

Prof. Soumitra Satapathi

PhD, MRSC, MNASI

Assistant Professor ; Département of Physics, IIT Roorkee, Uttarakhand 247667, India

Associated Professor, Center of Nanotechnology, IIT Roorkee

BASE Fellow, Indo-US Science and Technology Forum

Visting Professor, University of Massachusetts Lowell, USA

Visting Professor, Max Planck Institute for Polymer Research, Mainz, Germany

Co-author : Organic Photovoltaic: A green solution for a gray problem

Founder and CEO: LabX Scientific Pvt Ltd (www.labx.co.in)

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Summary

- Highly adaptable scientist with abilities in myriad of materials science with 10+ years of experience.
 - Adept on various experimental techniques on different platforms; able to adapt quickly to changing situations.
 - Extensive research experience internationally and nationally in the diverse areas of Materials Science and Applied Physics.
 - Strong leadership and networking skills.
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EDUCATION

PhD, Physics and Applied Physics

University of Massachusetts, Lowell, Massachusetts, USA (2012)

Thesis Title: Optical and optoelectronic properties of organic nanomaterials

M.S., Physics and Applied Physics

University of Massachusetts, Lowell, Massachusetts, USA (2010)

Thesis Title: Investigation of two-photon-induced-fluorescence from semiconducting polythiophenes

AWARDS

- Global Challenge Research Award, Royal Society, UK (2019).
- Young Faculty Research Fellowship Award, Ministry of Electronics and Telecommunication, Govt of India (2019).
- Indo Canada Shastri Award (2019).
- Member, Royal Society of Chemistry (MRSC) (2018).
- Member, National Academy of Science (MNASI) (2018).
- Young Scientist Delegate to BRICS meeting held in Hangzhou, China to represent India's energy Research (2017).
- Max Planck Institute Director's Award for Organic Electronics Research (2017).
- Board of Governor Member, Haiti Development Board, USA (2017-Onwards).

- Bhaskara Advanced Solar Energy Research Award from Indo-US Science and Technology Forum and DST, Govt. of India (2016).
 - Research on “Jamun Solar Cells” is 2nd Highest Read Science Article in The Hindu (2017).
 - Young Scientist Award from DST, Govt. of India (2015).
 - DST Nanomission Postdoctoral Research Award, Govt. of India (2013).
 - University of Massachusetts endowed scholarship, University of Massachusetts, Lowell, MA, USA (2012).
 - Sukant Tripathy Summer Fellowship, University of Massachusetts, Lowell, MA, USA (2012).
 - Graduate Research Scholar Award, University of Massachusetts, Lowell, MA, USA (2012).
 - Outstanding Graduate Student of the Physics Department award, UMASS, Lowell, MA, USA (2012).
 - Outstanding Graduate Student of the Year award, University of Massachusetts Lowell, MA, USA (2011).
 - Graduate Research Grants Awards, University of Massachusetts, Lowell, MA, USA (2009).
 - Marquis Who’s Who of America for 2011.
 - National Talent Search Scholarship (1995-1996).
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Research Experience

■ Assistant Professor, Physics Department, IIT Roorkee, Roorkee, Uttarakhand, India September 2014- Onwards

- Perovskite solar cells, perovskite single crystal solar Cells, 2D perovskite solar Cells, flexible printed solar cells, 3D printed solar cells, efficiency and stability study.
- Singlet Fission based solar cells
- Study of photophysics in perovskite and organic optoelectronics device by Time Resolved Absorption and Fluorescence Spectroscopy
- Organic Nanoparticle based solar cells
- Photocatalysis and its application
- Optical sensor, Terahertz based detection
- Artificial Intelligence Inspired Nanofabrication
- 3d printed microfluidics for point of care devices
- Entrepreneurships, tech consultancy in clean energy, low cost biomedical devices and materials science

■ Postdoctoral Researcher, Biomedical Engineering Department, Tufts University, Medford, USA December 2013-August 2014

- Optical diagnosis of engineered and diseased tissue; developed breast cancer model for nonlinear optical imaging and image analysis.
- 3dimensional Image analysis

- microrheology using optical tweezer.

■ **DST Postdoctoral Researcher, Indian Association for the Cultivation of Science, Kolkata, India**
February, 2013 – November 2013

- Studied time resolved spectroscopy of organic nanomaterials
- Developed a novel Muller Matrix approach for determining optical anisotropy.
- Studied phase separation in organic nanomaterials devices.

