas Medical Center; [3]University of Kansas Alzheimer's Disease Research Center; [4]Department of Physical Medicine and Rehabilitation, University of Kansas Medical Center; [5]Department of Cell Biology and Physiology, University of Kansas Medical Center

Post-stroke, individuals exhibit reduced fitness (VO_{2peak}) and impaired cognition, which negatively impact recovery. Research is required to determine how VO_{2peak} impacts cognition and explore which factors may moderate this relationship. Understanding this relationship may provide clinicians the knowledge required to optimize treatment plans and enhance recovery. Hypotheses: VO_{2peak} will be associated with processing speed, memory, and inhibition/attention. Due to the relationship between cerebral blood velocity (MCAv) and cognition in older adults, MCAv will moderate the relationship between VO_{2peak} and cognition post-stroke. Methods: Participants, 20-85 years of age and 6 months-5 years post-stroke, were recruited. VO_{2peak} was assessed using the Total Body Recumbent Stepper submaximal exercise test. Cognition was assessed using the NIH Toolbox for processing speed, memory, and inhibition/attention. Ultrasound was used to determine mean resting MCAv. Multiple linear regression was used to evaluate the relationship between VO_{2peak} and cognition. Moderation analyses were conducted to examine whether MCAv moderates the relationship between VO_{2peak} and cognition. Statistical significance: α=0.05. Results: Twenty-six participants, 62.8±13.4 years of age (46.2% F), 22.4±18.8 months post-stroke were included. Average VO_{2peak}: 21.2±8.6 ml/kg/min. Participants scored in the 29th age-corrected percentile for processing speed, 39th for memory, and 29th for inhibition/attention. Memory (p=0.02)

and inhibition/attention (p=0.03) were significantly associated with VO_{2peak} (p=0.016). MCAv did not moderate the relationship between VO_{2peak} and memory (p=0.13). However, analyses neared significance for MCAv moderating the relationship between VO_{2peak} and inhibition/attention (p=0.067), where the relationship between VO_{2peak} and inhibition/attention decreased as MCAv increased (p=0.055). Conclusion: Fitness and MCAv may contribute to cognition post-stroke.

EXPLORING THE INTERSECTION OF POLICY AND HEALTH IN PEOPLE WITH INTELLECTUAL AND DEVELOPMENTAL DISABILITIES: A NARRATIVE REVIEW

Scotti Brackett and Dr. Jill Peltzer
School of Nursing, University of Kansas Medical Center

The purpose of this historical narrative review is to explore U.S. policies that influence the health of people with intellectual and developmental disabilities (IDD). Individuals with IDD face health inequities due to housing, education, income, health care, and insurance policies. Yet, they often lack representation in policymaking and rely on advocacy efforts. The databases CINAHL Complete, PubMed, Web of Science, and Google Scholar were searched. Grey literature and published articles were included without a timeline restriction. Articles on maternal IDD, non-U.S. policies, or court cases were excluded. Twenty-one articles were included, primarily secondary data analyses and qualitative methods. Five IDD advocacy websites were also explored. A systematic approach was used to organize the literature by concept and then chronologically. Historically, families joined in civil rights movements to influence policies for their children with IDD. Their advocacy efforts mitigated health inequities and increased life expectancy in this population. Although pro-IDD policies are often bipartisan, they are poorly executed and underfunded. There is a gap in nursing research on IDD and a shortage of nurses advocating for health policy. Population-level advocacy is needed to address social factors influencing the health of people with IDD. Nursing research has implications for establishing priorities, funding, and addressing health inequalities. Integrating social determinants of health and policy in nursing programs is needed to prepare nurses for advocacy roles at the bedside and beyond. In practice, assessment of social factors, interdisciplinary collaboration, and tailored interventions can improve health outcomes and reduce healthcare costs.

