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75th Independence Day celebration at IIT Guwahati

IIT Guwahati Invents Biodegradable low-cost Composite Wound Dressing Film

Indian Institute of Technology Guwahati researchers have invented a Biodegradable low-cost Composite Transparent Wound Dressing Film. This material, based on the integration of a synthetic polymer, is non-toxic in nature and will create a moist environment that would enable the body to heal on its own through the endogenous enzymes, according to recent research.

The laboratory-scale development was found to be at least 50 percent economical in comparison with similar commercial materials.

Cotton wool, lint, and gauzes are commonly used wound dressing materials. They are often deployed to manage the wound exudates and accelerate the healing process. However, a major disadvantage of such materials is with respect to the painful removal exercises that can even damage a healed tissue. Further, their opaqueness becomes a critical issue for sensitive wound applications that demand periodic visualization based analysis and treatment procedures.

The research to address these issues was carried by out a team at the Department of Chemical Engineering, IIT Guwahati. Some of the findings were published in the International peer-reviewed International Journal of Biological Macromolecules by Ms. Aritra Das (First Author), Ph.D. Scholar, Ms. Srirupa Bhattacharyya, Doctoral Fellow, IIT Guwahati, Prof. Chandan Das and Prof. Ramagopal V. S. Uppaluri, Faculty in the Department of Chemical Engineering, IIT Guwahati.

Several promising features and advantages exist for the polymer-based hydrogel films as novel wound dressing materials. Few of these have been outlined as follows:

- Low-cost: In addition to their bio-degradability that counters environmental hazards, the mentioned films are easy for people to afford them.

- Biocompatible: Prevent any kind of toxicity that counters and hampers the growth of cells, tissues and natural healing processes.

- Transparent: To provide wound observation without changing the dressing materials. Further, ease of removal can be addressed due to the controlled moist environment being facilitated by the material. Thus, the transparent film can be easily removed.

- Super absorbent: To prevent wound exudate accumulation on the wound surface which may lead to the maceration of the newly generated tissue.

- Adequate mechanical characteristics: To provide existence under a huge flow of exudates and ability to adjust with the shape of the wound to prevent scar formation in due course of healing.

- Prevention from contamination: Even if the dressing material loses its occlusivity to bacteria after being swollen under huge flow of exudates, the material would leach few of its components that facilitate localized antibacterial effect in a hydrolytic environment.

Highlighting the unique aspects of this Research, Ms. Aritra Das (First Author), PhD scholar, IIT Guwahati, said, "This invention of IIT Guwahati has the potential to make a huge impact on the field. It emphasizes upon the integration of a synthetic polymer namely polyvinyl alcohol (PVA) with a natural polymer starch (St) to eventually achieve a low-cost, biodegradable, non-toxic and transparent composite hydrogel."

IIT Guwahati has created the knowledge framework and associated protocols for successful identification and optimization of polymer hydrogel films for the probable wound dressing applications.

Such customized and effectively designed novel materials provide the necessary hope to address effectively issues such as biodegradability of synthetic polymer-based materials, cost of raw materials and processes, utilization of expensive natural polymers to achieve functional materials, and biocompatibility of developed products, among others. All these are expected to further enrich the on-field applications of polymers in real-world applications.

Explaining how this invention will have an impact in the real world, Prof. Chandan Das, Department of Chemical Engineering, IIT Guwahati, said, "The product has potential to prevent bacterial invention even after it gets swelled under hydrolytic environment and loses its occlusivity. The steady weight loss characteristics presented by the polymer network provides essential release of the components, especially citric acid which secure the protection barrier. Apart from providing adequate environment towards the growth of the wounded cells, the leached components from the composite as well assist towards the accelerated growth of the healthy cells and tissues.

The laboratory achieved film constitution can be further targeted towards in-vivo characterizations and needful scale-up investigations. The enhancement of PVA-St composite hydrogel film characteristics with malic acid replacing citric acid affirmed even more promising results in terms of both property enhancement as a viable wound dressing film and reduction in the retail cost of the film fabrication.

Further, elaborating on the current status of the Research and how it can be taken to the field, Prof. Ramagopal V. S. Uppaluri, Department of Chemical Engineering, IIT Guwahati, said, "The carried-out research has been in an experimental and table top research environment that needs furthering studies towards scale up as well as in-vivo analysis (real world applications). Among these, the scale up related studies can be addressed after targeting the in-vivo analysis using specimens such as wounded rats."

