



NANOGOLD-LOADED SHARP- EDGED CARBON BULLETS AS GENE CARRIERS

NCL Innovations: Solutions from CSIR India

Technology

- With increasing research being directed towards genetic manipulation, the requirement for the ideal gene delivery vehicle is becoming vital
 - ▣ Need to overcome current limitations of viral (toxicity, limited cargo capacity, quality control etc.)/other non-viral vectors (used mostly in animal cells)
 - ▣ Most of the carriers are administered to animal cells- very few options for plant cells
 - ▣ The process for preparation of the carriers needs to be simple, easy to implement

- The process for the preparation of carbon embedded nano gold particles with sharp edges has been described here which can be used as gene carriers
 - ▣ Adequate capacity to carry genetic material
 - ▣ Sharpness to penetrate hard material, with less damage (a comparatively lower force of 0.1-0.2 nN required for penetration)
 - ▣ Intracellular gold particles (biogenic) synthesized by a fungus in situ, embedded on a carbonaceous matrix

- Can be delivered with a convenient delivery gun

Applications

- Gene therapy
- Improved gene delivery for research and other applications
- Potential applications
 - DNA based immunization
 - To study gene function and its regulation
 - To establish various disease models
- Metal ion removal
- Fuel cells
- Anti bacterial applications
- Catalysis

Market Potential

- The total market for nanobiotechnology products is forecasted to reach a market size of about \$30 billion in 2015¹
- Nanomedicines market is projected to rise to almost \$60 billion in 2014²
 - ▣ Medical applications also include drug delivery and microbicides
- Gene therapy is a major field for gene delivery applications
 - ▣ A lot of R&D is being conducted in this area to achieve the most desirable characteristics of a gene carrier
 - ▣ The market for gene therapy is expected to face a growth to \$5.7 billion in 2011³

¹<http://www.bccresearch.com/report/nanobiotechnology-market-nan050a.html> (viewed- 10/06/11)

²<http://www.marketresearch.com/product/display.asp?productid=2745365> (viewed- 10/06/11)

³<http://www.outsourcing-pharma.com/Preclinical-Research/Gene-therapy-market-suffers-growth-setbacks>
(viewed- 10/06/11)

Value

- Preparation process is very simple and easy to implement
- The carbon matrix forms 95% of the carrier reducing the amount of gold needed and the plasmid used per transformation
- Advantages of usage of gold particles
 - High DNA packing density
 - Better transformation efficiency
 - Low nuclease degradation
 - Being in nano scale, higher surface area is obtained- more gene cargo handled
- Carbon support
 - Inert and less damage causing- wound caused due to penetration healed faster
 - Better piercing capacity, for example, can effectively pierce hard plant cell walls
 - Less force required to penetrate the plasma membrane as compared to silver nano needles

Technology Status, IP Status

- Patent application filed
- Demonstrated at lab scale
- Ready to be licensed/commercialized

Links & References

- Prasad, B.L.V. et al. (2010) Nanogold-Loaded Sharp-Edged Carbon Bullets as Plant-Gene Carriers, *Advanced Functional Materials*, 20, 2416-2423
- Torney, F. et al. (2007) Mesoporous silica nanoparticles deliver DNA and chemicals into plants, *nature nanotechnology*, 2, 295-300
- Nie, L. et al. (2006) Three-Dimensional Functionalized Tetrapodlike ZnO Nanostructures for Plasmid DNA Delivery, *small*, 2 (5), 621-625
- [PCT application](#) filed

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Summary

Technology Summary	
Technology title	Nanogold-Loaded Sharp-Edged Carbon Bullets as Gene Carriers
Industry /sector	Biotechnology; Bio-pharma
Year of development	2010
Related patents (with links)	Patent application filed
Technology readiness level	Demonstrated at lab level
Licensing status	Ready to be licensed/commercialized
Encumbrances	None
Availability	Yes