INVESTIGATING THE MECHANISM UNDERLYING DIABETIC PERIPHERAL NEUROPATHY

Gentry Totta-Griese and Douglas E Wright
Department of Anesthesiology, University of Kansas Medical Center

Diabetic Peripheral Neuropathy (DPN), the degeneration of nerves resulting in pain and burning and ultimately a reduced quality of life, is a prominent issue in Kansas. According to the CDC, one in ten Kansas residents have diabetes. Up to 60% of those patients will develop DPN. Without a current cure, interventions aim only to mediate symptoms. Diabetes and DPN result in over 2 billion dollars of financial burden on Kansas annually. Our lab aims to understand the molecular pathway underlying the development of DPN to design a better therapeutic option for Kansas Residents. A characteristic marker of DPN is loss of nerve fibers, or axons of neurons that innervate extremities. Patients experiencing hyperglycemia have elevated levels of the toxin methylglyoxal. We demonstrate that high levels of methylglyoxal lead to loss of axons in both mice and cells. We suspect two main enzymes, RAGE and SARM1, are involved in the pathway leading methylglyoxal to cause loss of axons. To investigate this hypothesis, we blocked RAGE with a small molecule inhibitor and SARM1 by using a mouse model that has SARM1 genetically removed. We then gave methylglyoxal and looked at the density of axons to assess if methylglyoxal-induced axon loss was prevented. We did not see a loss of axons, indicating that both RAGE and SARM1 are required for methylglyoxal-induced axon loss. Understanding the pathway of methylglyoxal-induced axon loss would lead to enhanced treatment options for DPN, and potential economic implications of new companies in Kansas to further develop these treatments.

INTERDISCIPLINARY AIRWAY MANAGEMENT: A SURGICAL PRIMER FOR FIRST- AND SECOND- YEAR MEDICAL STUDENTS

Dylan T. Vance, BS[1], Tyler Elmendorf, BS[1], Sarah Adkins, MEd[1], Joseph Penn, BS[1], Katelyn Sanner Dixon, MD, MPH[2], Shaun Stokes, DO[3], Shannon Kraft, MD[4], Isuru Ratnayake, PhD[5], German Berbel, DO[2], Lyndsey J. Kilgore, MD, FACS[2]
[1]University of Kansas School of Medicine, [2]Department of Surgery, University of Kansas Medical Center, [3]Department of Anesthesiology, University of Kansas Medical Center. [4]Department of Otolaryngology, University of Kansas Medical Center, [5]Department of Biostatistics & Data Science, University of Kansas Medical Center

Effective airway management requires close collaboration between Anesthesiology and Otorhinolaryngology (ENT) to ensure patient safety. However, preclinical medical students have limited exposure to these specialties and their shared responsibilities. This pilot program introduced students to the interdisciplinary nature of airway management through a hands-on educational event.

Thirty first- and second-year medical students participated in an IRB-approved workshop led by Anesthesiology and ENT faculty. Using soft-embalmed cadavers, students practiced essential airway procedures, including bag-mask ventilation, intubation, tracheotomy, and cricothyroidotomy, while learning about their indications, techniques, and anatomical considerations. Pre- and post-surveys assessed changes in student confidence and understanding of specialty collaboration.

Students demonstrated a statistically significant improvement in understanding the purpose, timing, technique, and anatomy of airway management procedures, including bag-mask ventilation, intubation, tracheotomy, and cricothyroidotomy ($p<0.05$). Before the event, only 13% of students understood how Anesthesiology and ENT collaborate in airway management. Afterward, this increased by 84%. Understanding of the overlapping and distinct responsibilities of ANS and OTO-HNS in airway management also significantly increased ($p<0.05$). Confidence in selecting airway management techniques improved by 48%, while uncertainty decreased by 28% ($p<0.001$). Understanding of overlapping responsibilities between the two specialties increased by 49% ($p<0.001$).

This program demonstrated the value of early, hands-on exposure to multidisciplinary airway management. By enhancing students' confidence and awareness of specialty collaboration, this initiative supports efforts to improve surgical education in Kansas. Expanding such programs can better prepare future physicians for team-based care, ultimately benefiting patients across the state.

EXPLORING THE ROLE OF A LIFESTYLE INTERVENTION ON PERIPROSTATIC ADIPOSE TISSUE AND FAT METABOLISM IN MEN WITH PROSTATE CANCER

Jacob Zevitz, Cheryl Rajiv, Misty D. Bechtel[1], Pugazhendhi Srinivasan[1], Prabhakar Chalise[2], William P. Parker[1], Justin Gregg[3], John DiGiovanni[4,5,6], and Jill Hamilton-Reeves[1]
[1]Department of Urology, University of Kansas Medical Center; [2]Department of Biostatistics, University of Kansas Medical Center; [3]MD Anderson Cancer Center, University of Texas at Houston; [4]Division of Pharmacology and Toxicology, College of Pharmacy, The University of Texas at Austin; [5]Center for Molecular Carcinogenesis and Toxicology, The University of Texas at Austin; [6]Livestrong Cancer Institutes, Dell Medical School, The University of Texas at Austin