Key Journal Publications

Journal Publications

Book Chapter:

1. “Organic Photovoltaic: A green solution for a gray problem”, **Soumitra Satapathi**, Uttarakhand Science and Technology Department.
2. “Nanobiophotonics for Cancer Diagnostics”, **Soumitra Satapathi**, Manisha Chatterjee Satapathi, Anirban Mitra, Saugata Hazra, Anubhav Raghav, Manisha Sharma, Somesh Mahapatra, Manish Paul, Springer.

Publications:

34. Vshal Kumar, Binoy Maity, Mrinmoy K Chini, Priyodarshi De, Soumitra Satapathi, ““Multimodal Fluorescent Polymer Sensor for Highly Sensitive Detection of Nitroaromatics”, **Just Accepted, Nature Scientific Reports, 2019.**
33. Kulveer Singh, Anubhav Raghav, Prateek K Jha, Soumitra Satapathi, "Effect of size and charge asymmetry on aggregation kinetics of oppositely charged nanoparticles", **Nature Scientific Reports, 9 (1), 3762, 2019.**
32. Manisha Chatterjee, Manisha Sharma, Kulveer Singh, Soumitra Satapathi, “Design of a multimodal colloidal polymeric drug delivery vesicle: a detailed pharmaceutical study”, 18, 100245, **Nano-Structures & Nano-Objects, 2019.**
31. Kulveer Singh, **Soumitra Satapathi**, Prateek K Jha, “Ant-Wall” model to study drug release from excipient matrix”, **Physica A: Statistical Mechanics and its Applications**, 519, 1, 98-108, **2018.**
30. Priya Srivastava, Anukul Prasad Parhi, R Ranjan, **Soumitra Satapathi**, Monojit Bag, “Temperature Assisted Nucleation and Growth to Optimize Perovskite Morphology at Liquid Interface: A Study by Electrochemical Impedance Spectroscopy”, **ACS Applied Energy Materials**, 1, 9, 4420–4425, **2018.**
29. Soumitra Satapathi, Vishal Kumar, Mrinmoy Kumar Chini, Rajesh Bera, Krishna Kanta Halder, Amitava Patra, “Highly sensitive detection and removal of mercury ion using a multimodal nanosensor”, **Nano-Structures & Nano-Objects**, 16, 120-126, **2018.**
28. Payal Taya, Binoy Maiti, V Kumar, Priyodarshi De, **Soumitra Satapathi**, “Design of a novel FRET based fluorescent chemosensor and their application for highly sensitive detection of nitroaromatics”, **Sensors and Actuators B: Chemical** , 255, 3, 2628-2634, **2018.**