The laboratory scale-based retail cost of the optimized CA-based PVA-St composite hydrogel film has been about ₹ 0.188/cm^2, which is about 66 percent inexpensive in comparison with similar commercial materials that costs ₹ 0.565 /cm^2

Considering processing costs and probable insights from scale up studies, the anticipated price of the developed materials is expected to be about 50% or lesser of the commercial price of the mentioned materials. Compared to the CA-based PVA-St composite hydrogel film, the recently invented MA-based similar film has been about 4.56 percent inexpensive.

(L-R) Aritra Das, PhD Scholar, Prof. Chandan Das and Prof. Ramagopal V.S. Uppaluri

The low-cost Composite Wound Dressing Film developed by IIT Guwahati Researchers

IIT Guwahati holds Virtual Orientation for New Batch of PhD Scholars, Masters' and International Joint Degree Students

Indian Institute of Technology Guwahati conducted a virtual orientation for its new Masters' students and PhD scholars recently. More than 850 students attended the session along with their parents and guardians and were welcomed into the IIT Guwahati family.

Students from Gifu University, Japan, who were admitted to the International Joint Master's Degree Programme in Food Science and Technology also participated virtually in the event. This is the second batch of students from Gifu University to enroll and attend this International Joint Degree program. The first batch saw four students from Gifu University graduating this year.

Welcoming the new students and providing a broad overview of the Institute, Prof. T. G. Sitharam, Director, IIT Guwahati, said that the students and scholars have come through a tough selection process. He emphasized the rapid progress made by the Institute in different critical areas of research and academics including the establishment of new schools and centers to enhance the multidisciplinary approach to academics and research at IIT Guwahati.

The event was attended by senior dignitaries of the Institute who welcomed the new students to their chosen programmes and gave an outline of different aspects of life and study at IIT Guwahati.

Prof. Chitralekha Mahanta, Dean of Academic Affairs and Prof. K. V. Krishna, Associate Dean of Academic Affairs (PG) made detailed presentations on all the academic aspects of different programmes at IIT Guwahati and highlighted the importance of academics especially at this time of pandemic.

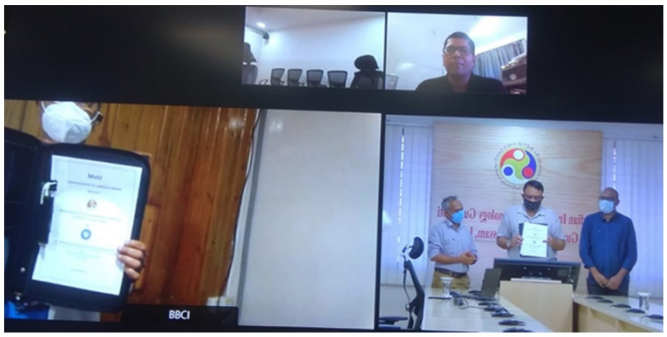
Along with this, they were also introduced to the different Student Bodies on campus and how they can enhance their personalities by being part of different extracurricular forums.

Prof. V. V. Dasu, Dean of Students' Affairs informed the new students about life on campus while stressing that students would be welcomed to the campus once the situation stabilizes due to the ongoing pandemic. He also introduced the students to the different student bodies on campus and highlighting how students can enhance their personalities by being part of the different extracurricular forums.

IIT Guwahati has multiple international collaborations with the top universities around the world. During the orientation session, the Institute encouraged the students to take advantage of the existing collaborations and fellowships available to visit foreign universities and enhance their professional skills and to also get exposure to industry.

Several senior faculty addressed the students during this session. They include:

- Prof. Lasihram B. Singh, Chairman, GATE
- Prof Chitraleka Mahanta, Dean of Academic Affairs
- Prof. K.V. Krishna, Associate Dean of Academic Affairs (PG)
- Prof. V.V. Dasu, Dean of Students' Affairs
- Prof. M. K. Purkait, Dean of Alumni and External Relations
- Dr. Abhishek Kumar, Head of Centre for Career Development
- Prof. S. K. Kakoty, Deputy Director



Signing of MoU between IIT Guwahati and Dr. Bhubaneswar Borooah Cancer Institute (BBCI)

IIT Guwahati Researchers make Breakthrough in Memory Architectures

Indian Institute of Technology Guwahati Researchers have made fundamental contributions to memory architectures by preventing redundancy in data values and improving slow and frequent writes in the multi-core processor systems.

