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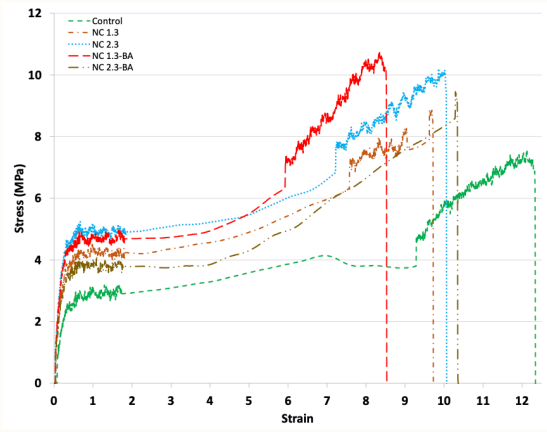
Research Bulletin

April 2025

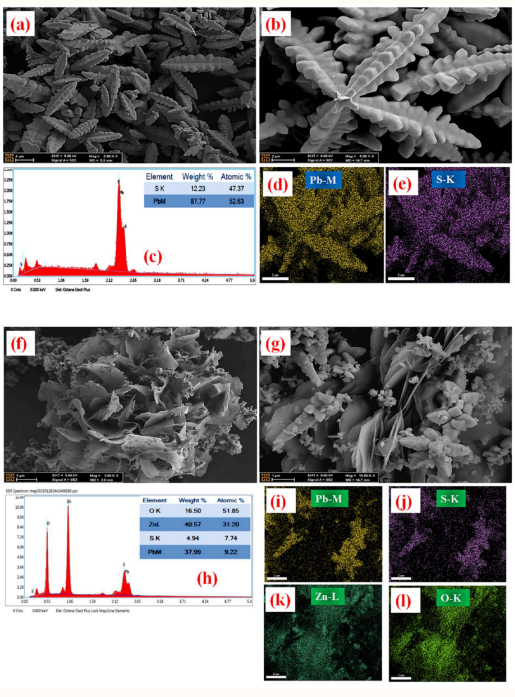
POLYMERS WITH ENHANCED FIRE AND STRESS RESISTANCE WERE PRODUCED USING A NEW MATERIAL REINFORCED WITH BORON AND NANOCLAY

New composite materials with improved heat and stress resistance were developed by adding boric acid and two different types of nanoclay to ethylene-vinyl acetate (EVA) polymer. Tests showed that increasing the nanoclay content enhanced the material's mechanical strength and fire resistance. It was also observed that the addition of boric acid improved tensile strength in some samples. The prepared materials were thoroughly examined through thermal resistance tests (TGA), structural analyses (FTIR, XRD), mechanical tests, and flammability tests.



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Erdem, İ., Avcı, Ş., & Kapçı, M. F. (2025). Ethyl Vinyl Acetate (EVA) Composites with Nanoclays and Boric Acid: Thermal and Mechanical Properties. Journal of Boron, 10(1), 19-34. https://doi.org/10.30728/boron.1568002



HIGH EFFICIENCY ACHIEVED IN DYE REMOVAL FROM WASTEWATER USING NANOCOMPOSITE MATERIALS

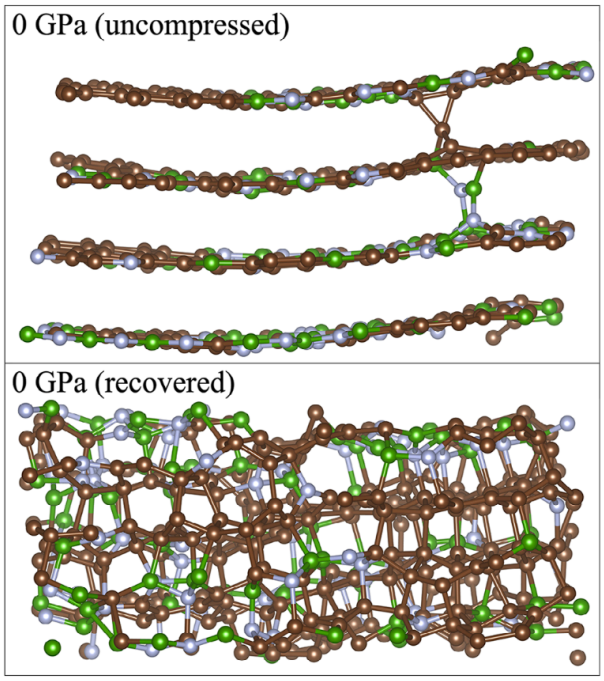
ZnS@ZnO, CdS@ZnO, and PbS@ZnO nanocomposites were synthesized to address organic dye pollution in wastewater, and their performances were compared. Experimental results revealed that the ZnS@ZnO nanocomposite exhibited high efficiency in removing methylene blue dye through both photocatalytic and adsorptive processes. The structural and surface properties of the materials were analyzed using detailed characterization techniques. The results indicate that these materials could contribute to the protection of water resources and promote environmental sustainability.