27. Jill Wenderott, Anubhav Raghav, Max Shtein, Peter Green, **Soumitra Satapathi**, “Local optoelectronic characterization of solvent annealed lead-free bismuth-based perovskite films”, **Langmuir**, 34, 26, 7647-7654, **2018**.
26. Kulveer Singh, Prateek K. Jha, and **Soumitra Satapathi**, “Controllable Bulk Heterojunction Morphology by Self-Assembly of Oppositely Charged Nanoparticles”, **Journal of Physical Chemistry C**, 121, 16045–16050, **2017**.
25. Somesh Mohapatra, Rutusmita Mishra, Manisha Chatterjee, Partha Roy and **Soumitra Satapathi**, “Functionalized Nano-graphene Oxide as Multi-modal Clinic for Effective Drug Delivery”, **International Journal of Pharmaceutical Sciences and Nanotechnology**, 10, 4, 3768-3771, **2017**.
24. Anubhav Raghav, Shivam Singh, Shailendra Kumar Sharma, Kabra Dinesh, Monojit Bag, **Soumitra Satapathi**, “Controlling morphology of CH₃NH₃PbI₃ perovskite film by dual solvent elimination method”, **Nano-Structures & Nano-Objects**, 12, 106–112, **2017**.
23. Nipun Sawhney, **Soumitra Satapathi**, “Utilization of Naturally Occurring Dyes as Sensitizers in Dye Sensitized Solar Cells.”, **IEEE Photovoltaics**, 7, 2, 539-544, **2017**. [Featured in **Nature Asia**, **PTI**, **Quartz**, **BBC**, **Chemical Today**]
22. **Soumitra Satapathi**, Lian Li, Robinson Anandakathir, Lynne Samuleson , and Jayant Kumar, “Effect of side groups on two-photon-absorption of soluble polythiophenes”, **Spectroscopy Letters**, 50, 7, 375–380, **2017**.
21. Nivedita Choudhary, Nipun Sahwney, Anubhav Raghav, M. Sankar, **Soumitra Satapathi**, “Effect of functional groups on sensitization of dye-sensitized solar cells (DSSCs) using free base Porphyrins”, **Journal of Porphyrins and Phthalocyanines**, 21, 222, **2017**.
20. Shailendra Kumar Sharma, Shivali Sokhi, Chandrajit Balomajumder, **Soumitra Satapathi**, “Reusable graphene oxide nanofibers for enhanced photocatalytic activity: a detailed mechanistic study”, **Journal of Materials Science**, 52, 9, 5390–5403, **2017**.
19. Somesh Mohapatra, Rutusmita Mishra, Partha Roy, K.L.Yadav, **Soumitra Satapathi**, "Systematic Investigation and in vitro Biocompatibility Studies on Implantable Magnetic Nanocomposites for Hyperthermia Treatment of Osteoarthritic Knee Joint", **Journal of Materials Science (JMSC)**, 52, 9262–9268, **2017**.
18. Purnendu, **Soumitra Satapathi** “Graphene-Based 3D Xerogel as Adsorbent for Removal of Heavy Metal Ions from Industrial Wastewater”, **Journal of Renewable Materials**, 5, 2, 96-102, **2017**.
17. Somesh Mohapatra, Rutusmita Mishra, Manisha Chatterjee, Partha Roy and **Soumitra Satapathi**, “Functionalized Nano-graphene Oxide as Multi-modal Clinic for Effective Drug Delivery”, **International Journal of Pharmaceutical Sciences and Nanotechnology**, 10, 4, 3768-3771, **2017**.
16. **Soumitra Satapathi**, Jalpa Soni and Nirmalya Ghosh, “Fluorescent Muller matrix analysis of highly scattering turbid media”, **Applied Physics Letters**, 104, 131902, **2014**.
15. Preeti Yadav, **Soumitra Satapathi**, Meena Kumari, Akanksha Chaturvedi, Lian Li, Lynne A Samuelson, Jayant Kumar, Sunil K Sharma, “Synthesis of two-photon active cinnamoyl coumarins for high-contrast imaging of cancer cells and their photophysical characterization”, **Journal of Photochemistry and Photobiology A: Chemistry**, 280, 39-45, **2014**.
14. **Soumitra Satapathi**, Anoop K. Pal, Lian Li, Lynne A. Samuelson, Dhimiter Bello and Jayant Kumar, “Two-photon active polymeric nanoparticles for high contrast in vitro imaging”, , **RSC Advances**, 4, 1116, **2014**.

