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Waste-Derived Carbon Nanostructures

Synthesis and Applications

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Chapter 4
Biological Waste-Derived Carbon Dots and Their Applications

Subhamoy Banerjee and Ruchira Mukherjee

Abstract Carbon dots (CDots) belong to a zero-dimensional material family which has garnered a lot of scientific attention due to their superior physico-chemical properties like high photostability, water solubility, high quantum yield, tunable optical properties, etc. CDots have gained much attention from the biomedical field due to their superior water solubility, biocompatibility, low toxicity, and ease of surface functionalization resulting in more efficient detection and varieties of target identification. CDots are synthesized using various methods from various sources. Due to the current emphasis on recycling materials, biological waste is an attractive source to synthesize CDots. Biological waste materials are abundant, and it is increasing day by day. Waste-derived products used to have lower production costs given a suitable synthesis method. Biological waste has high carbon content. As a result, large-scale synthesis of CDots at a lower price is possible. Different synthesis methods have been designed to synthesize CDots from a variety of biological waste materials. Different synthesis methods have specific applications like imaging and screening, drug delivery, cancer theranostics, tissue engineering, etc. In the current chapter, we have discussed different methods used to synthesize CDots from biological wastes and their various applications.

Keywords Carbon dots · Bio-waste · Fluorescence · Theranostics · Functionalization · Catalysis

4.1 Introduction

Biological waste is any kind of material that contains biohazardous substances. It is broadly categorized into category 1 and 2. Category 1 consists of biological waste that may cause harm to humans. Category 2 waste is non-infectious waste materials like

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