Excess visceral adiposity and altered lipid metabolism are associated with prostate cancer (PCa) progression. We aimed to determine if a weight loss lifestyle intervention using diet and exercise affected dietary fat intake, periprostatic adipose tissue (PPAT) fatty acid (FA) composition and signaling pathways, and plasma sphingolipid signatures in men with PCa. Forty men scheduled for radical prostatectomy (RP) were randomized into intervention (n=20) or active control (n=20) arms in a phase II trial. Participants in the intervention adhered to a diet- and exercise-based weight loss program for 4-16 weeks before and 6 months after RP. Participants in the active control arm received standard of care and educational materials. Blood samples and health metrics of participants were collected at three time points. PPAT biopsies were collected at the time of RP. FA analysis of PPAT was performed using flame-ionization gas chromatography. RNA from third passage adipose stromal cells was isolated using a RNeasy kit (Qiagen). RNA samples were analyzed using nCounter® PanCancer Immune Panel (NanoString). Sphingolipids were analyzed in plasma via Xevo GS-X2 quadrupole time-of-flight mass spectrometers using a 2D column configuration. The intervention group achieved an average 5.5% weight loss from baseline to surgery. Significant changes in dietary FA intake did not correlate with PPAT composition. Weight loss and dietary modifications altered PPAT transcriptomics. Decreased plasma sphingolipid signatures in the intervention suggest favorable lipid metabolism changes protective against PCa progression. This project is critical in understanding the role of fat metabolism in PCa and identifying interventions to halt disease advancement.

Wichita State University

POWER DISTRIBUTION SYSTEM RESTORATION DURING EXTREME EVENTS: EQUALITY OR EQUITY?

Adithya Melagoda and Visvakumar Aravinthan
Department of Electrical and Computer Engineering, Wichita State University

Extreme events such as natural disasters, extreme weather and man-made attacks have the potential to disrupt the operation of power grid and in turn impact the society at large. Owing to the recent increase of these events which lead to sustained power outages, power system planners and policy makers are continuously interested in developing new and efficient post restoration schemes to

improve grid resiliency. With the increased emergence of distributed energy resources (DERs) such as Solar PV plants and consumer owned diesel generators especially in the state of Kansas and worldwide at present, restoration can be acquired using these resources by forming possible microgrids and supplying critical loads.

However, the existence of different types of customers with varying social equity factors in a power distribution system urges the system operators to consider equitable load restoration. In current restoration schemes, these equity variations are less valued, resulting the people in rural areas or financially marginalized communities to have longer outage durations and limited access to resources. Taking this factor into account, this work proposes a method for power system restoration considering both social equity and consumer priority. The method is tested using actual data in a rural city in Kansas which is publicly available, and the results show both the significances of priority and equity-based power distribution system restoration. Further, the developed restoration algorithm provides valuable insights to system operators for faster restoration to communities with varying vulnerabilities which is frequent in states like Kansas.

ARTIFICIAL PROJECTION: EXTENDING HUMAN CAPABILITIES THROUGH *INTELLIGENT ROBOTIC AVATARS*

Rizwan Raisulhaq and Muhammad Aamir Usmani
Department of Computer Science, Wichita State University

Artificial Projection envisions a future where individuals transcend geographical limits by operating intelligent robotic avatars remotely. A Kansan could control a custom-intelligence robot in, say, Japan, executing task e.g., surgical procedures or precision farming with human-like adaptability. This paradigm leverages converging technologies: *Artificial Intelligence (AI)* and *Machine Learning (ML)* enable robots to mirror operator behaviors, adapting to preferences via neural networks; high-fidelity *telepresence* with *haptic feedback* provides real-time sensory immersion; and *5G/6G networks* ensure ultra-low latency for seamless control. Advanced *robotics* featuring soft actuators and biomimetic sensor supports complex tasks, while *edge computing* boosts autonomy by processing data onboard. Robust *cybersecurity*, including quantum encryption, safeguards against breaches. Applications span remote telemedicine (e.g., robotic diagnostics in rural clinics), disaster response (e.g., navigating flood zones), and cultural exchange (e.g., virtual classroom interactions). For Kansas, Artificial Projection could bridge healthcare gaps, linking rural patients to Wichita specialists via avatars, and revolutionize agriculture by deploying robots for autonomous crop monitoring, reducing labor shortages. Kansas businesses could tap global talent without relocation, enhancing manufacturing output. By pioneering this technology, Kansas could attract tech investments, fostering a Silicon Prairie hub. This research underscores a transformative synergy of AI and robotics, positioning Kansas as a leader in innovation, economic resilience, and equitable resource access.

