TECHNOLOGY

# Fluorescent Porous Silica Nanoparticles for Drug Delivery, Diagnostic and Imaging Applications

## OVERVIEW

Background

The majority of chemotherapeutic drugs are highly effective in eradicating cancer cells, however they act systemically and kill all cells with minimal selectivity based on cell type, resulting in high toxicity and serious side effects. Therefore, in traditional chemotherapy, the strength of cancer drugs that can be used is limited by adverse effects to healthy tissues. One of the potential solutions to this problem is to employ targeted delivery coupled with stimuli-specific cellular response to ensure high selectivity against the cancer cell. If successfully applied, this approach would allow one to use chemotherapy agents with high toxicity while still avoiding side effects, since the drug would never be delivered to normal tissue. Additionally, this delivery approach may also be used to deliver imaging agents for diagnostic purposes.

Innovative Technology

Researchers at the University of Maryland have developed a portfolio of novel methods for the synthesis of mesoporous silica nano-shells (MSN) and fluorescent MSN (FSN) that are well-suited for both drug delivery and diagnostic applications. MSN shells can be filled with chemotherapy agent then coated to prevent release until the appropriate stimulus (i.e. pH, temperature) is provided. MSN are ideally suited for this application because they have low in vitro cytotoxicity, robust chemical functionalization possibilities, easily manipulated morphological characteristics, simple target material loading, and physiologically relevant (pH and temperature) release profiles. Cytotoxicity studies have shown MSN to be relatively non-cytotoxic in healthy human endothelial cells, as well as human breast cancer cells. In addition, functionalization of MSN with physiologically relevant bioconjugates (DNA, peptides, and oligosaccharides) is readily achieved and allows for specific cellular targeting, indicating the potential for MSN in targeted drug delivery. The particles are also ideal candidates for diagnostic applications since they can be filled with virtually any fluorescent dye or dye mixture.

## APPLICATIONS

1. Cancer diagnostics
2. Targeted drug delivery of chemotherapeutic agents
3. Tumor Imaging
4. Sensors

## ADVANTAGES

1. Easy to prepare and customize. Size and shape of particles easily manipulated.
2. Biocompatible and non-toxic in in vitro and in vivo environments compared to quantum dots.
3. Robust and differential functionalization of bioconjugates possible
4. Brightness of FSN particles exceeds that of quantum dots (by 5x)
5. Fluorescent dyes does not leach from the particles under physiological conditions

6. MSN drug delivery system targets abnormal cells with more specificity than existing techniques

### CONTACT INFO

UM Ventures
0134 Lee Building
7809 Regents Drive
College Park, MD 20742
Email: umdtechtransfer@umd.edu
Phone: (301) 405-3947 | Fax: (301) 314-9502

## Additional Information

### INSTITUTION

University of Maryland, College Park

### PATENT STATUS

Patent(s) pending

### LICENSE STATUS

Contact OTC for licensing information

### CATEGORIES

- Nanotechnology + Nanoparticles + Nanomaterials
- Imaging devices
- Drug delivery devices

### EXTERNAL RESOURCES

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