When the world is rapidly moving towards research in applied areas, IIT Guwahati researchers have developed methods to solve the problems in computer systems domain. Specific contributions being in multi-core processor-based systems that need an equally large on-chip memory to commensurate the data demands of the ever-growing applications and hence preventing energy consumption to ensure the temperature remains under the thermal design power (TDP) budget.

The research is being led by Prof. Hemangee K. Kapoor, Department of Computer Science and Engineering (CSE), IIT Guwahati, and comprises a team of research scholars: Sukarn Agarwal, Palash Das, Sheel Sindhu Manohar, Arijit Nath and Khushboo Rani. The findings of their research are published in reputed peer-reviewed journals like IEEE Transactions on Computers, IEEE Transactions in VLSI, IEEE TCAD, ACM Transactions on Embedded Computing Systems, ACM TODAES, ACM JETC, to name a few. The links to some papers can be found at: https://ieeexplore.ieee.org/document/8611205 and https://dl.acm.org/doi/abs/10.1145/3411368.

Explaining the challenges of multi-core processor-based systems, Prof. Hemangee K. Kapoor, Department of CSE, IIT Guwahati said, "The application data access patterns are not uniformly distributed and hence leads to several orders of writes to certain memory locations compared to others. Such heavily written locations become prone to wear-out and thus prevents the use of complete memory device without error corrections".

To handle this non-uniformity, IIT Guwahati researchers developed methods to evenly distribute the accesses across the overall memory capacity to reduce the wear-out pressure on heavily written locations and also worked in the area which avoids writing redundant values thus prolonging the wear-out.

Further, Prof. Hemangee K. Kapoor said, "Slow and frequent writes can be re-directed to temporary SRAM partitions sparing the NVM from getting written with such frequent accesses. Such structures are called hybrid memories".

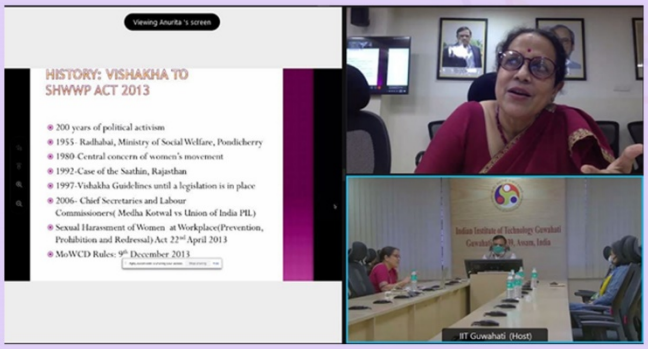
"The team is also working on extending them to off-chip main memory. The future challenges are to handle lifetime enhancement in presence of encryption methods used to secure the Non-volatile memory and to handle temperature and process technology driven disturbance errors introduced when the cells are read or written," Prof. Hemangee K. Kapoor added.

The researcher's current and future contributions will help mitigate the drawbacks of promising emerging memories and ease their adaptability. Once some drawbacks are easily removed, scientists can find newer avenues for using such technologies without worrying about its limitations.

Artificial Intelligence (AI) and Machine Learning (ML) are used as tools to solve several real-time problems. However, they involve enormous computations on huge datasets. Building close to memory accelerators to process the data are efficient in performance as well as energy. The research team is also working on building customized parallel architecture designs to give better FLOPS.

As a long-term perspective, the researchers see a trend towards edge computing leading to skyrocketing generation of data. Data creation is also fueled by 5G networks, image processing and real-time voice processing. All these big-data applications need real-time analysis at run-time and with immediate responses. Better storage and close to memory processing is the need of the hour. Non-volatile memory are advised to be used in Internet of things (IoT) and edge devices. The longevity of non-volatile memory in such devices is crucial for their service guarantees and durability. Effective lifetime improvement methods will help improving the state-of-the art in this field which is still in its nascent stage. Solutions for better management of NVMs will give them wider acceptance in critical applications including healthcare and autonomous vehicles.

Prof. Hemangee Kapoor (R) & Team



An ONLINE talk on 'Women's Safety in Workspaces' was organized by Internal Complaint Committee of IIT Guwahati. Smt. Anurita Pathak Hazarika, External Member in the IC of Assam Police, TISS, the Social Welfare Department and the Chairperson of Local Committee of Kamrup Metro delivered a talk during this event.