SOLAR ENERGY TO IMPROVE ELECTRIC SERVICE RELIABILITY DURING WINTER WEATHER

Mary Peterson and Visvakumar Aravinthan
Department of Electrical Engineering, Wichita State University

In February 2021, fuel shortages and extremely cold weather led to widespread power outages across Kansas. If solar energy had been available during this event, the outages could have been avoided. This research analyzes actual data from the February 2021 outages to show how households at different income levels could be impacted by solar generation during energy shortages. This includes evaluating how their energy bill would be affected, and quantifying the benefit they would obtain from uninterrupted electrical service. The results show that solar energy would significantly benefit an average Kansas household during energy shortages, and that solar energy would have greater benefits for households with lower incomes.

INVESTIGATING SPEECH ENHANCEMENT TOWARDS ROBUST SYNTHETIC AUDIO SPOOFING DETECTION IN THE WILD

Angela Anacin[1], Dr. Shruti Kshirsagar[1] and Dr. Anderson Avila[2]
[1]Department of Computer Science, Wichita State University; [2]Department of Computer Science, INRS-Canada

Logical Access (LA) attacks involve the use of Text-to-Speech (TTS) or voice conversion (VC) techniques to generate spoofed speech data. This represents a serious threat to automatic speaker verification as intruders can use such attacks to bypass biometric security systems. In this study, we train a state-of-the-art model to distinguish between bonafide and spoofed speech samples, and we investigate its performance in the wild. For that, we used the LA data provided in the ASVspoof 2019 Challenge in

the presence of different levels and types of background noises. We also explored two enhancement algorithms, namely SEGAN and MetricGAN+, to mitigate the detrimental effects of noisy speech. Results show that applying enhancement priorto the LA task can improve performance in more degraded scenarios. We also found that quality measures, such as PESQ, can be an important asset as indicator of enhancement algorithms performance.

A MULTI CRITERIA ELECTRICAL LOAD PRIORITIZATION FRAMEWORK TO MINIMIZE IMPACTS TO THE SOCIETY: A CASE STUDY BASED ON GARDEN CITY,KANSAS

Sangar Shanthanam and Visvakumar Aravinthan
Department of Electrical and Computer Engineering, Wichita State University

Extreme weather events such as winter storms cause major power outages. These power outages create social and economic impacts on society. For instance, severe weather events caused a major power outage in July 2024 and more than 100,000 Kansans lost power. It was estimated by the Department of Energy power outages cost approximately $150 billion annually. Various grid resilience enhancement techniques have been proposed by researchers. However, these techniques require very high investment and still the protection from such extreme events is beyond human control. Prioritizing electrical load points can help planners to wisely allocate resources, especially during emergency times, to minimize social and economic impacts. Traditionally prioritization considers only technical factors and often neglects the social and economic factors. In this work, modified TOPSIS (Technique for Order Preference Similarity to Ideal) based Multi Criteria Decision Framework is proposed which considers several criteria and takes inputs from policy makers and stake holders to effectively prioritize electrical loads. The proposed method was evaluated using a case study. Where a test system was developed based on garden city, Kansas and CLARC (Customizable Artificial Community) system data. An extreme event was simulated, and the performance was recorded. The proposed method minimizes the impacts on the population, without any significant economic loss, to less than 12% compared to conventional methods over 33%. Therefore, this method can benefit the Kansans since Kansas also experiences from time-to-time major power outages and the frequency of such outages are expected to be high in the future.