13. **Soumitra Satapathi**, Sriya Das, Lian Li, Lynne A Samuelson, Ravi Mosurkal, Micah Green and Jayant Kumar, "Performance enhancement of dye sensitized solar cells by incorporating graphene nanosheets of various sizes", **Applied Surface Science**, 314,638-641, **2014**.
12. **Soumitra Satapathi**, Mijanur Rahaman Molla, Santanu Bhattacharya, Suhrit Ghosh and Amitava Patra, "Photophysical Study of P3HT/NDI Based Hybrid Nanoparticles", **European Journal of Physics D**, 2014, 68:350, **2014**.
11. **Soumitra Satapathi**, Hardeep Singh Gill, Lian Li, Lynne Samukeson, Jayant Kumar, Ravi Mosurkal, "Synthesis of Nanoparticles of P3HT and PCBM for Optimizing Morphology in Polymeric Solar Cells", **Applied Surface Science**, 323, 3–18, **2014**.
10. **Soumitra Satapathi**, Amarnath Bheemaraju, Dhandapani Venkataraman and Jayant Kumar "Enhanced sensory response of quaterthiophene bearing 1,2,3-triazole moiety to explosives", **IEEE Sensors**, 14, 12, 4334 - 4339, **2014**.
9. **Soumitra Satapathi**, Akshay Kokil, B. Harihara Venkataraman, Lian Li, Dhandapani Venkataraman, Jayant Kumar, "Sensitive detection of nitroaromatics with colloidal conjugated polymer nanoparticles", **IEEE Sensor**, 13,2329, **2013**.
8. **Soumitra Satapathi**, Hardeep Singh Gill, Lian Li, Lynne Samuleson and Jayant Kumar, "Two-photon active Nile Red loaded fluorescent polystyrene nanoparticles", **Advanced Science Focus**, 1,3, **2013**.
7. **Soumitra Satapathi**, Lian Li, Abhishek Kumar, Haibin Huo, Robinson Anandakathir, Mengyan Shen, Lynne Samuelson, Jayant Kumar, "Strong two-photon-induced fluorescence from a highly soluble polythiophene", **Optics Communications**, 4, 3612, **2011**.
6. **Soumitra Satapathi**, Sethumadhavan Ravichandran, Ravi Mosurkal, Subhalakshmi Nagarajan, Lian Li, Ramaswamy Nagarajan, Lynne A. Samuelson, Jayant Kumar, "Biocatalytic Synthesis of Two-Photon Active Resveratrol Oligomer", **Journal of Macromolecular Science, Part A: Pure and Applied Chemistry**, 48(12), 1061-1066, **2011**.
5. Harihara Venkatraman, Akshay Kokil, **Soumitra Satapathi**, Jayant Kumar, Dhandapani Venkataraman "Conjugated Polymer:TiO₂ Nanocomposite Solar Cells Based on P3HT Nanoparticles," B., **MRS Proceedings**, **2011**, 1312, mrsf10-1312-ii09-06,.
4. **Soumitra Satapathi**, Lian Li, Robinson Anandakathir, Lynne A. Samuelson, Jayant Kumar, "Sensory Response and Two-Photon-Fluorescence Study of Regioregular Polythiophene Nanoparticles", **Journal of Macromolecular Science, Part A: Pure and Applied Chemistry**, 48(12), 1049-1054, **2011**.
3. **Soumitra Satapathi**, Anoop Pal, Amarnath Bheemaraju, Dhandapani Venkataraman and Jayant Kumar, "Oligothiophene nanoparticles for high contrast imaging of cancerous cells", **ACS Fall 2012 preprint**.
2. **Soumitra Satapathi**, Robinson Anandakathir, Jayant Kumar, "Synthesis and Characterization of a Thiophene Copolymer for Photovoltaic Application," **Journal of Macromolecular Science, Part A: Pure and Applied Chemistry**, 48(12), 1044-1048, **2011**.
1. **Soumitra Satapathi**, Fa-Dong Yan, Robinson Anandakathir, Ke Yang, Lian Li, Ravi Mosurkal, Lynne A Samuelson, Jayant Kumar, "Fabrication of Dye-sensitized Solar Cells and Fluorescence Quenching Study Using Thiophene Based Copolymers", **Journal of Macromolecular Science, Part A: Pure and Applied Chemistry**, 47(12), 1180-1183, **2010**.

Invited Talk (Significant talk):

28. Soumitra Satapathi, “Functional Materials”, **Invited Lecture, Indo-German Workshop, Delhi University, Delhi, 2019.**
27. Soumitra Satapathi, “Low Cost Technology for Arsenic Removal”, **Invited Lecture, Newton Bhabha International Workshop, Kolkata, 2018.**
26. Soumitra Satapathi, “Smart Materials for Energy Harvesting, Optical Sensing and Water Remediation”, **AK-Palberg Seminar Lecture, Max Planck Institute for Polymer Research, Mainz, Germany, 2018.**
25. Soumitra Satapathi, “Smart Materials: Capabilities and Applications”, **Invited Lecture, KU Leuven, Belgium, 2018.**
24. Soumitra Satapathi, “Organic Nanoparticles for Energy Harvesting, Sensing and Bioimaging: Magic at Nanoscale”, **Invited Talk, International Conference on Nanomaterials and their Applications, University of Mysore, 2018.**
23. Soumitra Satapathi, “Perovskite Revolution”, **Invited Lecture, Department of Physics Colloquium, University of Hyderabad, Hyderabad, 2017.**
22. Soumitra Satapathi, “Nanomaterials for Solar Cells”, **Center of Nanotechnology Excellence Lecture, Jawaharlal Nehru Technical University, Hyderabad, 2017.**
21. Soumitra Satapathi, “Photophysics, Sensing and Bioimaging Study in Polymeric Nanoparticles System”, **Invited Lecture, Newton Bhabha International Workshop, Kolkata, 2017.**
20. Soumitra Satapathi, “Photophysical, Sensing and Bioimaging Study in Polymeric Nanoparticle System”, **Invited Lecture, Center for Soft and Nano Research Institute, Bangalore, 2017.**
19. Soumitra Satapathi, “Smart Nanomaterials for Drug Delivery”, Nanobioteck, **AIIMS, New Delhi, 2016.**
18. Soumitra Satapathi, “Implantable Magnetic Nanocomposite for Hyperthermia Treatment of Osteoarthritic Knee Joint”, **ICBET, Singapore, 2016.**
17. Soumitra Satapathi, “Perovskite Solar Cells: Morphology Optimization”, **Invited Lecture, SERIUS, IIT Bombay, 2016.**
16. Soumitra Satapathi, “Organic Solar Cells: A Green Solution to a Grey Problem”, **QIP Talk, IIT Roorkee, 2015.**
15. Soumitra Satapathi, “Photophysical Study of P3HT/NDI Based Hybrid Nanoparticles International Symposium on Polymer Science and Technology”, **MACRO, Kolkata, 2015.**
14. Soumitra Satapathi, “Strong Two-Photon-Fluorescence from Semiconducting Polymer Nanoparticles for High Contrast Imaging of Cancerous Cells”, **American Physical Society Fall Meeting, Boston, USA, 2012.**

