Synthesis of Amine-Functionalized Carbon Dots from Biotin-Modified Chitosan and Silk-Fibroin Blend for Targeted Delivery of Anticancer Drugs

Himadree Das[1], Himali Horo[1], and L.M. Kundu[*1, 2]

[1]*Centre for the Environment, Indian Institute of Technology, Guwahati, Assam-781039, India.*

[2]*Department of Chemistry, Indian Institute of Technology, Guwahati, Assam- 781039, India.*

Author E-mail: d.himadree@iitg.ac.in, himali@alumni.iitg.ac.in

**Corresponding Author E-mail: lmkundu@iitg.ac.in*

ABSTRACT

Nanotheranostics, which integrates diagnosis and therapy into a single platform, has emerged as one of the powerful strategies in cancer treatment. Carbon dots (CDs) or carbon nanoparticles have been recognized as highly promising theranostic candidates. In this study, we have synthesized a primary amine functionalized fluorescent CDs using LMWC and SF blend. Upon increasing the SF content in the blend, there was an enhancement in the fluorescence properties due to doping. The size of the CDs was evaluated by FETEM analysis. it is evident that the CDs were quasi-spherical in shape with a size of 3 ± 1.5 nm. The cancer cell targeting moiety, biotin, has been successfully conjugated to the CD, and the 5-FU has also been loaded with a very high encapsulation efficiency. The cell imaging on MCF-7 cell lines showed bright blue fluorescence with increased internalization of the conjugated CDs compared to normal cell lines due to biotin receptor-mediated endocytosis. The high-water solubility, drug encapsulating efficiency, fluorescence properties, and target specificity proves the efficiency of the synthesized biotin-conjugated CDs as drug delivery carrier and cell-imaging tool.

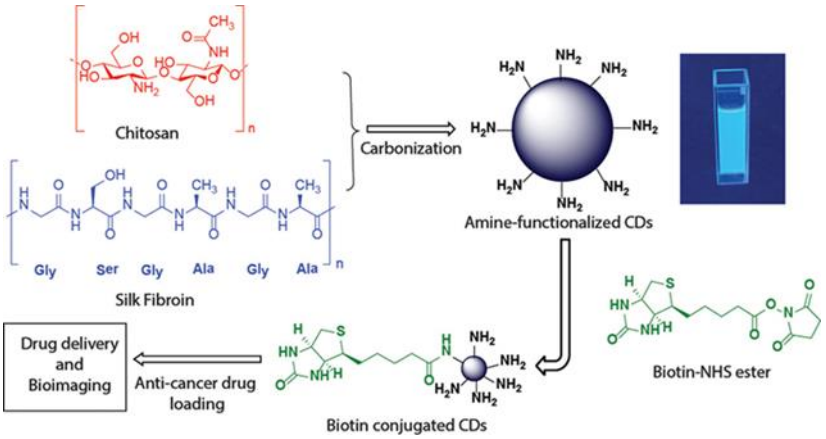

Figure 1: Synthesis process of 5-FU loaded biotin-conjugated CDs.

Keywords: Carbon dots; Silk fibroin; Low molecular weight chitosan; 5-fluorouracil