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Biosynthesis of nanomaterials from industrial mine wastes

Abhilash
CSIR-National Metallurgical Laboratory, India

Nanostructured materials have attracted considerable attention in recent years because they exhibit useful and unusual properties compared to conventional polycrystalline materials. These nanocrystalline particles have a high surface/volume ratio leading to better and desired properties different from those of bulk materials. The synthesis of minerals by bacteria has been classified according to the degree of control over the mineralization process, namely those that are formed passively or actively.

Keeping this in view, efforts have been put in place to utilize microbial technology for synthesis of nano-sized materials/products from industrial wastes. The background knowledge has been applied to wastes from iron and zinc industries. From zinc wastes with less than 3% Zn and additives of Pb, Cu and Fe, consortia of bacteria in a dual stage process was able to synthesize various types of ZnO products, viz., 30-40 nm rods, 55-60 nm hexagonal plates, ~5 nm thick plates at room temperature. The purity of the material was estimated to be 99.99999% conforming to international standards.

Pickle liquor generated from steel plants after electroplating containing high levels of iron, was microbially reduced to synthesize maghemite nanoparticles of 10 nm size, and high magnetization. Oxidizing bacteria were also employed to synthesize an array of nanoparticles with around 5-20 nm size at room temperature.

These results with other similar efforts in this area can surely open up possibilities for utilization of such wastes for synthesizing valuables economically and in an environment friendly manner.

abhibios@gmail.com

Nanocomposite multilayer fibrous membrane for sustained drug release

Ahmed Hassanin[1], Mohamed Ghaniem[2], Hassan Nageh[2] and Ahmed Abdelmoniem[2]
[1]Alexandria University, Egypt
[2]Egypt-Japan University for Science and Technology, Egypt

Building on the success of many earlier studies on electrospun nanofibers technique which provide a non-woven web to the order of nanometers introducing superior properties such as large surface area, superior mechanical properties and ease of implementation in many fields of applications, elctrospun nanofibers became an important issue for many researchers in various fields. Using elctrospun fibers as a drug carrier, is showing a huge promising potential for the future of biomedical application, especially developing non-traditional wound dressing. Our work in this research is focusing on engineering a system to control the drug release profile rate especially for wound dressing. Different wound types require different drug release rates. So that controlling the rate of drug release attract the attention of many researchers.

Nanocomposite multilayer fibrous membranes, using electrospinning method, have been developed for drug release in form of sandwich structure of three layers. Inner layer which is kept polycaprolactane (PCL) loaded with drug. The two outer layers have been changed with different blend ratios between chitosan (Cs) and PCL as follow [0%:100% Cs:PCL, 30%:70% Cs:PCL, 50%:50% Cs:PCL, 70%:30% Cs:PCL]. The results showed that the release rate has been affected dramatically by the outer layer composition. SEM images showed changing in the morphology due to the difference in the composition of outer layer. Release profiles from the electrospun membrane were compared to cast membrane from polycaprolactane.

Biography

Ahmed Hassanin joined North Carolina State University, College of Textile in September 2006 as exchange visitor. In fall 2008, he started as a graduate student to pursue his Ph.D. He obtained his Ph.D. in Fiber and Polymer Science in August 2011. During the Ph.D. program, he worked in improving UV resistance of high performance fibers. This project was funded by NASA, Balloon program office. In 2012, he started his faculty position at College of Engineering, Alexandria University. He is also working as a research fellow at Material Science and Engineering Department, Egypt-Japan University for Science and Technology, Egypt.

ahassanin2003@yahoo.com