

Review

Anticancer Compounds Derived from Marine Diatoms

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Abstract: Cancer is the main cause of death worldwide, so the discovery of new and effective therapeutic agents must be urgently addressed. Diatoms are rich in minerals and secondary metabolites such as saturated and unsaturated fatty acids, esters, acyl lipids, sterols, proteins, and flavonoids. These bioactive compounds have been reported as potent anti-cancer, anti-oxidant and anti-bacterial agents. Diatoms are unicellular photosynthetic organisms, which are important in the biogeochemical circulation of silica, nitrogen, and carbon, attributable to their short growth-cycle and high yield. The biosilica of diatoms is potentially effective as a carrier for targeted drug delivery in cancer therapy due to its high surface area, nano-porosity, bio-compatibility, and bio-degradability. In vivo studies have shown no significant symptoms of tissue damage in animal models, suggesting the suitability of a diatoms-based system as a safe nanocarrier in nano-medicine applications. This review presents an overview of diatoms' microalgae possessing anti-cancer activities and the potential role of the diatoms and biosilica in the delivery of anticancer drugs. Diatoms-based antibodies and vitamin B12 as drug carriers are also elaborated.

Keywords: diatoms; bioactive molecules; anticancer activity; nanomedicine; drug delivery system; biosilica

1. Introduction

Cancer is the major cause of morbidity and mortality worldwide, with an estimated 18.1 million new cases and 9.6 million deaths in 2018 [1]. There are over 200 types of cancers, and some can spread to other tissues in the body, leading to metastases and death [2]. Cancer progression is caused by the damaged DNA, abnormal DNA repair mechanism, activation of cancerous tumors, damaged tumor suppression activity, and promotion of cellular survival by angiogenesis, and metastasis. Cancer incidences have been projected to increase globally by about 68% in 2030. This calls for concerted efforts to discover novel chemotherapy, especially for prevalent cases such as lung/bronchial cancer in males, and breast cancer in females [3]. Chemotherapies are the first-line of treatment that could destroy or prevent the growth of cancer cells. There are, however, side-effects associated with chemotherapeutic drugs, which may lead to baldness or anorexia, and most of the drugs have some degree of harmfulness ranging from mild reactions to severe life-threatening effects [4]. Anticancer agents can inhibit the activity of oncogene by up or down-regulating successive signals of oncogene activation, or by activating the production of antitoxins, or the inhibitors of histone-deacetylases (HDAC), topoisomerase, acetyl-histones acetyltransferases (HATs), cyclin-dependent kinase, and DNA methyl-transferases [5].

The discovery of cancer therapies from marine sources is highly relevant to combat cancer. More than 60% of anti-tumor drugs are derived from natural sources, including the confirmed pharmaceuticals and molecules, which are currently under clinical trials [6]. Biologically-active