A PHYSICS INFORMED MACHINE LEARNING FRAMEWORK FOR STATE-OF HEALTH ASSESSMENT OF LITHIUM-ION BATTERIES IN RESILIENT INFRASTRUCTURE APPLICATIONS

Eric Pereira, Damilola Ogun and Davi Soares
Department of Electrical and Computer Engineering, Wichita State University

Lithium-ion batteries (LIBs) are widely used as energy sources in transportation and grid energy storage due to their high energy density, efficiency, and long lifespan. For instance, in regions like Kansas, which are prone to severe weather events such as tornadoes, LIBs offer a feasible solution for backup power during outages, playing an essential role in maintaining essential services and supporting resilient infrastructure. However, LIBs degrade over time, and if their degradation mechanisms are not properly monitored and managed, they can lead to operational failures or thermal runaway. State of health (SOH) assessment is crucial for monitoring battery performance. However, traditional methods that rely solely on capacity changes are insufficient due to the complexity of LIBs degradation. This work presents a framework for SOH assessment using differential voltage analysis (DVA) and machine learning. Commercial LIBs were tested under various charge/discharge rates, depths of discharge (DOD), and temperatures. Reference performance tests (RPTs) were conducted until end-of-life (EOL), and DVA extracted significant parameters, including internal resistance, active mass loss, and electrode stoichiometries. Additionally, to predict EOL, a Random Forest machine learning model was implemented on a Raspberry Pi computer, to enable real-time monitoring and remote data transmission to a cloud service for a centralized disaster control agency. Cells cycled at 100% DOD experienced greater cathode material loss. The Random Forest model processed data in about 2.9 seconds and achieved an accuracy of 86.67%. This accuracy demonstrates the potential of the low-cost model to facilitate remote monitoring of SOH and for secure power supply in extreme conditions.

ASSESING TONGUE MOBILITY AND STRENGTH USING PARROT: AN ORAL DEVICE

Toomaj Amiri[1], Jeremy Patterson[1] and Heidi A. VanRavenhorst-Bell[2]
[1]Department of Innovation and Design, Wichita State University; [2]Department of Human Performance Studies, Wichita State University

The tongue plays a crucial role in human health, contributing to chewing, swallowing, breathing, speech,

and overall well-being. Composed of eight interwoven muscles, it performs complex movements essential for food manipulation, articulation and upper air-way patency. Reduced tongue mobility or strength—caused by weak muscles, poor tone due to aging, obesity, or neurological disorders such as stroke or Parkinson's disease—can lead to conditions like dysphagia, speech impairments, and obstructive sleep apnea. This research aims to develop "PARROT," a wireless wearable mouthpiece device designed to assess tongue function through lingual pressure mapping at various points in the oral cavity with real-time feedback. The device will be used for diagnosing and treating tongue positioning habits and for providing personalized, targeted exercises to improve lingual function. Not restricted by location, PARROT will accommodate the individual needs of both caregivers and patients, whether inside or outside a clinical setting. Incorporating AI and machine learning algorithms, the system will customize training regimens by monitoring progress to enhance therapeutic outcomes. This innovation has the potential to improve tongue functionality and overall health, addressing challenges faced by individuals with lingual dysfunction in the state of Kansas and beyond.

PREDICTION OF VOLUNTARY LOAD REDUCTION BASED ON HUMAN BEHAVIOURS DURING GRID EMERGENCIES

Nirasha Bataduvaarachchi[1], Demy Alexander[1], Visvakumar Aravinthan[1], Abigail Devereaux[2], Al Tamimi[3] *[1]Department of Electrical and Computer Engineering, Wichita State University; [2]Department of Economics, Wichita State University; [3]Transmission Planning & Policy, Sunflower Electric Power Corporation*

In February 2021, the winter storm Uri swept across several U.S. regions, including Kansas, leaving communities struggling to stay warm as the power grid came under immense strain. To prevent the entire electricity system from collapsing, the system operators overseeing Kansas and 13 other states made a difficult decision: cutting power to consumers as the last resort. Before resorting to outages, they turned to the public with a heartfelt plea: lower your thermostat, turn off unnecessary appliances, and conserve energy in any way possible. The goal was simple, if enough people reduced their electricity use, widespread power cuts could be avoided. And many did to help their neighbors and communities. But despite this collective effort, there was a critical gap in the system: there was no way to measure how much energy people actually saved. Without a mechanism to account for these voluntary reductions, their contributions went unrecognized. Therefore, this research aims to change that. We've developed a way to predict how much electricity people voluntarily save during extreme events. Using census data from 1,000 households in Wichita, Kansas, the model factors in human behavior, motivations, and responses to financial incentives. The findings reveal that households with backup generators and those more informed about financial rewards are more likely to reduce their energy use. This study is about valuing the strength of collective action, ensuring that every small sacrifice made by individuals is acknowledged and to build a system that genuinely supports communities like Kansas during their most challenging moments.