Bayram, Ü., Özer, Ç., & Yılmaz, E. (2025). Comparison of Photocatalytic and Adsorption Properties of ZnS@ZnO, CdS@ZnO ve PbS@ZnO Nanocomposites to Select the Best Material for the Bifunctional Removal of Methylene Blue. ACS Omega, 10(10), 9986-10003. https://doi.org/10.1021/acsomega.4c07910

6 CLEAN WATER AND SANITATION
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

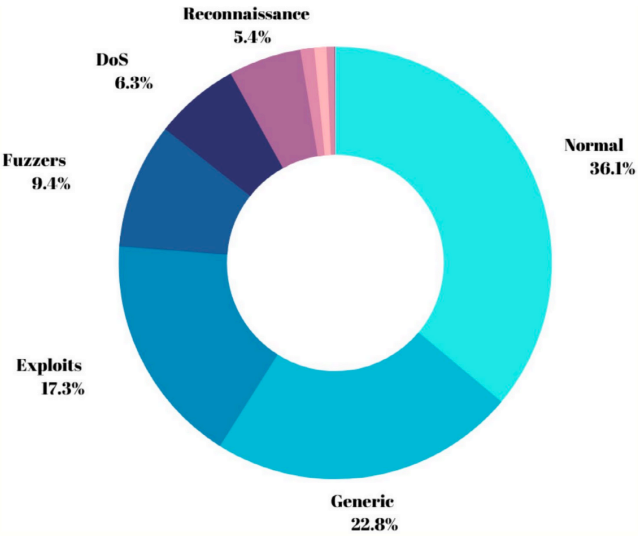
A NEW SUPERHARD MATERIAL DISCOVERED: THE TETRAHEDRAL AMORPHOUS FORM OF BC_4N

The behavior of amorphous BC_4N under high pressure was investigated, and the formation of a unique tetrahedral amorphous phase was observed. This new structure, featuring 88% sp^3 bonding, demonstrated a Vickers hardness of 46 GPa and a compressive modulus of 326 GPa, placing it among superhard materials. Additionally, the material exhibited a narrow band gap of 0.4 eV and showed semiconducting properties. The developed phase was highlighted as a promising candidate for both mechanical durability and electronic applications.



Durandurdu, M. (2025). Pressure-Induced Quenchable Superhard Tetrahedral Amorphous Phase of Bc4n. Journal Of The American Ceramic Society. https://doi.org/10.1111/Jace.20493

A NEW APPROACH TO EARTHQUAKE AND CYBERSECURITY USING THE ARTIFICIAL BEE COLONY ALGORITHM



A new solution for multi-class problems was proposed by combining the Artificial Bee Colony (ABC) algorithm with artificial neural networks. This approach was applied to both the detection of network attacks and the prediction of building damage after earthquakes. To enhance the model's accuracy and processing speed, GPU parallelization and vectorization techniques were implemented. Success rates of up to 80% were achieved on earthquake data and up to 72% on cybersecurity data. The developed method offers new solutions in both disaster management and cybersecurity fields.

Hacılar, H., Dedetürk, B. K., Özmen, M., Çelik, M., & Güngör, V. Ç. (2025). Accelerated Artificial Bee Colony Optimization for Cost-Sensitive Neural Networks in Multi-Class Problems. Expert Systems, 42(5). https://doi.org/10.1111/exsy.70045

A NEW APPROACH FOR INVESTMENT DECISIONS IN BIST100: RISK REDUCTION THROUGH STOCK CLUSTERING

The stock movements of BIST100 companies listed on Borsa İstanbul were analyzed using the Symbolic Aggregate approXimation (SAX) method. The study identified groups of stocks with similar price movements, aiming to reduce investment risk. Analyses conducted on a three-year dataset revealed stock clusters both within and across sectors. This method demonstrated that investors could build more balanced and diversified portfolios. The research offers a new perspective on decision-making processes in capital markets.

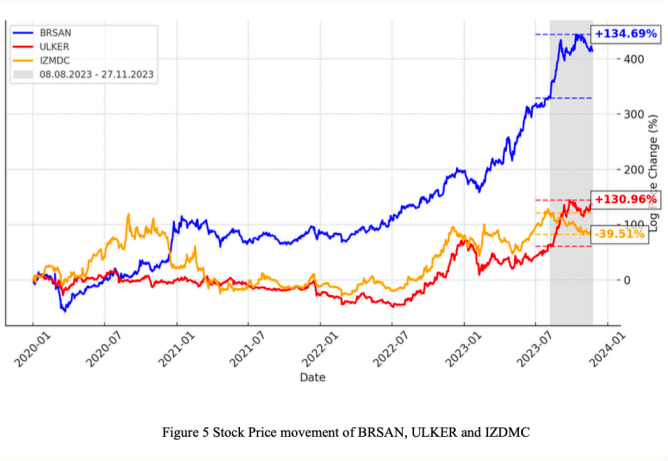
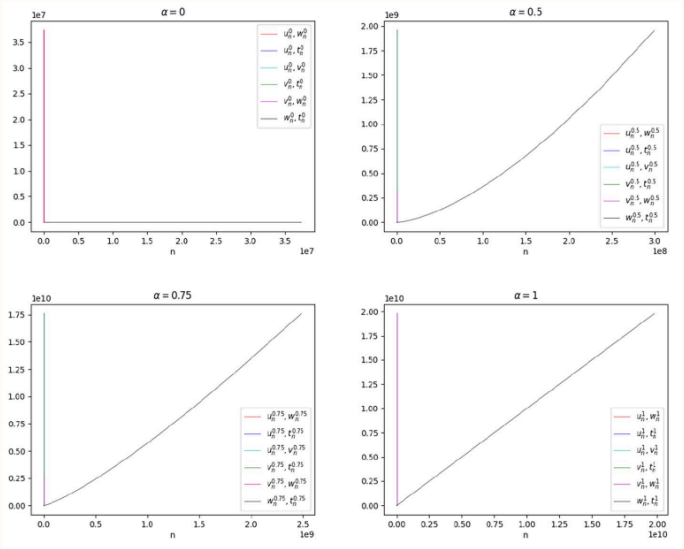