IIT Guwahati develops Pseudocapacitive Hydrogels for high performance Energy Storage Devices

A group of researchers from Indian Institute of Technology Guwahati have successfully developed hydrogel-based electrodes that could enhance the performance of an energy storage device.

The research group at Department of Physics, IIT Guwahati led by Dr. Uday Narayan Maiti, in collaboration with Prof. Subhradip Ghosh, IIT Guwahati and Dr. N. Padma of Physics group, Bhabha Atomic Research Centre (BARC), Mumbai, under BRNS (Board of Research in Nuclear Science) project has developed a new soft hybrid material, known as hydrogel, to increase the energy storage performance of supercapacitor devices.

A hydrogel is a porous framework of interconnected materials, in which water remains stably locked within the pores. As a building block of the hydrogel, they have chosen two different kinds of nanosheets, namely graphene and MXene, which store charge via two different mechanisms.

Highlighting the unique aspects of the research, Dr. Uday Narayan Maiti, Department of Physics, IIT Guwahati, "Most important aspect of this development lies in its extreme simplicity, scalability and mainly room temperature process which prevents the temperature sensitive MXene from changing its conducting property which ensures high device performance"

He further added, "The entire process of hydrogel development is like constructing a large building with bricks as building blocks. However, development of hydrogels for energy storage using nanosheets require multi-level tuning starting from electronic properties, surface chemical properties and mutual interactions. In our hydrogel structure large graphene sheets provide mechanical stability to the hydrogels, whereas synergistic electronic properties of graphene and MXene give excellent energy storage performance. We believe this development can serve as a platform for further exploration in the area of energy storage devices and beyond."

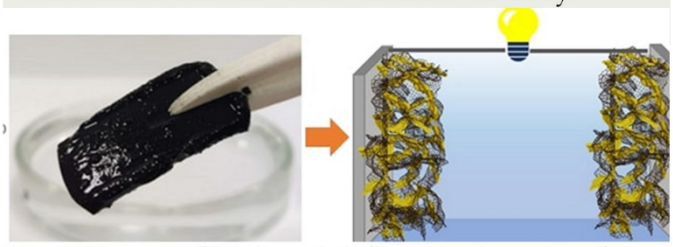
In Supercapacitors two electrodes (anode and cathode), made of suitable materials, are immersed within electrolyte solution, and energy is stored by charge accumulation on the electrode surfaces.

Atomic-thin sheet-like materials, known as nanosheets, are considered as the best choice for supercapacitor electrode as they can offer large area to store charge. However, integrating microscopic ultra-small nanosheets into usable macroscopic scale is highly challenging.

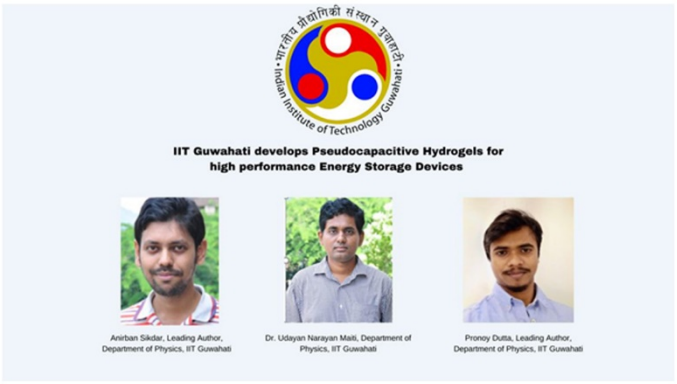
They have developed the hydrogels electrodes by simple room temperature process in which graphene and MXene spontaneously assemble themselves over metal plate within water medium. This unique structure can avoid the restacking challenge associated with charge-storing nanosheets. Graphene, single atom thin carbon sheet, stores charge on its surface via physical adsorption, known as electrical double layer mechanism (EDLC). Whereas, MXene, nanosheets of titanium carbide, stores charge via both EDLC and chemical reaction on its surface, known as pseudo-capacitance.