SYNTHESIS AND DEGRADATION OF ALPHATIC POLY (ESTER CARBONATE) COPOLYMERS USING NOVEL CHLOROFORMATES

Mahrokh Moradi and Coleen Pugh

Department of Chemistry and Biochemistry, Wichita State University

Aliphatic polyesters and polycarbonates have been widely investigated due to their biodegradability, which is important for both biomaterials and sustainable plastics. We are exploring the synthesis and copolymerization of the new aliphatic monomer, 2- (chlorocarbonyl)ethyl chloroformate (CFEO), and its chlorinated analog Cl-CFEO. Both CFEO and Cl-CFEO have two reactive functional groups that will react with diols to produce alternating poly (ester carbonate)s under conditions that allow the more reactive acid chloride group to react before the chloroformate group, or statistical copolymers when both functional groups can react. In addition to developing copolymerization reactions, this presentation will compare the hydrolytic stability of the alternating and statistical copolymers and their corresponding polyester and polycarbonate analogs under basic and enzymatic conditions and then will discuss the implications of these properties in medical and biodegradable applications.

REDUCING TRANSMISSION LINE IMPACTS CAUSED BY ROOFTOP SOLAR PANELS USING ELECTRICITY MARKET MECHANISM

Demy Alexander[1], Arun Manoharan[1], Visvakumar Aravinthan[1] and Al-Tamimi[2].

[1]*Department of Electrical and Computer Engineering, Wichita State University;*
Transmission Planning and Policy, Sunflower Electric Power Corporation

Large penetration of renewable resources creates new challenges for grid operators. The recent FERC ruling on transmission asset depreciation highlights one of the impactful but understudied issues, transmission asset usage and depreciation. Change in line usage can be accounted for by rewarding or penalizing the market participants directly. However, the impact of large penetration of distributed energy resources such as rooftop solar PVs (which do not participate in the electricity wholesale market) on transmission flows needs indirect solutions. This work proposes a market adjustment technique using virtual loads to mitigate the change in line flows caused by distributed resources in multi-area systems. Optimal virtual loads needed at each bus in the day- ahead planning to limit the line flow to a desired level are determined using power transfer distribution factors. The simulation, conducted on a modified IEEE RTS-96 system with real load data and estimated solar data, demonstrates that the average total line flow difference can be mitigated in multi-area network, while the average total conventional generation cost remains largely unchanged. This result shows that the method is highly effective in substantially reducing the transmission line impacts caused by distributed resources. This research was mainly motivated by transmission utility in western Kansas as they have experienced a difference in revenue.

Emporia State University

Jerald Spotswood, Emporia State University, Plumb Hall 313, 1 Kellogg Circle, Emporia, KS 66801, (620)341-5508, http://www.emporia.edu/grad/

Fort Hays State University

Angela E. Pool-Funai, Fort Hays State University, 302 Sheridan Hall, Hays, KS 67601, (785) 628-4236, http://www.fhsu.edu/gradschl/

Kansas State University

Claudia Petrescu, Kansas State University, 117 Eisenhower Hall, Manhattan, KS, (785) 532-6191. www.ksu.edu/grad

Pittsburg State University

Erik Mayer, S203 Kansas Technology Center, 1701 South Broadway, Pittsburg, KS 66762. https://www.pittstate.edu/office/grants/

University of Kansas

Jennifer A. Roberts, The University of Kansas, 213 Strong Hall, 1450 Jayhawk Blvd., Lawrence, KS 66045-7535, (785) 864-8040. www.graduate.ku.edu

University of Kansas Medical Center

Michael J. Werle, The University of Kansas Medical Center, MSN 1040, 3901 Rainbow Blvd, Kansas City, KS 66160, (913) 588-7491. http://www.kumc.edu/academic-affairs/graduate-studies.html

Wichita State University

Coleen Pugh, Wichita State University, 107 Jardine Hall, 1845 Fairmount., Wichita, KS 67260-0004, (316) 978-3095. www.wichita.edu/gradschool

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