Online Proceedings

Poster Session 2

MGH 241, Easel 137

12:45 PM to 2:15 PM

Tailoring the Surface Properties of Iron Oxide Nanoparticles for Biomedical Applications

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Mentor: Kannan Krishnan, Materials Science & Engineering
Mentor: Amit Khandhar

Iron-oxide magnetic nanoparticles (MNPs) with tuned magnetic properties can enable novel diagnostic and therapeutic technologies such as magnetic particle imaging and hyperthermia. In order to optimize the magnetic properties of MNPs, organic synthesis methods are required. However, these organic synthesis methods render the nanoparticles hydrophobic and unusable for biomedical applications. To make MNPs functional in biomedical applications whilst retaining their magnetic functionality, they must be transferred to the aqueous phase using a biocompatible polymer. In this work, MNPs will be coated using a biocompatible PEG-ylated amphiphilic polymer: poly (maleic anhydride-alt-1-octadecene) or PMAO-PEG. To ensure the PMAO-PEG is a well suited polymer coating for MNPs, various molecular weights and molar ratios of PMAO-PEG are synthesized and characterized to study the effects of PEG surface density and molecular weight on MNPs. By altering the density of the polymer used to coat and phase transfer MNPs, effects such as the solubility, circulating life, colloidal stability, dosage frequency, and proteolytic degradation rates of MNPs in the biomedical applications are studied using data obtained from Gel Permeation Chromatography (GPC) and Fourier Transform Infrared Spectroscopy (FTIR). Molecular weight distributions of the various polymers are obtained from the GPC to evaluate the conjugation success after PEG-ylation. In addition, FTIR was used to identify known and unknown materials in the samples, determine the quality and consistency of samples, and to determine the amount of components in samples.

Poster Session 3

Balcony, Easel 106

2:30 PM to 4:00 PM

Use of Fungal and Nitrogen Fixing Bacterial Endophytes to Improve Growth of Conifers in the Presence of Abiotic Stresses Caused by Climate Change

Daniela Navil Ramos, Junior, Extended Pre-Major
Mentor: Sharon Doty, Environmental&Forest Sciences
Mentor: Zareen Khan, Forest Resources

Today, plants are facing increasing environmentally stressful conditions due to several factors attributed to climate change such as heat, drought and water salinity. These factors hinder most plant growth and, in response, there is often an increase in the use of chemical fertilizers. These fertilizers can become expensive and also have adverse effects on the environment. A possible alternative to fertilizers is the use of nitrogen fixing endophytes and abiotic stress reducing fungal endophytes. Endophytes are bacteria or fungi that live within a plant, establishing a mutualistic relationship in which they provide essential nutrients or abiotic stress relief for the plant in return for nutrients and protection. Conifers are an important part of the forest industry and are extensively planted for timber production. Thus, it would prove beneficial for plantations and the environment alike to decrease the use of fertilizers. In my research I have inoculated Cedar, Pine and Douglas Fir seeds with different strains of nitrogen fixing endophytes and stress reducing fungal endophytes. Because confirmation of inoculation is essential, these endophytes have been tagged with a florescent marker to confirm inoculation using fluorescent microscopy. Once inoculation was confirmed, I introduced the conifers to various stressful growing conditions such as; low nitrogen levels, high heat, water scarcity and increased water salinity. Nitrogen levels, growth, and response to stress between inoculated and uninoculated conifers were then measured. These fungal and bacterial endophytes have been shown to increase plant metabolic efficiency, reduce water and nutrient use, and produce greater biomass and yields in crop plants. Thus, similar results are predicted in conifers inoculated with these endophytes. If these results are confirmed, the use of these endophytes could become a sustainable alternative to chemical fertilizers and, in turn, aid in the mitigation of climate change on forestry ecosystems and the environment.

Poster Session 4

Commons East, Easel 83

4:15 PM to 5:45 PM

Colonization, Degradation of TCE and Comparison of Phytotoxicity in Plants Inoculated with PDN3

Raymond Yap, Senior, Extended Pre-Major
Mentor: Zareen Khan, Forest Resources
Mentor: Sharon Doty, Environmental&Forest Sciences

Trichloroethylene (TCE) is a widely found pollutant that is carcinogenic and hazardous to humans. Phytoremediation, which uses plants to degrade toxins, offers a more economical solution to removing toxic wastes from the environment. The Doty lab has isolated an endophyte (microbes living inside plants) from hybrid poplar that can degrade TCE, an enterobacter sp. strain PDN3. In this study, we are determining its potential to colonize the plants, protect against TCE toxicity and its ability to help plants degrade TCE. Colonization was studied using fluorescent microscopy, using plant tissues of S365 (*Salix discolor*) inoculated with fluorescent PDN3 through either foliar spray or root inoculation. The presence of the inoculated endophyte in roots of root-inoculated plants suggests that PDN3's can colonize roots. We also tagged PD1(a phenanthrene degrader) with a red fluorescent marker to study co-colonization by both PD1 and PDN3 in S365 so that we can understand their preferred methods of colonization and their potential use in remediating sites contaminated with multiple pollutants. Because PDN3 is known to degrade TCE, we want to see whether it enhances the plants' capacity to degrade TCE. In the next study we inoculated S365 with PDN3 and exposed them to TCE in hydroponics solution to monitor TCE removal and chloride release (metabolite of TCE). In a previous study, clone SX64 (*Salix miyabeana*) showed decreased biomass when exposed to TCE. So we want to examine if adding PDN3 would help the plants against the toxic effects of TCE. We are also screening other willows and poplar clones for phytotoxicity to TCE and the data generated in these studies will help us in developing a cost effective clean up technology.