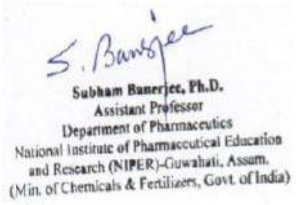
Summary of work

With respect to the recent report from Indian Council for Medical Research (ICMR) for oral cancer burden in India, the North-East Region (NER) of India showed more prevalence of oral cancer. The major reason behind this is habits adapted by locals like chewing tobacco, betel quid and areca nuts. Along with this, NER is having tremendous biodiversity among medicinal plants and their therapeutic potential. But the poor solubility and permeability leading to low bioavailability of these herbal medicines halt their development and reduces utility. Advancement in nanotechnology can be the best tool for delivery of these phytoconstituents to treat life threatening diseases. In order to get societal benefits from the project, development of translational form of drug delivery is important. Hence the project was designed as "***Active Plant Constituents Enriched Nanostructured Lipid Carriers Embedded into 3D Printed Wafer for Oral Cancer Mitigation in North-eastern Region of India***". In this regard, we have selected two drugs from herbal origin in combination includes quercetin and piperine, with previously well proven anti-cancer activity. Nanostructured lipid carriers (NLCs) formulation was developed to enhance the bioavailability of both drugs and can be used as novel drug delivery system against oral cancer. Further evaluation of prepared NLCs has been performed using various sophisticated advanced analytical techniques like DLS, SEM, DSC, TEM, AFM and so far. Along with this, in-vitro cellular evaluation has been done in cancer cell lines (FaDu Cells). Results have been found to be promising w.r.t. formulation development and its characterization. Pharmacokinetic profile along with bio-distribution in various tissues for developed NLCs has been conducted in rats followed by estimation through LCMS/MS system. 3D printed moth dissolving wafers have been developed to deliver NLCs in buccal cavity to deliver against oral cancer. The release of NLCs from wafer has been estimated for particle release application artificial saliva through derived KCPS from dynamic light scattering technique. There are various outcomes we achieved from this project are as follows:

1. **Chaudhari VS**, Borkar RM, Murty USN, Banerjee S. Analytical method development and validation of reverse-phase high-performance liquid chromatography (RP-HPLC) method for simultaneous quantification of quercetin and piperine in dual-drug loaded nanostructured lipid carriers. *Journal of Pharmaceutical and Biomedical Analysis* 2020:186–113325. https://doi.org/10.1016/j.jpba.2020.113325 (Impact Factor **3.935**)
2. **Chaudhari VS**, Murty USN, Banerjee S. Nanostructured lipid carriers as a strategy for encapsulation of active plant constituents: Formulation and in vitro physicochemical characterisations. *Chemistry and Physics of Lipids* 2021: 235, 105037. https://doi.org/10.1016/j.chemphyslip.2020.105037 (Impact Factor **3.329**)

3. **Chaudhari VS,** Murty USN, Banerjee S. Fused deposition modelling (FDM)-mediated 3D printed mouth-dissolving wafers loaded with nanostructured lipid carriers (NLCs) for in vitro release. *Journal of Material Research*. 2021:1-10. https://doi.org/10.1557/s43578-021-00288-1. (Impact Factor **3.089**)
4. **Chaudhari VS**, Gavali B, Saha P, Murty USN, Naidu VGM, Banerjee S. Quercetin and piperine enriched nanostructured lipid carriers (NLCs) to improve apoptosis in oral squamous cell carcinoma (FaDu cells) with improved bio-distribution profile. *European Journal of Pharmacology*. 2021: 909, 174400. https://doi.org/10.1016/j.ejphar.2021.174400 (Impact Factor **4.432**
5. **Chaudhari VS**, Murty USN, Banerjee S. Lipidic nanomaterials to deliver natural compounds against cancer: a review. *Environmental Chemistry Letters*. 18(6), 1803-1812. 2020. https://doi.org/10.1007/s10311-020-01042-5 (Impact Factor: **9.027**)
6. **Chaudhari VS**, Hazam PK, Banerjee S. "Lipid nanoarchitectonics for natural product delivery in cancer therapy." SPRINGER-NATURE book titled Pharmaceutical Technology for Natural Products Delivery, Sustainable Agriculture Reviews, Vol-44, Chapter-5, 2020, 169-203. 2020. [ISBN: 9783030418410]
7. **Vishal Sharad Chaudhari**, Tushar Kanti Malakar, USN Murty, and Subham Banerjee "3D Printed Mouth Dissolving Wafers" Application No. 342624-001. Cbr No. 202856, **FER replied**: 02 July, 2021 date of filing: 22 April 2021.



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