

# Additive Manufacturing in Pharmaceuticals (AMP)

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## Abstract

Research in the field of drug delivery always strives to meet new challenges and hard-to-reach therapeutic objectives, for instance through the improvement of dissolution profiles, enhanced patient compliance, and possible adaption to the needs of a specific subject. Such a scenario laid the basis for scientists to start investigating the application potential of new fabrication techniques. In this respect, AMP was started at the Department of Pharmaceutics, NIPER Guwahati, under the National Centre of Pharmacoengineering (State-of-the-art-facility) funded by the Drugs Pharmaceuticals Research Programme (DPRP), DST, Govt. of India in the year of 2019. Since its establishment, LAMP has been actively engaged in the research programs associated with 3D/4D mediated fabrication and coming up with novel and customized second-generation translational pharmaceutical and bio-medical systems for effective drug delivery. In this regard, we explored the various kind of 3D/4D printed drug delivery systems for the effective delivery of therapeutic agents by the way of example, we prepared mini printlets, bi-layered tablets, mouth dissolving wafers for the effective delivery of BCS class II drugs, and nanoparticles for effective delivery of medicaments using hot-melt extrusion followed by the fused deposition modeling 3D printing technique. In addition, we explored a stereolithography 3D printing platform for the formulation of hollow capsular devices, ghost tablets, polymeric film, and hollow microneedles for the effective delivery of high molecular drugs. In addition, our team explored a one-step selective laser sintering 3D printing for the formulation of sintered tablets. Beyond the 3D printing technology, our team focused on the synthesis of new polymeric materials for 3D printing and 4D printing technology in drug delivery systems. Further, the LAMP research area is not only limited to the formulation of novel drug delivery systems but also LAMP is dedicatedly working in the field of analytical research. For example, the LAMP team fabricated 3D-printed sorbents for the effective extraction of small molecules and NSAIDs from the rat plasma, and the effectiveness of the sorbents was validated using LC-MS/MS.



**Biography:** Dr. Subham Banerjee currently working as an Associate Professor in the Department of Pharmaceutics, National Institute of Pharmaceutical Education and Research (NIPER)-Guwahati, Assam. He is also a visiting staff faculty of the University of Texas (UT) at Austin, USA. Dr. Banerjee's research area focuses on Pharmacoengineering including Pharmaceutical Additive Manufacturing (AM)/3D & 4D Printing, and Cutting-edge Translational Pharmaceutical Research.

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## Notes/Comments

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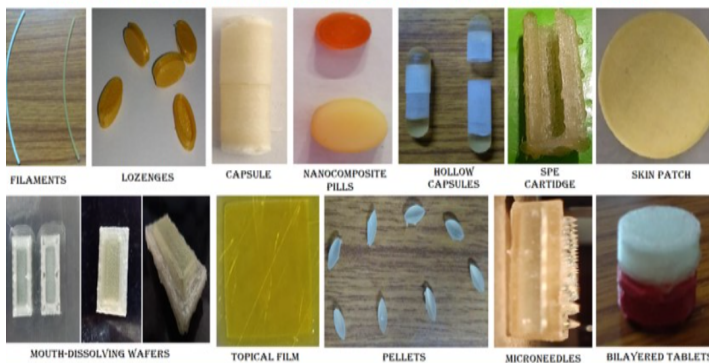
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## NEXT GENERATION PERSONALIZED 3D FORMULATIONS



**Figure1:** Various drug delivery device prototypes fabricated using 3D printing technology at NIPER Guwahati.

## Recent Publications

1. Suryavanshi P, Wang J, Duggal I, Maniruzzaman M, Banerjee S. Four-Dimensional Printed Construct from Temperature-Responsive Self-Folding Feedstock for Pharmaceutical Applications with Machine Learning Modeling. *Pharmaceutics*. 2023 Apr 18;15(4):1266.
2. Ukti Bhatt, Sachin Jorvekar, USN Murty, Roshan Borkar, Subham Banerjee\*. Extrusion 3D Printing of Minicapslets for Estimating in vitro & in vivo Praziquantel Delivery Capability. Part of special issue: SI: Latest Trends in Pharmaceutical Printing, *International Journal of Pharmaceutics*. 630, 122445. 2023.
3. Dinesh Choudhury, Peeyush Kumar Sharma, USN Murty, Subham Banerjee\*. Stereolithography assisted fabrication of 3D printed polymeric film for topical berberine delivery: in vitro, ex-vivo & in vivo investigations. *VSI: 3D Printing in Pharmacological & Pharmaceutical Sciences, Journal of Pharmacy and Pharmacology*. 74(10), 1477-1488, 2022.
4. Srushti Lekurwale, Tukaram Karanwad, Subham Banerjee\*. Selective Laser Sintering (SLS) of 3D Printlets using a 3D Printer comprised of IR/red-diode Laser. *Annals of 3D Printed Medicine*. 6, 100054, 2022.
5. Tushar K Malakar, Vishal S Chaudhari, Santosha K Dwivedy, USN Murty, Subham Banerjee\*. 3D printed housing devices for segregated compartmental delivery of oral fixed-dose anti-tubercular drugs adopting print & fill strategy. *3D Printing & Additive Manufacturing*. 9(6), 535-546, 2022.