Figure 5 Stock Price movement of BRSAN, ULKER and IZDMC

Nalici, M. E., Söylemez, I., & Ünlü, R. (2025). Strategic Investment in BIST100: A Machine Learning Approach Using Symbolic Aggregate Approximation Clustering. International Journal of Industrial Engineering: Theory, Applications and Practice, 32(2). https://doi.org/10.23055/ijietap.2025.32.2.10273

A NEW STUDY CONDUCTED ON TWO-DIMENSIONAL FUZZY DIFFERENCE EQUATIONS

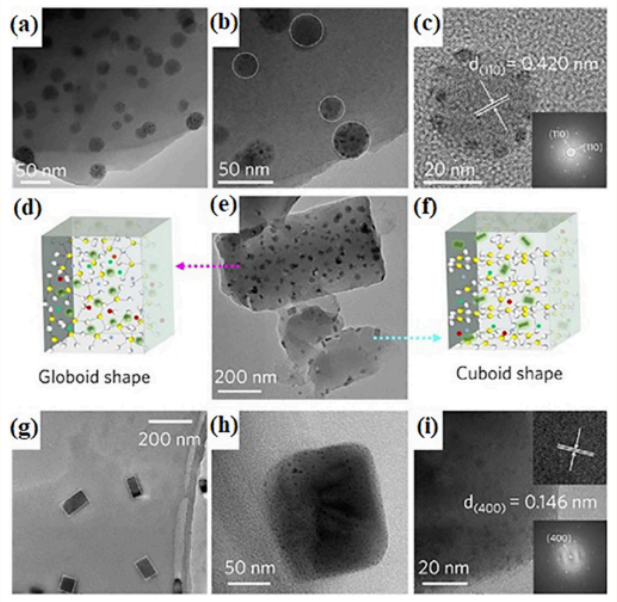


A new study was carried out on two-dimensional high-order fuzzy difference equations. The existence, uniqueness, boundedness, continuity, and convergence to equilibrium of the solutions were mathematically analyzed. The findings provided a deeper understanding of the system's behavior and were supported by numerical simulations. The research is noted to contribute to more accurate modeling of uncertainties across various fields, from engineering to the natural sciences.

Topan, O., Yazlık, Y., & Atpınar, S. (2025). Dynamics of Fuzzy Difference Equations System with Higher-Order. Journal of Applied Mathematics and Computing. https://doi.org/10.1007/s12190-025-02440-0

ADVANCING FUTURE OPTOELECTRONIC DEVICES WITH PEROVSKITE CRYSTALS ENCAPSULATED IN GLASS

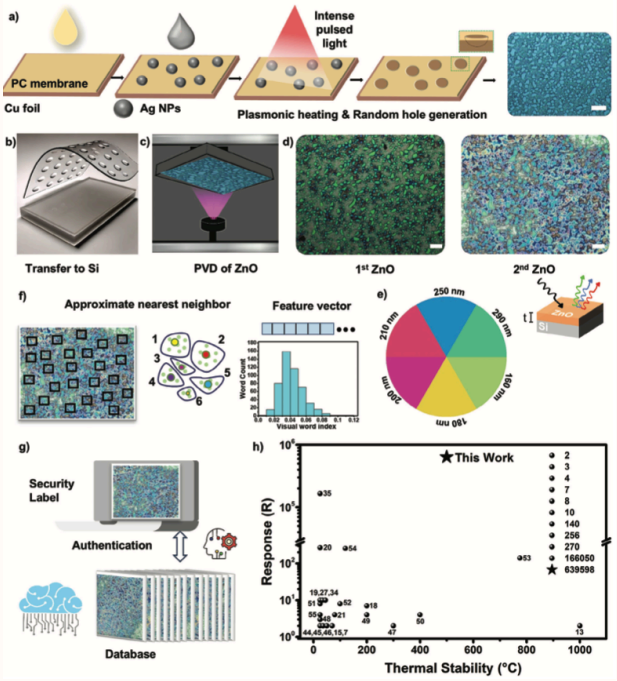
Significant progress has been made in recent studies on encapsulating perovskite nanocrystals within glass. This method preserves the light-emitting properties of the crystals while enhancing their resistance to environmental factors. The glass structures were shown to contribute to the crystals' long-term stability and improved optical performance. Additionally, structures emitting different colors of light were achieved within the glass, highlighting potential applications in energy-efficient lighting, display technologies, and medical imaging.



