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Review

Supramolecular Chemotherapy with Cucurbit[*n*]urils as Encapsulating Hosts

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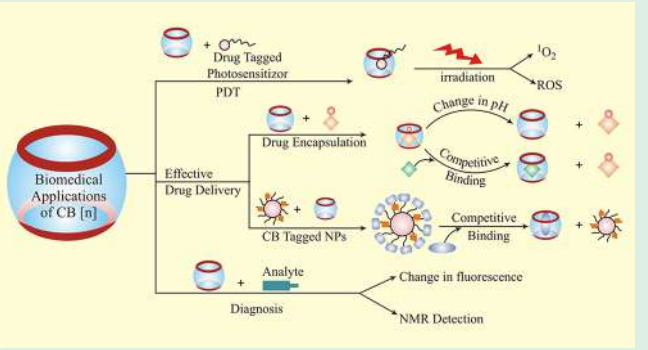
ABSTRACT: The cucurbit[*n*]urils (CB[*n*]) belong to the field of relatively young supramolecules which act as containers for a large variety of guests and are being explored extensively for their numerous biomedical applications. This includes drug formulation and delivery, controlled drug release, photodynamic therapy, sensing for bioanalytical purposes, etc. These supramolecular host−guest systems have distinctive recognition properties and have successfully been shown to enhance the *in vitro* and *in vivo* utility of various chemotherapeutic agents. The CB[*n*]s are tailored to optimize their application in payload delivery and diagnostics and in lowering the toxicity of existing drugs. This review has listed the recent studies on working mechanisms and host−guest complexation of the biologically vital molecules with CB[*n*] and highlighted their implementation in anticancer therapeutics. Various modifications in CB-drug inclusion compounds like CB supramolecular nanoarchitectures along with application in photodynamic therapy, which has shown potential as targeted drug delivery vehicles in cancer chemotherapy, have also been discussed.



KEYWORDS: *cucurbit[n]uril, supramolecular chemotherapy, anticancer, photodynamic therapy, supramolecular nanoparticles, drug delivery vehicles*

INTRODUCTION

Among several challenges in the history of medicine, none has had a more controversial beginning and painstaking advancement than the cure for cancer. Cancer is globally regarded as a leading cause of mortality which is pacing at an alarming rate. The scientific community has been tirelessly working in this regard which has led to a diminished mortality rate in the past few decades, but it is still a long way to the complete solution. The GLOBOCAN 2020 survey estimates about 19.3 million new cases in the year reported and 10.0 million deaths with the burden to rise by about 47% to 24 million by 2040.[1] Therefore, immediate action is necessary to avert this formidable forecast with novel and improved therapeutics with the least cytotoxicity, thus also taking into account a balanced treatment, alongside the quality of lifestyle for the patients.

In the armamentarium for the effective treatment of cancer, the first one is the conventional chemotherapeutic agents. Chemotherapy works by inhibiting or slowing the growth of malignant cells. It is a treatment strategy that uses chemical compounds as cytotoxic agents against malignant cells. These are often used in combination with other anticancer therapies like photothermal therapy, photodynamic radiotherapy, immunotherapy, and surgical cessation. But sometimes chemotherapy remains the only resort due to complications associated with other therapeutic techniques.[2−6] The intrinsic and acquired resistance of cancerous cells against these chemotherapeutic drugs and various side effects like loss of appetite, CINV (Chemotherapy Induced Nausea and Vomiting), pain, fatigue, etc., have limited their potency against various cancer cell lines. Most of the conventional chemotherapeutic agents often suffer issues like poor solubility and stability in *in vivo* conditions. Apart from this, processes involved in the transportation of the drug molecule, *viz.*, translocation, activation, and excretion, could be hardly tracked because of the nonfluorescent nature of the drug molecules. Therefore, there is a dire need for the development of more potent, stable, and soluble chemotherapeutic agents with newer methods of specific delivery of these drug molecules to the targeted tissues.

Supramolecular chemistry is a branch of chemistry that deals with molecules that are bonded together via intermolecular

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