13. **Soumitra Satapathi**, “Oligothiophene Nanoparticles for High Contrast Imaging of Cancerous Cells”, American Chemical Society Fall Meeting Philadelphia, USA, 2012.
12. **Soumitra Satapathi**, “Enhancement of Efficiency in Dye Sensitized Solar Cells by Incorporation of Graphene”, **Materials Research Society Fall, Boston, USA, 2011.**
11. **Soumitra Satapathi**, “Enhancement of Efficiency in Dye Sensitized Solar Cells by Incorporation of Graphene”, **Sukant Tripathy Annual Symposium, Lowell, USA, 2011.**
10. **Soumitra Satapathi**, “Enhanced efficiency in dye sensitized solar cells using reduced graphene oxide-TiO₂ nanocomposites”, **American Physical Society Spring Meeting, UMASS Lowell, USA, 2011.**
9. **Soumitra Satapathi**, “Sensitive detection of nitro aromatic explosives using novel polythiophene nanoparticles”, **American Physical Society Fall meeting Texas, USA, 2011.**
8. **Soumitra Satapathi**, “Two-photon-induced Fluorescence Study from Soluble Polythiophenes”, **Material Research Society Fall Meeting, USA, 2010.**
7. **Soumitra Satapathi**, “Thiophene based polymer for organic solar cells, International Conference and Exhibition on Device Packaging”, **Massachusetts, USA, 2016.**
6. **Soumitra Satapathi**, “Detection of Nitro Aromatic Explosives using Pegylated Polythiophene Copolymer”, **Sukant Tripathy Annual Symposium, Lowell, USA, 2010.**
5. **Soumitra Satapathi**, “Detection of Nitro Aromatic Explosives Using Novel Polythiophene Nanoparticles”, **Sukant Tripathy Annual Symposium, Lowell, USA, 2010.**
4. **Soumitra Satapathi**, “Detection of Nitro-Containing Explosive Materials with Silicon Nanostructures: an Application of Surface Enhanced Raman Scattering”, **American Physical Society New England Meeting, University of Massachusetts Amherst, USA, 2011.**
3. **Soumitra Satapathi**, “Enhanced Efficiency in Dye Sensitized Solar Cells by Incorporation of Graphene”, **Invited Talk, Canadian American Mexican Meeting, Washington D.C. ,USA, 2011.**
2. **Soumitra Satapathi**, “Biocatalytic Synthesis of Two-Photon Active Resveratrol Oligomer”, **Sukant Tripathy Annual Symposium, Lowell, USA, 2009.**
1. **Soumitra Satapathi**, “Sensory Response and Two-Photon-Fluorescence Study of Regioregular Polythiophene Nanoparticles”, **Sukant Tripathy Annual Symposium, Lowell, USA, 2010.**

Patent:

1. Provisional patent filed “DEVICE AND METHOD FOR REAL TIME THICKNESS CONTROLLED SPIN COATING”, Application#: 201611039173 and Date of Filing: November 17, 2016.
2. Patent filed “Peristaltic Pump with Automated Gear Assembly Fabrication and its Method”, Application #: 201811031020, Date of Filing: 20.08.2018

Technology Transfer:

Founder and Director: LabX Scientific Pvt Ltd (www.labx.co.in)

Objective: LabX is a startup founded by Prof Soumitra Satapathi and a highly skilled team of Physics and Engineering students from IIT Roorkee with an expertise in electronics, instrumentation, design and 3D Printing. We have developed smart Spin Coater in the TIDES Business Incubation Center, IIT Roorkee. We have an aim to achieve a totally personalized fabrication of devices and bring about an IOT revolution in the field of Laboratory Instrumentation.