Samiei, S., Lin, J., Soheyli, E., Nabiyouni, G., & Chen, D. Recent Advances in CsPbX3 (X= Cl, Br, I) Perovskite NCs@ Glass: Structures, Characterizations, and Applications. Advanced Optical Materials, 2500162.

A NEW COLOR-CODING METHOD HAS BEEN DEVELOPED FOR HIGH-SECURITY LABELS

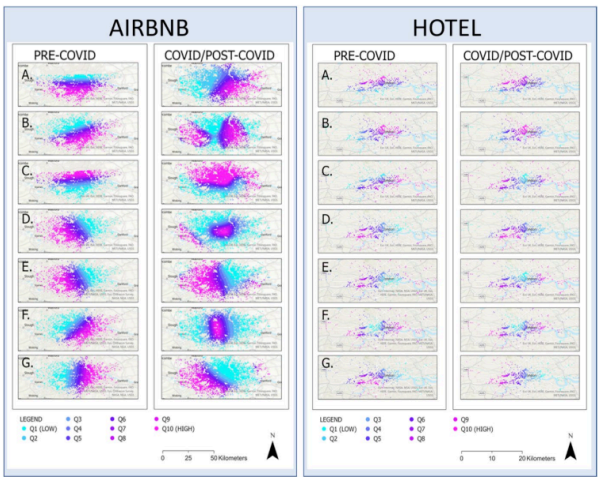
Unclonable security labels were created using zinc oxide (ZnO) thin films. The colors on these labels were generated through structural coloration, which varied with the film thickness, enabling a high coding capacity. The labels remained intact at temperatures up to 500°C and in various chemical environments. Using an AI-powered algorithm, color patterns were recognized, allowing counterfeit and genuine products to be distinguished with 91% accuracy.



Esidir A., Ren M., Pekdemir S., Kalay M., Kayaci N., Gunaltay N., Usta H., Huang X., Onses M.S. (2024). Structurally Colored Physically Unclonable Functions with Ultra-Rich and Stable Encoding Capacity. Advanced Functional Materials, 35(12). https://doi.org/10.1002/adfm.202417673

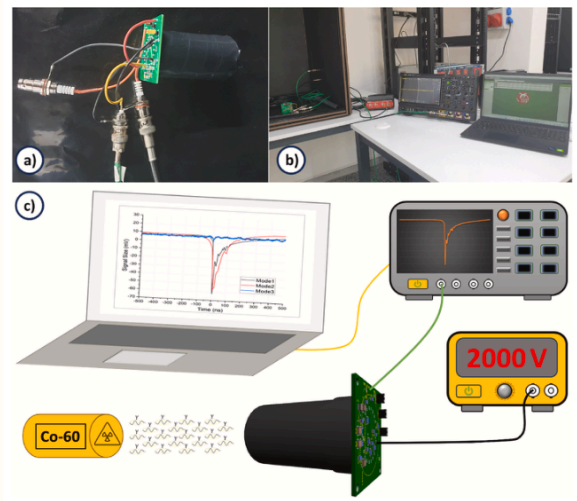
FACTORS BOOSTING TOURIST SATISFACTION IDENTIFIED THROUGH DIGITAL METHODS

Visitor satisfaction levels in London were analyzed through online reviews, evaluating the effects of location, transportation, and access to natural areas. By examining Airbnb and hotel data, the study found that proximity to parks, access to public transport, and natural attractions significantly enhanced visitor satisfaction. Particularly in the western and southern areas, access to nature was linked to higher satisfaction. Changes in these trends were observed during the pandemic. The research provides valuable insights into how digital data can be used to enhance visitor experiences.



Kourtit, K., Nijkamp, P., Östh, J., & Türk, U. (2025). A Digital 'Smiley' Analysis of the Appreciation for Tourist Amenities by Visitors to London. Applied Research in Quality of Life. https://doi.org/10.1007/s11482-025-10432-2

A NEW PARTICLE DETECTOR DEVELOPED FOR HIGH-RADIATION ENVIRONMENTS



To develop particle detectors resistant to high-radiation conditions, a new ionization calorimeter module based on the secondary emission principle was produced and tested. The modules, created by modifying Hamamatsu R7761-type photomultiplier tubes, were tested with cosmic rays and Co-60 gamma sources. Experiments conducted at three different voltage settings demonstrated that the modules are sensitive to electromagnetic particles and operate effectively in harsh radiation environments. This study contributes to the development of durable detectors for future nuclear and high-energy physics experiments.

