Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4262** Type: **Oral not-in-competition (Graduate Student) / Orale non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

(G) Biomass-derived carbon nanoparticles and their adsorption of polycyclic hydrocarbons in water investigated by synchrotron X-ray absorption

Tuesday 28 May 2024 15:15 (15 minutes)

Polycyclic hydrocarbons (PHs) are carcinogens often present in water due to its contamination from oil and vehicle exhausts, and their removal is difficult due to their resistance to conventional water purification methods. Here, we present a thorough synchrotron-based characterization of carbon nano-particles derived from different parts of the cannabis plant (hurd and bast) and their ability to adsorb PHs in aqueous environment, with anthracene as a case study. The synthesis of carbon nano-particles was carried out by pyrolysis at varying temperatures followed by strong acid (HNO3:H2SO4) treatment. The goal is to establish a structure-function relationship between the synthesis parameters and the ability of these nano-particles to promote PH adhesion at their surface via pi-pi electron stacking. Synchrotron based X-ray absorption (XAS) is used to investigate the composition of these nanoparticles as well as their electronic structure which profoundly differs from graphene oxide and carbon dots, and is more resembling to amorphous carbons. Along with dynamic light scattering, XAS also demonstrates that defect-free sp2 carbon clusters (with limited hydroxyl and carboxyl groups at their surface) is necessary for the interfacial adhesion of anthracene at their surfaces. Our XAS results are also corroborated by benchtop techniques including Fourier-transform infrared (FTIR), photo-luminescence (PL) and UV-visible optical spectroscopies, as well as atomic force microscopy (AFM). We demonstrate that a unique advantage of our biomass-derived carbon nano-particles rests in the rapidity of their anthracene capture process, only requiring a few seconds, as opposed to several hours as in other systems proposed in the literature. Collectively, our study demonstrates the importance of advanced XAS techniques for the characterization of pi-pi electron stacking in carbon nanosystems.

Keyword-1

Synchrotron X-ray absorption

Keyword-2

Carbon nano-particles

Keyword-3

Sorbents

Authors: Mr MENDES, Carlos E. (University of Western Ontario); Dr ZAVITZ, Daniel (PUR Botanicals Ltd); Prof. SHAM, Tsun-Kong (University of Western Ontario); Prof. FANCHINI, Giovanni (University of Western Ontario)

Presenter: Mr MENDES, Carlos E. (University of Western Ontario)

Session Classification: (DAPI) T2-6 Advances in Instrumentation I | Progrès en matière d'instrumentation I (DPAI)

Track Classification: Technical Sessions / Sessions techniques: Applied Physics and Instrumentation / Physique appliquée et de l'instrumentation (DAPI / DPAI)