

**Sector:** Pharmaceuticals  
**Subsector:** drug delivery

## Natural, non-toxic, fluorescent emitting nanoparticle for drug delivery

### Information Summary

Reference code	08057
Technology Overview:	Drug delivery system
Application:	Encapsulation and parenteral delivery of drugs
Validation	In vitro
Lead Investigator:	Dr. Satya Prakash et al.
Contact:	Laurent Masaro, Ph.D., MBA (1) 514-398-8667 <a href="mailto:laurent.masaro@mcgill.ca">laurent.masaro@mcgill.ca</a>

### Background Information

This invention relates to a drug delivery system consisting of Human Serum Albumin (HSA) crosslinked with genipin (HAS-genipin).

Genipin is a natural compound, extracted from gardenia fruits. Genipin is also known as a crosslinking agent less toxic than conventional widely used crosslinkers such as glutaraldehyde for example.

### Performance

Particles have shown to be of spherical shape and are highly monodispersed (less than 200 nm) independently of the crosslinking ratio.

In vitro experiments demonstrated that HSA-genipin particles are less toxic than HSA-glutaraldehyde particles. It was also demonstrated that HSA-genipin particles are more stable, showing less ruptures which can be explained by less enzymatic degradation. Finally, it was also demonstrated that Noscapine loaded nanoparticles were shown to be less toxic than free drug suggesting such delivery system could be used to release drugs over a long period to avoid high drug dosage injection inducing numerous side effects.

Genipin is known to react with amino acids to make blue pigments. This characteristic could be used to use our nanoparticles as markers or labels for real time imaging.

### Advantage

- Natural, non-toxic, biodegradable drug delivery system;
- Forming stable, spherical and monodispersed particles with diameter less than 200 nm;
- Extended release profile (less than 10% dissolution after 4 days based on *in vitro* experiments);
- Fluorescent delivery system allowing for real-time imaging;

### Medical/Market Need and Opportunity

The U.S. drug delivery market was estimated to reach nearly \$91 billion in 2009. This market is mainly driven by two forces. First, pharmaceutical companies are devoting considerable efforts to extend the patent lives of successful products. In fact, drug delivery systems will help drug companies respond to nearly \$80 billion in lost value for drugs with expiring patents during the next few years. The second driver is the delivery of biologicals drugs (DNA, siRNA, etc.) which represents an emerging opportunity for drug delivery technologies because by their very nature these products are difficult to administer.



**Dr. Satya Prakash**

BSc (H), M. Sc. M.Tech. Ph.D.

**Associate Professor**, Department of Biomedical Engineering,  
Member, Artificial Cells and Organs Research Center  
Associate Member, Department of Physiology

**Research Description**

The primary research interest of Dr. Prakash's laboratory is in several innovative areas of artificial cells, microencapsulation, cell therapy, tissue engineering, nanomedicine, regenerative medicine, biomaterials, drug delivery, probiotics, cell therapy, medical device engineering, and other biomedical technology developments. Research is focused on the development of new medical treatment strategies including novel cell and drug- based therapies. Specifically his research team is developing novel microcapsule formulations for targeted deliveries, artificial cell oral kidney substitutes for renal failure, designing oral therapy microcapsule formulations to lower cholesterol in coronary heart disease, colon cancer, diabetes, non-alcoholic fatty liver disease and developing polymeric membrane carbon nanotube devices for targeted delivery of drug and other therapeutic molecules .

Dr Prakash has published 60 refereed journal papers, 29 patents (pending/ publish), 15 book chapters, 9 proceedings, 84 research abstracts and edited 3 books that have been well recognized by peers. And his research has been supported by multiple research grants (CIHR, NSERC, DFC, MEDI, FRSQ, FQRNT, MEQ, CFI, Liver Foundations, CBCRA and others). Currently, he is principle investigator (PI) on 7 grants from national agencies (4 CIHR, 1 MEDI SIIRI, 1 NSERC discovery, 7 research contracts) and co-PI in 3 grants (1 NSERC strategic, 1 FRSQ, and 1 MEQ). His current research team includes 7 PhDs, 5 M Eng, 2 Research Assistants, 2 visiting and 2 summer students.

Dr. Prakash serves as the Regional Editor (Americas) for the *International Journal of Probiotics and Prebiotics* (2007-cont) and Assistant Editor for the journal *Artificial Cells, Blood Substitute and Biotechnology* (2001-cont) and serve on various international journal editorial boards, including the journals *Recent Patents on Drug Delivery and Formulation* (2007-cont), *Open Biomedical Engineering Journal* (2007-cont), *Hematology and Pancreatic Diseases International* (2006-cont), and the journal *Biologics: Targets & Therapy* UK (2007-cont).

The significance of Dr. Prakash research is reflected in its impact on health and wellness. As founder of Micropharma (McGill spin-off company, 2003), and its current Director, VP and Chief Scientific Officer, he contributes directly to translational research and to the biomedical and biopharmaceutical industry. Currently, this company is focusing on a novel cholesterol lowering strategy that was developed in his laboratory, with microencapsulation and probiotic approach.