Paran, N., Tiras, E., Tekgun, B., & Abubakar, S. (2025). Development and Radiation Test of a Secondary Emission Ionization Calorimetry Module. Radiation Measurements, 184, 107426. https://doi.org/10.1016/j.radmeas.2025.107426

A MORE RELIABLE SITE SELECTION ACHIEVED FOR SOLAR POWER PLANTS

A new approach was introduced to improve the traditional Analytic Hierarchy Process (AHP) method for selecting the most suitable sites for solar power plants. Named AHP-OH, this method reduces dependency on expert opinions and produces more objective results. In the study, factors such as solar radiation, land use, slope, and proximity to roads and power lines were evaluated for the Konya province. The results showed that 2.56% of the land was classified as having very high suitability.

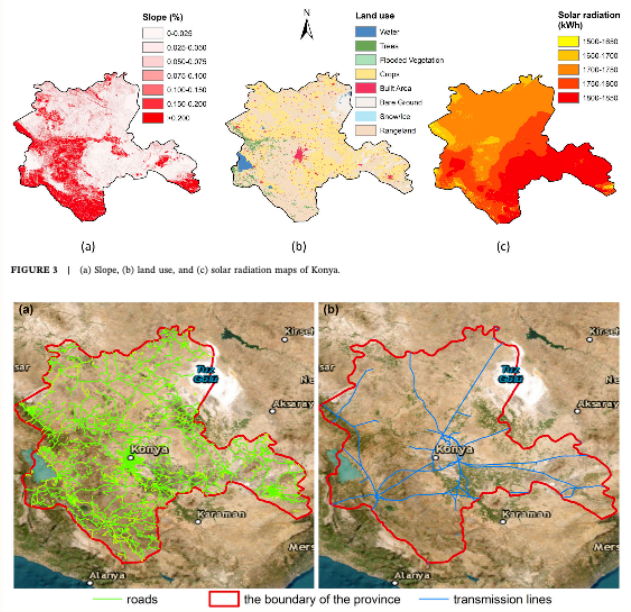
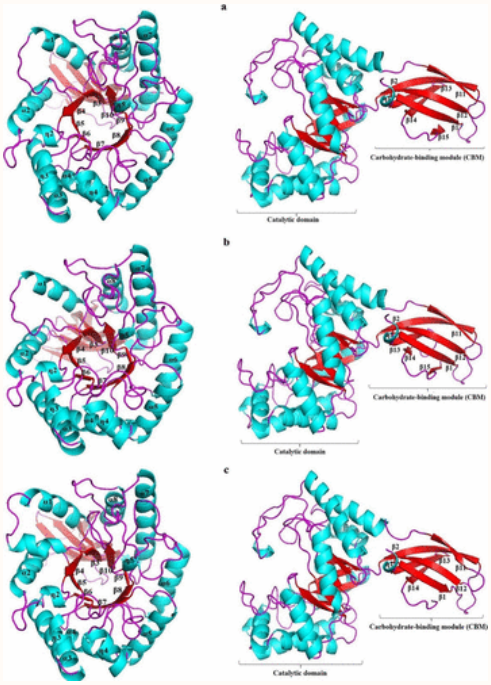


FIGURE 3 | (a) Slope, (b) land use, and (c) solar radiation maps of Konya.

Dinçer, A. E., Demir, A., & Yılmaz, K. (2025). Enhanced Objectivity of AHP for More Reliable Solar Farm Site Selection. Energy Science &Amp; Engineering. https://doi.org/10.1002/ese3.70027



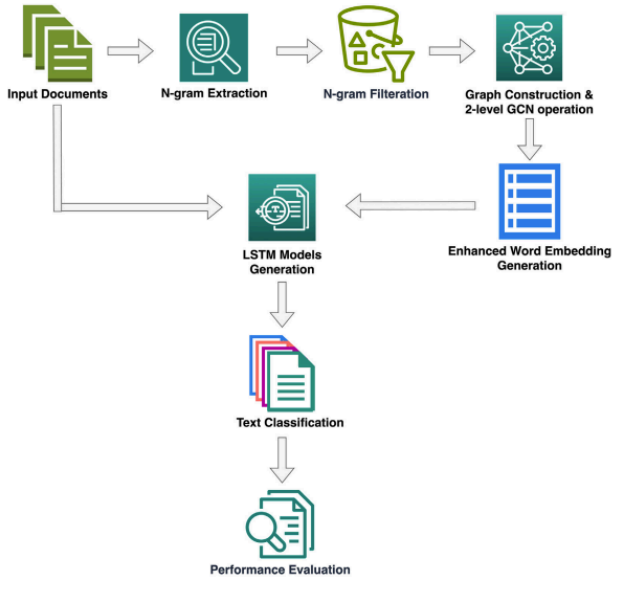
NEW HEAT-RESISTANT XYLANASES DISCOVERED FROM ANATOLIAN WATER BUFFALO

New xylanase enzymes were discovered in bacteria isolated from the rumen of Anatolian water buffalo and analyzed in detail using computer-assisted methods. The study demonstrated that these enzymes are resistant to high temperatures and could be utilized across various industrial sectors. They were found to be particularly effective in breaking down natural resources like lignocellulose. The structural properties and stability of the enzymes were examined through molecular modeling and simulations.