Researchers at IIT Guwahati showed that their supercapacitors based on MXene-graphene hydrogels can be repeatedly charged and discharged for over 10000 times, with only minimal performance degradation. Such durability is much better than the conventional batteries that typically wear out within 300-500 charging-discharging cycles. The supercapacitor devices developed in lab can be charged in seconds to its full capacity. It can store energy as high as 30 Wh per kilogram of the materials, which is one of the best value reported to date in MXene based system. Importantly, these supercapacitors can deliver the energy at a very fast rate when required, which is presented in terms of power density. They have achieved a highest power density 1.13 kW per kg of electrode material which is almost twice the power offered by current Li-ion batteries. Their hydrogel devices can be engineered to be compact enough to fit the extreme tight spaces of modern portable electronics, which is gaining increasing popularity among the masses.

The results of these breakthrough work in MXene based supercapacitor technologies were published in "Electrochimica Acta" and "Carbon" recently.



Digital image of hydrogel (left) and schematic of supercapacitor device (right)



Extension of existing MoU between AICTE and IIT Guwahati for another two years has been signed with the addition of digital connectivity infrastructure along with solar power and water supply. This extended MoU also includes mentoring for MODROBS and RPS schemes with empowering the faculties of AICTE approved Institutes of North East Region

IIT Guwahati to collaborate with Amrita Vishwa Vidyapeetham on Research & Development

Indian Institute of Technology Guwahati is collaborating with Amrita Vishwa Vidyapeetham (AVV), a private, deemed-university based in Coimbatore, Tamil Nadu, in Education and Research activities. This will help in enriching academic programmes and promote exchange of students between two institutions.

A MoU towards this collaboration was signed by Prof. T.G. Sitharam, Director, IIT Guwahati, and Prof. Venkata Rangan, Vice-Chancellor, AVV, recently in the presence of Prof. A. S. Achalkumar, Dean (Outreach Education Programme), Department of Chemistry, IIT Guwahati, Prof. S. Senthilvelan, Department of Mechanical Engineering, IIT Guwahati, Prof. K.S.R.K. Krishna Murthy, Head, Department of Mechanical Engineering, IIT Guwahati, Prof. S. Thirumalini, Head, Mechanical Engineering, AVV and Prof. Sasangan Ramanathan, Dean, Faculty of Engineering, AVV.

Highlighting the unique aspects of this collaboration, Prof. T. G. Sitharam, Director, IIT Guwahati said, "AVV has many similarities in terms of vast and beautiful campus along with a team of highly dedicated team of faculty and students. With the emergence of many new interdisciplinary research and academic centres equipped with state-of-the-art equipment at IIT Guwahati, the institute is destined serve the country with extra vigour. This mutual collaboration will help both the institutes scale new heights in research and academics."

IIT Guwahati and AVV will encourage cooperation between their faculty members, departments, and research centres including visits of faculty members to deliver lectures, conduct seminars, discussions, research and supervise student studies. Students visits to attend courses and jointly develop teaching programmes would also be encouraged along with collaboration in research projects.

Speaking about the collaboration, Dr. Venkat Rangan, Vice Chancellor, Amrita Vishwa Vidyapeetham, said, "This is a historical moment for both the Institutions, which strive for excellence in Teaching and Research, to come together in a perfect Public-Private Partnership. I am sure we will leverage our strengths and work for a sustainable world to the betterment of humanity as our Chancellor Amma has always envisaged."

IIT Guwahati, founded in 1994, is well-equipped with world-class infrastructure to with a global research ranking of 41 and an overall ranking of 395 in world. In a short span of 25 years the institute has got the global reputation for its research and academic standing. The institute has a beautiful green campus spanning 700 acres and standing on the banks of mighty Brahmaputra River.

Amrita Vishwa Vidyapeetham is a young and dynamic, multi-campus, multidisciplinary "deemed to be University" established by its Chancellor, Sri Mata Amritanandamayi Devi, popularly called Amma all over the world and one of the foremost humanitarian leaders of the world today. It is ranked 4th by NIRF, Government of India in the University category and has been awarded the IOE status by UGC in 2019. Amrita Vishwa Vidyapeetham is ranked 81st in the world by Times Higher Education (THE) Impact Rankings in the Year 2021 and is one of the fastest growing universities in India.

Ramesh K Sonkar, Assistant Professor, Department of Electronics and Electrical Engineering has been admitted as OSA Senior Member.

IIT Guwahati takes up Disaster Preparedness and Management programme in Assam state

IIT Guwahati has taken up a programme for developing social activism for research diplomacy in this area of disaster management.

