Task 3: Explore nanotechnologies for dairy wastewater treatment

TCD Project Team:

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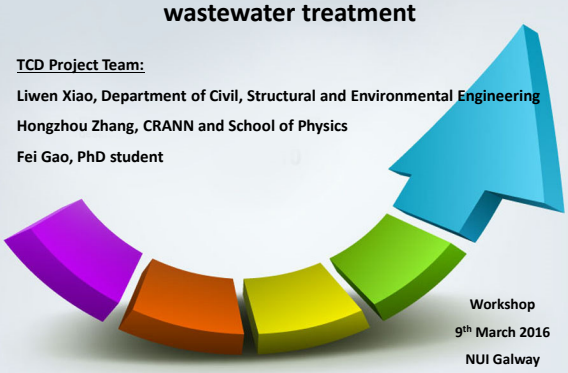


Workshop

9th March 2016

NUI Galway

Introduction

- Two-dimensional (2D) nanostructures with a large lateral size and a small thickness construct an important cornerstone for modern materials science.
- Nanomaterials are typically defined as materials smaller than 100 nm in at least one dimension
- At this scale, materials often possess novel size-dependent properties different from their large counterparts

Introduction

- Nanotechnology offer leapfrogging opportunities to develop next-generation water supply systems
- 4 classes when it comes to water treatment applications, which are dendrimers, metal-containing nanoparticles, zeolites and carbonaceous nanomaterials.

Introduction

- A number of nanomaterials fabricated in CRANN at TCD may have potential to be used for treatment of dairy wastewater.

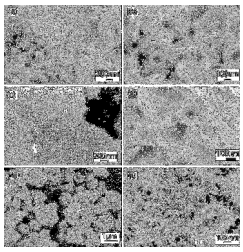


Fig.2. SEM images of the milled MnO_2 (a, b), SnO_2 (c, d) and rutile TiO_2 (e, f) after the hydrothermal treatment in 2 M NaOH aqueous solution at 120 ° C for 4 h, respectively.

Introduction

- The porous boron nitride (BN) nanosheets have been reported to have great potential for effective cleaning of oil mixed wastewater

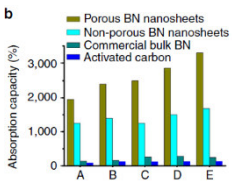


Figure 1. Comparison of porous BN nanosheets' absorption capacity with non-porous BN nanosheets, commercial bulk BN and activated carbon (Lei et al., 2013).

Barriers and research needs

- The performance of various nanotechnologies in treating real natural and waste waters needs to be tested
- Cost-effectiveness, and potential environmental and human risk.

Objectives of this task are to:

- Carry out a **literature review** of water and wastewater treatment by using nanomaterial/nanotechnologies
- **Assess the performance** of novel nanomaterials developed in CRANN **on removal of nutrients and organic contaminants** from dairy wastewater and optimum nanomaterials structures and operational conditions
- Determine **the efficiency** of novel nanomaterials on water disinfection

Expected outcome:

Find the right nanomaterials for dairy wastewater treatment:

- Cheap,
- Easy to fabricate
- Efficient,
- Easy to recycle/reuse.

Environmental Engineering Laboratory

- Environmental Laboratory
- Water analyser
- Microsensor laboratory
- TOC analyser
- Gas and liquid chromatography

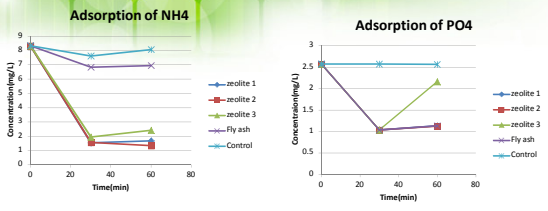
The Advanced Microscopy Laboratory at CRANN

- High temperature tube-furnaces, fabrication of nanostructures
- Helium ion microscope
- Transmission electron microscope
- Scanning probe microscopes, sample characterisation
- JEMS/Crystal Maker TEM computer program
- Raman Spectrometer

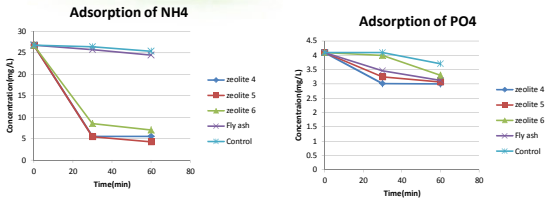
Nano-zeolite

- Nano-zeolite: zeolites with crystal sizes less than 100 nm
- Coal fly ash which from Moneypoint thermoelectric power plants in Co. Clare
- 20 treatments

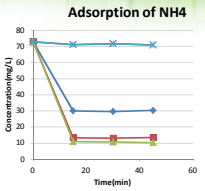
Preliminary results

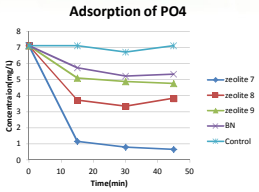


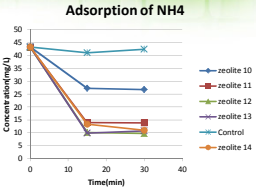
Preliminary results

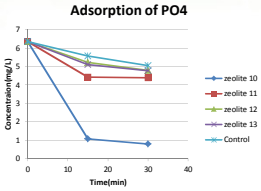


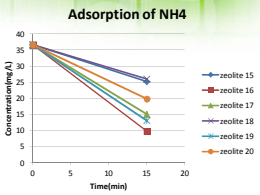
Preliminary results

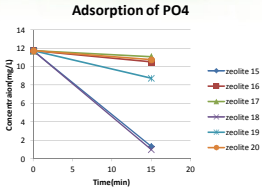












Thanks!