Kurt H., Sever Kaya D., Akçok I., Sarı C., Albayrak E., Velioğlu H.M., Şamlı H.E., Özdüven M.L., Sürmeli Y. (2025). Discovery and In Silico Characterization of Anatolian Water Buffalo Rumen-Derived Bacterial Thermostable Xylanases: A Sequence-Based Metagenomic Approach. ACS Omega.

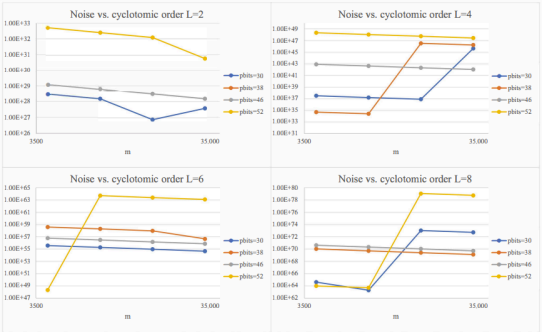
A NEW STEP IN TEXT CLASSIFICATION WITH N-GRAM AND GRAPH-BASED METHODS

A new method has been developed in the field of text classification by leveraging the power of traditional n-gram features. Texts were transformed into graph structures and processed using a graph convolutional network. This approach captured distant relationships between words and, when integrated into an LSTM model, achieved an approximate 2% improvement in performance. The method proved effective across different datasets.



Şen, T. Ü., Yakit, M. C., Gümüş, M. S., Abar, O., & Bakal, G. (2025). Combining N-grams and Graph Convolution for Text Classification. Applied Soft Computing, 113092.

A NEW OPTIMIZATION METHOD DEVELOPED FOR PARAMETER SELECTION IN FULLY HOMOMORPHIC ENCRYPTION

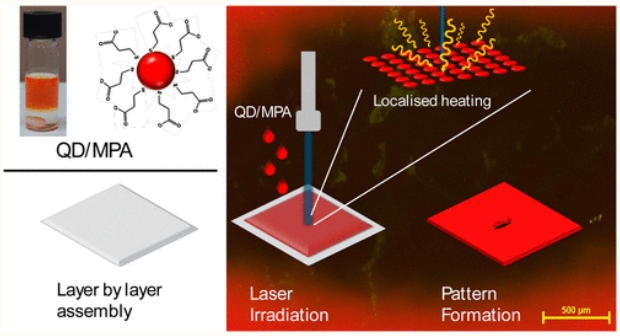


An innovative solution was proposed for the parameter selection problem in fully homomorphic encryption (FHE) systems. In the study, a new method was developed for the BFVrns encryption scheme that simultaneously optimizes performance, security, and communication efficiency. By combining regression analysis and multi-objective optimization techniques, optimal parameter sets were created, allowing users to perform secure and fast operations. The proposed method achieved approximately a fivefold reduction in ciphertext expansion factor (CEF) compared to existing parameter sets. This approach has the potential to make FHE usage more accessible and practical.

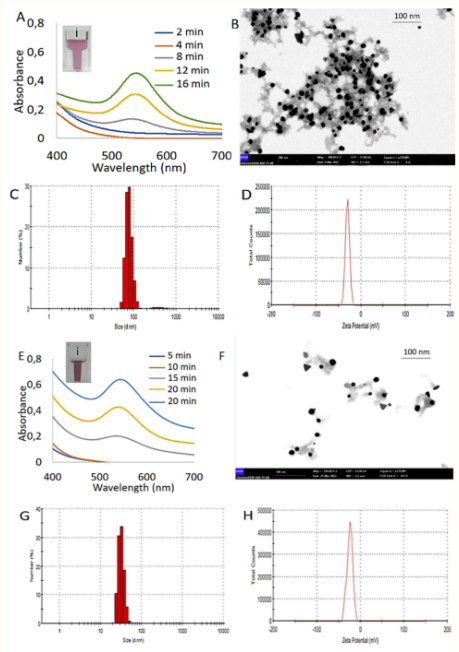
Yakupoğlu Karaağaç, C., & Rohloff, K. (2025). Optimizing Parameters for Efficient Computation with Fully Homomorphic Encryption Schemes. Turkish Journal of Electrical Engineering and Computer Sciences, 33(2), 106-126.

LIGHT-GUIDED QUANTUM DOTS FOR NEXT-GENERATION OPTOELECTRONIC MANUFACTURING

The electrostatic self-assembly of quantum dots was successfully controlled using light. The study demonstrated that laser illumination imparts kinetic energy to quantum dots, preventing them from adhering to surfaces. As a result, desired patterns could be created without the need for full surface coating. This method holds potential as a lower-cost and more sustainable alternative for the production of optoelectronic devices.