There is an urgent need for disaster preparedness for the state of Assam, which witnesses almost all forms of disasters such as earthquakes, droughts, floods, cyclones, storms, heatwaves, landslides, etc. The higher education in disaster management and research seems to be negligible as compared to the youth resources in India. IIT Guwahati has taken up a programme for developing social activism for research diplomacy in this area of disaster management.

The Sendai Framework for Disaster Risk Reduction which was adopted in 2015, left with only 9 years to implement the same by 2030. Sendai Framework was the major agreement of the development agenda and provides Member States with concrete steps to protect from the risk of disaster. Sendai framework was endorsed by the UN General Assembly after the Third UN World Conference on Disaster Risk Reduction (WCDRR). WCDRR emphasizes that the Government or the state should lead and has the primary role to reduce disaster risk.

However, the responsibility should be shared with all stakeholders including local government, the private sector, educational institutions and common people. Understanding and Prioritizing Research and Higher Education in Disaster Risk Management is very critical for action on the ground.

Four specific priorities for action are:

- o Understanding disaster risk
- o Strengthening disaster risk governance
- o Investing in disaster risk reduction for resilience
- o Enhancing disaster preparedness for an effective response for rehabilitation and reconstruction.

In India, disaster management evolved from the action taken during extreme events like floods, drought, cyclones, heat waves, etc. due to climatic variability and the consequent loss of lives and property. Actions for responding to climate change and disaster management initiatives is critical for any state.

Assam presents an interesting case for identifying linkages between disaster management and climate change. Disaster Management deals with the management of assets pre-, during, and, post-event for the safety of the people and the habitat. addressing prevention and mitigation of hazards. In India, disaster management is evolved from the action taken during or after extreme events like floods, drought, cyclones, heat waves, etc. which are due to the climatic variability and the consequent loss of lives & property. Actions before such a disaster and initiatives taken to minimize the risk is critical for any state.

International Decade for Natural Disaster Reduction (IDNDR)

The United Nations declared the decade (1990-1999) as the International Decade for Natural Disaster Reduction (IDNDR). In May 1994, the first Yokohama Strategy was adopted by all countries to unequivocally give political commitment to reduce vulnerability through appropriate methods. The strategy contributed to shifting focus from disaster response to prevention and mitigation. The UN has decided to observe 13th October as International Day for Disaster Reduction (IDNDR) every year.

Objective of IDNDR

The objective of IDNDR is to create public awareness and educate the citizens about the impact of natural disasters and importance of disaster preparedness and mitigation. Disaster preparedness requires specific skill set that someone has to be trained for, and thus it can save lives and property.

For this purpose, in higher education the theoretical, experimental and applied research needs to be accelerated in prioritizing action through graduate institutions to understand the issues that come with the different phases of disaster management such as Mitigation, Preparedness, Response and Recovery.

The vulnerability profile is very high for the entire state of Assam in North Eastern region with reference to earthquake, floods and high wind velocities.

The Centre has a team of young and energetic faculty who wish to contribute to the state of Assam & NER and elsewhere meaningfully and are determined to make this Centre a hub for research, innovation and capacity building.

This new academic centre - CDMR at IIT Guwahati will assimilate the recent developments in both climate change and disaster management fields and specifically address the need for integrating adaptation to climate change and disaster management. CDMR will develop an activity-based setup to an institutionalized structure; from a single faculty domain to a multi-stakeholder set-up; and from a relief-based approach to a multi-dimensional approach for reducing risks.

IIT Guwahati

IIT Guwahati has been promoting Sustainable Development Goals and has already made it a part of its curriculum at the undergraduate level and has been the first institute in the country to do so. Personnel exchange between industry/government and academia through visiting professorships and sabbaticals or summer leaves in industry and government is also being pursued at CDMR.

Through this centre, IIT Guwahati is trying to leap forward by embracing the rising demands of newer and interdisciplinary areas of research and technology development in disaster management and research. Disaster Management and preparedness can contribute towards enhancing Disaster Resilience if the knowledge from the laboratory could be taken to the vulnerable community through implementation and innovations. This would definitely evolve a strategy for effective research-based disaster diplomacy.

Article by Dr T.G. Sitharam, Director, IIT Guwahati.

Indian Institute of Technology Guwahati
Guwahati - 781039
Assam, India

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