Impact of Research by Dr. Soumitra Satapathi

Dr. Soumitra Satapathi is actively involved in Materials Science and Water Remediation Research in IIT Roorkee where his main focus is water remediation, low cost solar cells based water treatment, Optical Sensing and Drug Delivery. Recently, he and his research group have developed a new class of solar cells called Dye Sensitized Solar Cells (DSSCs) using naturally occurring polyphenolic dye anthocyanine from Indian summer fruit Jamun. As Jamun is easily available in a large amount during summer, therefore the dye extraction and purification process is also cost effective using this source of anthocyanine. These dye sensitized, low cost solar cells would be very useful in addressing next generation energy challenges. *This research was featured in all leading national and international print and electronic media including Nature Asia, PTI, BBC, Quartz, USA Today, Times of India to name a few. The National Renewable Energy Laboratory (NREL), USA, the apex body of energy research in the world has proposed to call the natural dye based solar cells as “Satapathi Cells” from 2018. His research on Jamun Solar Cells was also identified as “top ten technological breakthrough” under 40 for 2017 by times group.* Tata power is developing the Jamun based solar cells module along with Satapathi’s research group.

Apart from DSSCs, Dr. Satapathi is closely involved in research in other organic electronics devices like perovskite solar cells, organic solar cells, nanoparticles based solar cells development etc. In water remediation, he is developing ultra-low cost sensor for domestic and industrial effluents removal. In sensor work, he is developing a field based sensor for rapid detection of explosives. In support of his research excellence in next generation solar cells, *he received the prestigious Bhaskara Advanced Solar Energy (BASE) Award, 2016 from Govt. of India and Indo-US Science & Technology Forum.* As a part of this award, he was invited to Materials Science Dept, University of Michigan, Ann Arbor in summer, 2016 and developed kirigami based flexible solar tracking system integrated on perovskite solar cells. His work on nanoparticles based solar cells was recognized by DST and DAAD, Germany as *he received prestigious DST DAAD PPP fellowship, 2016 to jointly work with University of Bayeruth, Germany on nanoparticles based solar cells. He has been nominated for prestigious Max Planck Institute Director Award for young scientist, 2017 from India. Dr. Satapathi has received more than 1.50 crore extramural grant in support of his research program and published many high impact journals papers and also filed patents from IITR.* He has delivered more than 20 invited lectures after joining IIT Roorkee. *In accreditation of his research contribution to the energy field, Govt. of India has selected him as young scientist delegate to represent the energy policy and research ecology in Hangzhou, China in BRICS meeting, 2017.*

Based on his translation research output, he has founded a start-up “Lab X”, pre-incubated by TIDES, IITR. Apart from mentoring undergraduates and graduate students, he is also actively involved in popularizing science in various forums.

Media Link of Research:

English News Coverage:

1. <http://www.natureasia.com/en/nindia/article/10.1038/nindia.2017.47>
2. http://www.ptinews.com/news/8645027_Jamun-used-to-make-low-cost-solar-cells.html
3. <http://www.deccanchronicle.com/technology/in-other-news/300417/iit-scientists-create-low-cost-solar-cells-using-jamun.html>
4. <http://www.thehindu.com/sci-tech/science/iit-scientists-create-low-cost-solar-cells-using-jamun/article18333363.ece?homepage=true>
5. <http://www.dnaindia.com/scitech/report-iit-scientists-create-low-cost-solar-cells-using-jamun-2422964>
6. <http://indianexpress.com/article/technology/science/iit-scientists-create-low-cost-solar-cells-using-jamun-4634601/>
7. <http://indiatoday.intoday.in/story/iit-scientists-create-low-cost-solar-cells-using-jamun/1/942005.html>
8. <https://qz.com/969989/iit-an-indian-berry-contains-a-crucial-ingredient-for-creating-cheap-solar-cells/>
9. <http://www.livemint.com/Science/ymfe3m9bx7FMzeGSJhFYMK/Jamuns-can-be-used-to-make-lowcost-solar-cells-say-IIT-Roo.html>
10. <http://www.news18.com/news/tech/iit-scientists-create-low-cost-solar-cells-using-jamun-1384249.html>
11. <https://www.nationalheraldindia.com/news/2017/04/26/eat-drink-and-make-solar-cells-from-jamun-iit-roorkee-inexpensive-photosensitiser>
12. <http://www.tribuneindia.com/mobi/news/science-technology/jamun-used-to-make-low-cost-solar-cells/397981.html>
13. <http://www.thebetterindia.com/98164/jamun-iit-roorkee-solar-energy/>
14. <https://www.topnewstoday.in/news/112187/iit-scientists-create-low-cost-solar-cells-using-jamun>
15. http://wap.business-standard.com/article/pti-stories/jamun-used-to-make-low-cost-solar-cells-117042600376_1.html
16. <https://www.brainbuxa.com/education-news/iit-scientist-are-using-jamuns-to-create-solar-cells-in-india-6350>
17. <http://www.techsourceint.com/scientists-create-low-cost-solar-cells-using-indian-fruit-jamun/>
18. <http://currentaffairs.gktoday.in/scientists-iit-create-cost-solar-cells-jamun-05201744265.html>
19. <http://www.techsourceint.com/scientists-create-low-cost-solar-cells-using-indian-fruit-jamun/>

20. <http://www.jagranjosh.com/current-affairs/iit-researchers-used-jamun-to-create-inexpensive-solar-cells-1493706525-1>
21. <https://www.crazyengineers.com/news/iit-roorkee-engineers-are-working-on-developing-solar-cells-using-jamun.95839/>
22. <https://energyinfrapost.com/iit-scientists-create-low-cost-solar-cells-using-jamun/>
23. <http://www.ummid.com/news/2017/April/30.04.2017/iit-roorkee-scientists-create-low-cost-solar-cell.html>
24. <http://www.newsnation.in/science-news/scientists-at-iit-roorkee-use-jamun-to-create-low-cost-solar-cells-article-169984.html>
25. <http://www.ecowatch.com/india-berry-solar-cell-2389135918.html>
26. <http://www.iasabhiyan.com/iit-scientists-create-low-cost-solar-cells-using-jamun/>
27. <http://www.competitive-exam.in/post/scientists-at-iit-create-low-cost-solar-cells-using-jamun>
28. <https://www.inshorts.com/news/jamuns-can-be-used-to-make-lowcost-solar-cells-iitr-study-1493280251055>
29. <https://www.sufiyandroiddevelopers.com/iit-scientists-create-low-cost-solar-cells-using-jamun-fruit/>
30. <http://www.kodson.com/finance/2017/04/30/iit-scientists-create-low-cost-solar-cells-using-jamun/>
31. <http://www.examlover.com/currentaffairs/IIT-scientists-create-low-cost-solar-cells-using-jamun>
32. <https://steelguru.com/power/iit-scientists-create-low-cost-more-efficient-solar-cells-using-jamun/479663>
33. <http://hungarytoday.hu/~newsinfo/latest/iit-scientists-create-lowcost-solar-cells-using-jamun>
34. <http://giveandgain.shop/news/iit-scientists-create-low-cost-solar-cells-using-jamuns/>
35. <http://www.indiaeveryday.com/news-iit-scientists-create-low-cost-solar-cells-using-jamun-1005-3473792.htm>
36. <http://renewablesnaps.com/are-iit-scientists-really-using-jamuns-to-create-solar-cells-in-india/>
37. https://article.wn.com/view/2017/04/26/Jamun_used_to_make_lowcost_solar_cells/
38. <http://menafn.com/1095425830/IIT-Roorkee-scientists-use-Jamuns-to-make-solar-cells>
39. http://energy.einnews.com/article_detail/378606976-iit-scientists-create-low-cost-solar-cells-using-jamun?vcode=XIbw
40. <https://www.optimistdaily.com/2017/05/creating-cheap-solar-cells-with-an-ingredient-from-a-delicious-indian-berry/>

41. <http://www.scienceworldreport.com/articles/59099/20170503/component-indian-berry-absorbs-much-sunlight-lead-production-solar-panels.htm>
42. <http://mytimesnow.com/news/94294/iit-scientists-create-low-cost-solar-cells-using-jamun>
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