Akrema, Phul, R., Yazıcı, A. F., Senel, Z., & Erdem, T. (2025). Light-Controlled Electrostatic Self-Assembly of Quantum Dots. The Journal of Physical Chemistry C.



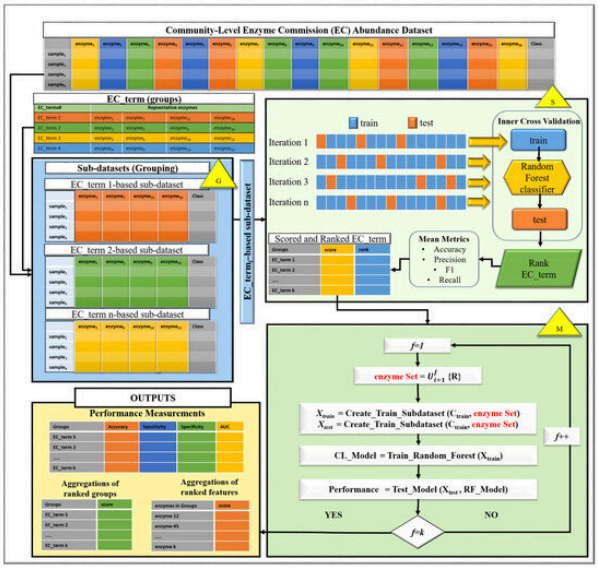
LIGHT-DRIVEN GOLD NANOPARTICLES OPEN NEW DOORS FOR BIOMEDICAL APPLICATIONS

Stable gold nanoparticles were synthesized using dihydrolipoic acid (DHLA) and DHLA-aspartame through just 10 minutes of UV light exposure. This method, which does not require additional reducing agents, produced nanoparticles that demonstrated salt resistance and catalytic, peroxidase-like activities. This achievement is considered an important step, particularly in the development of eco-friendly materials and biomedical sensors.

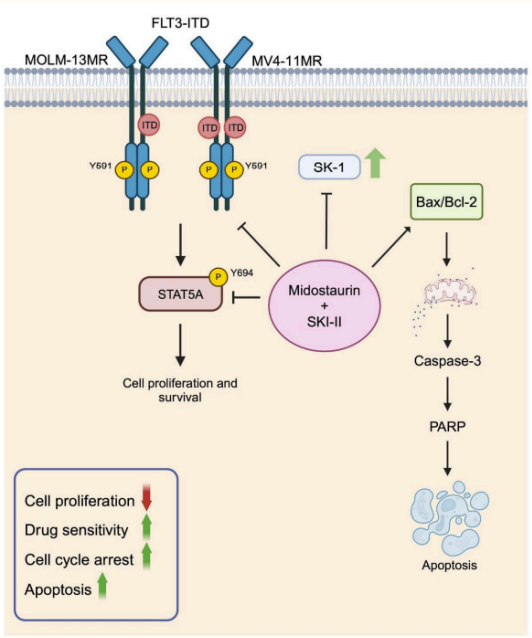
Temur, N., Dadi, S., Dogan, A. N., Nisari, M., Avan, I., & Ocsoy, I. (2025). Benefiting from Both Ethanol Oxidation and Bidentate Thiol Groups of DHLA Ligands Under Photoirradiation for Synthesis of Au Nanoparticles With Their Catalytic and Peroxidase Like Activity. ACS Omega.

IDENTIFYING COLORECTAL CANCER-ASSOCIATED ENZYMES THROUGH MACHINE LEARNING AND BIOLOGICAL KNOWLEDGE

Enzymes from the gut microbiome associated with colorectal cancer were identified using a novel machine learning method enhanced with biological knowledge. In the study, EC numbers were used for enzyme classification, adding biological meaning to the analyses. The results suggested that certain enzymes produced by bacteria such as *Escherichia coli* and *Salmonella enterica* may play a role in CRC development. This approach shows promise for identifying microbial signatures linked to disease.



Bakir-Gungor, B., Ersoz, N. S., & Yousef, M. (2025). Integrating Biological Domain Knowledge with Machine Learning for Identifying Colorectal-Cancer-Associated Microbial Enzymes in Metagenomic Data. Applied Sciences, 15(6), 2940.



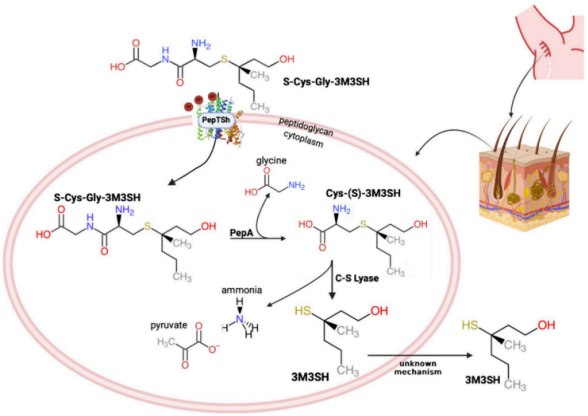
A DOUBLE STRIKE AGAINST RESISTANCE: TARGETING FLT3 AND SK-1 TO HALT LEUKEMIA CELLS

The growth of cells that developed resistance in acute myeloid leukemia (AML) treatment was reduced by simultaneously inhibiting two targets, FLT3 and SK-1. The study showed that midostaurin resistance is associated with increased levels of the SK-1 enzyme. Treatment with an SK-1 inhibitor halted cell proliferation and triggered programmed cell death. These findings suggest that new combination therapies may offer hope for patients with resistant AML.

