

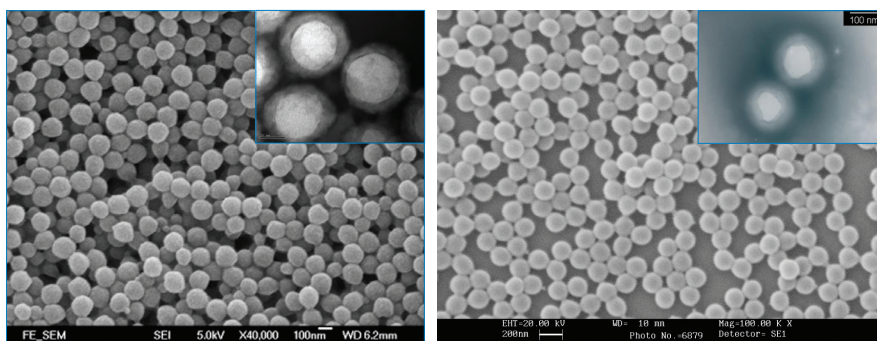
# 全新納米材料用於高效和環保污水淨化

## Smart Core-Shell Nanosorbents for Wastewater Treatment

使用全新可多次循環使用的球狀納米粒子材料，能極有效地除去溶在各類污水中的有機和無機污染物  
Novel polymeric nanoparticles able to smartly remove recalcitrant compounds from highly contaminated wastewater.

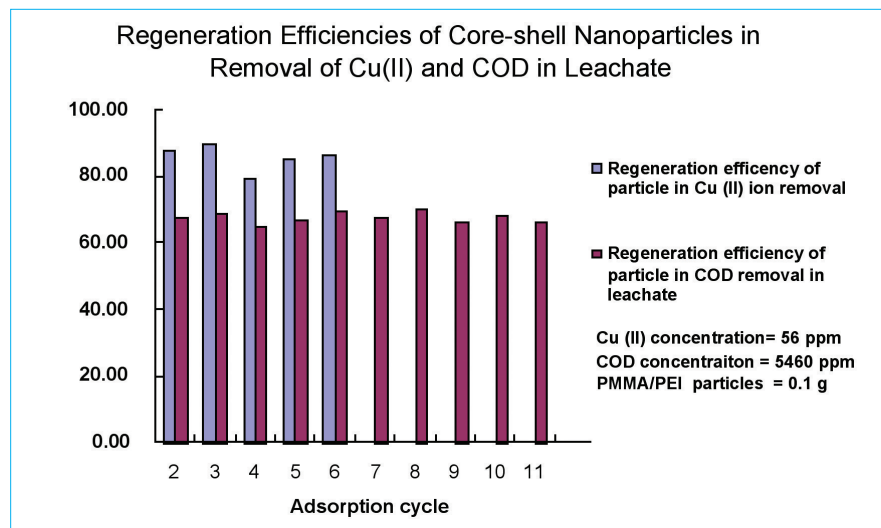
專利編號及國家：US 7,323,110B1

香港理工大學應用生物及化學科技學系的其中一個研究小組成功開發出一類新型球狀及多層的聚合物納米粒子，並且成功地應用於各類污水處理。這些全新的納米粒子是由油溶性的聚合物作為核和水溶性的功能材料作為殼已組成的。它可以極有效地吸收溶在各類污水中的有機和無機污染物。此外，這種全新納米材料能通過薄膜過濾技術，從水中分離，通過簡易脫污和活化處理後多次循環使用，既經濟又環保。除此之外，這些納米粒子可以殺死水中的有害細菌和病毒。



PMMA/PEI core-shell nanoparticles

PMMA/chitosan core-shell nanoparticles



A research team at the Department of Applied Biology and Chemical Technology of The Hong Kong Polytechnic University has developed innovative polymer particles which have well-defined hydrophobic cores and functional hydrophilic shells with particle sizes in nano- to submicro-scale. The core-shell particles can effectively adsorb most of recalcitrant organic and inorganic contaminants frequently found in landfill leachate and industrial wastewater. The saturated nanoparticles containing the adsorbed contaminants can be separated by using ultrafiltration systems, and then easily regenerated for multiple uses without affecting their adsorption capacity/removal performance for the targeted compounds.

### Principal Investigator

Prof. Pauline Pei LI

Department of Applied Biology and Chemical Technology

### Contact Details

Institute for Entrepreneurship

Tel: (852) 3400 2929 Fax: (852) 2333 2410 Email: pdadmin@polyu.edu.hk

### 特色與優點

- 納米粒子有大量的活化表面，大量提高吸污能力
- 粒子表層有高活性的化學基團，能有效地吸走污染物
- 使用簡易和快速吸收污物
- 易在水中分散及流動
- 可多次循環再用，減少廢物處理的成本
- 納米粒子能提供抗菌功能

### 應用

- 環境納米技術應用於水淨化，包括：
  - 堆填區滲透液污水處理
  - 工業污水處理(電鍍，漂染等)
  - 污水中回收貴重金屬
- 緊急處理油或有毒化合物的洩漏

### 獎項

- 第三十五屆瑞士日內瓦國際發明及創新技術與產品展金獎 (2007年4月)
- 國際評審及伊朗伊斯蘭自由大學頒發最優秀發明大獎 (2007年4月)

### Adsorption capacity of COD and NH<sub>3</sub>-N for Leachate Treatment

	COD Removal (per gram of adsorbent)	NH <sub>3</sub> -N Removal (per gram of adsorbent)
PMMA/PEI nanoparticles	3.12 g	391 mg
PMMA/Chitosan nanoparticles	2.03 g	938 mg
As-received GAC	1.14 g	321mg

PEI = Branched poly(ethyleneimine); PMMA = Poly(methyl methacrylate); GAC = Granular activated carbon; COD = Chemical oxygen demand; NH<sub>3</sub>-N = ammoniacal nitrogen

Patent No: US 7,323,110B1

### Special Features and Advantages

Compared to other low-cost adsorbents, these core-shell nanoparticles have many benefits:

- Large surface area for efficient adsorption
- High reactivity to refractory pollutants such as NH<sub>3</sub>-N
- Short treatment time and ease of operation
- Easy dispersability and rapid diffusion in water
- Regenerability for multiple uses
- Reduction of waste disposal costs which is economically attractive
- Anti-virus and anti-bacterial properties

### Applications

- Environmental nanotechnology for water pollution control such as
  - Landfill leachate treatment
  - Industrial wastewater treatment
  - Adsorption of heavy-metal ions and their recovery
- Rapid remediation of oil and toxic chemical spills for emergency uses

### Awards

- Gold Medal, 35th International Exhibition of Inventions New Techniques & Products, Geneva (April 2007)
- Best Invention from International Jury and Islamic Azad University, Islamic Republic of Iran (April 2007)



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