Tecik, M., & Adan, A. (2025). Concurrent Inhibition of FLT3 and Sphingosine Kinase-1 Triggers Synergistic Cytotoxicity in Midostaurin Resistant FLT3-ITD Positive Acute Myeloid Leukemia Cells via Blocking FLT3/STAT5A Signaling To Induce Apoptosis. Journal of Chemotherapy, 1-17.

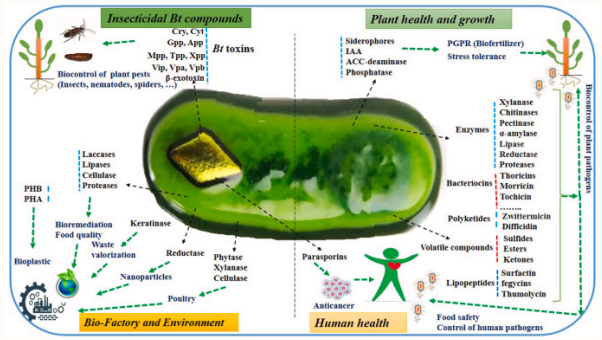
A NATURAL SOLUTION: FIGHTING BODY ODOR WITH TANNIC ACID

The foul-smelling molecules produced by bacteria involved in human body odor formation have been reduced using tannic acid, a natural compound. The study demonstrated that tannic acid strongly inhibits the C-S lyase enzyme, which plays a critical role in odor production by Staphylococcus hominis. Importantly, this effect was achieved without compromising the overall health of the bacteria. Thus, tannic acid has been proposed as an environmentally friendly and natural deodorant ingredient.



Fidan O., Karipcin A.D., Köse A.H., Anaz A., Demirsoy B.N., Arslansoy N., Sun L., Mujwar S. (2024). Discovery of a CS Lyase Inhibitor for the Prevention of Human Body Malodor Formation: Tannic Acid Inhibits the Thioalcohol Production in Staphylococcus Hominis. International Microbiology, 1-12.

THE NEW FACE OF *BACILLUS THURINGIENSIS*: THE HIDDEN HERO OF AGRICULTURE AND INDUSTRY

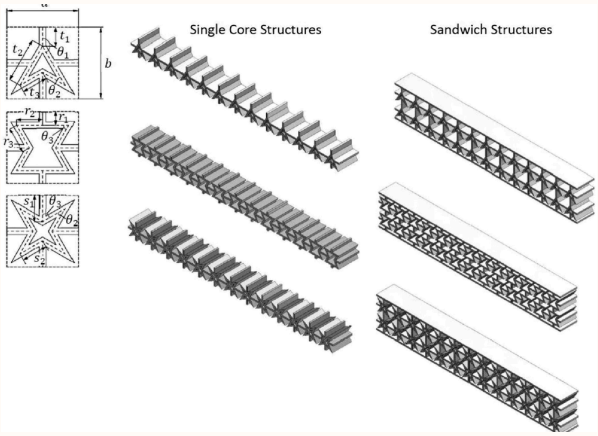


Bacillus thuringiensis (Bt) has been revealed not only as a bioinsecticide but also as a significant player in agriculture, environmental management, and healthcare. It has been shown that Bt produces various biological compounds that promote plant growth, prevent diseases, remove heavy metals, and facilitate industrial production. Furthermore, Bt's potential in new applications such as cancer therapies and food preservation has also been highlighted.

Jouzani, G. S., Sharafi, R., Argentel-Martínez, L., Peñuelas-Rubio, O., Ozkan, C., Incegul, B., Goksu R., Hayta Z., Yilki D., Yazici B., Hancer V., & Azizoglu, U. (2024). Novel Insights Into Bacillus Thuringiensis: Beyond Its Role as a Bioinsecticide. Research in Microbiology, 104264.

REPAIRABLE AND DURABLE SANDWICH STRUCTURES DEVELOPED WITH A NEW PRODUCTION METHOD

New sandwich structures, produced with 3D printing and bonded using special adhesives, were found to exhibit durability and energy absorption performance comparable to traditional structures. These specially designed cores—re-entrant, star-shaped, and V-shaped—were successfully evaluated through bending tests. Thanks to adhesive-layer damage rather than structural failure, the structures were shown to be easily repairable, offering a significant advantage for sustainable manufacturing.



Atahan, M. G., Sevim, C., Demirbas, M. D., Apalak, M. K. Comparative Study on Bending Performances of 3D-Printed Monolithic and Adhesively Bonded Sandwich Structures with Various Auxetic Cores: An Innovative Production Approach. Journal of Sandwich Structures & Materials, 10996362251331097.