



Benefits of Natural Products as Anti-Cancer Agents

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INTRODUCTION

Cancer is a leading cause of mortality all over the world. Although there are a variety of anticancer medications available, most of them are costly and have substantial side effects. Natural substances are frequently non-toxic and low-cost. For ages, many of these substances have been recognised and studied for their health benefits, and some dietary elements derived from natural products have gotten a lot of attention as cancer prevention and therapy agents. Surgical excision and radiation treatment of the vast accumulated biomass of cancer is commonly employed in current cancer treatments, followed by systemic chemotherapy treatment for maintenance treatment.

The vinca alkaloids (vinblastine, vincristine, vinorelbine), the epipodophyllotoxin lignans (etoposide, teniposide, etoposide phosphate), the taxane diterpenoids (paclitaxel, docetaxel), and the camptothecin quinoline alkaloid derivatives are now the four major structural classes of plant-derived compounds used in medicine as single chemical entity compounds (topotecan, irinotecan).

Plants are a good source of anti-cancer chemicals. Nine plant-derived chemicals have been licenced for use as anti-cancer medicines in the United States since 1961.

Alkaloids

Vinblastine and vincristine are vinca monoterpene indole alkaloids that come from the Madagascar periwinkle plant (*Catharanthus roseus*). Vinblastine is a drug that is frequently used to treat tumours like Hodgkin's lymphoma. Vinblastine and vincristine have essential pharmacological properties, although they are difficult to synthesise. Alkaloid biosynthesis metabolic engineering can give a cost-effective and ecologically friendly approach to analogues of these pharmaceutically important natural compounds. Strictosidine synthase, the enzyme at the process's start, has a limited substrate range, which hinders a pathway engineering approach.

Certain plants synthesise camptothecin, a modified monoterpene indole alkaloid. *Entrophospora infrequens*, an endophytic fungus, produces it from the plant *Nathapodytes foetida*. Camptothecin is a drug that is used to treat recurrent colon cancer, as well as lung, ovarian, and uterine cancer. Colon cancer is the second greatest cause of cancer-related deaths in the United States, as well as the third most frequent cancer among Americans. The water-soluble derivatives of camptothecin, irinotecan and topotecan, are also employed in clinical trials.

Taxol (paclitaxel), a diterpene alkaloid, is a highly effective anti-tumour agent. It was first identified in plants, but it has now been revealed to be a fungal metabolite as well. Taxol is produced by fungi such as *Taxomyces adreanae*, *Pestalotiopsis microspora*, *Tubercularia* sp., and *Phyllosticta citricarpa*. *P. citricarpa* produces just 265 mg l⁻¹, which is rather low. However, it is reported that another fungus, *Alternaria alternative* var *monosporus*, isolated from the bark of *Taxus yunnanensis*, may generate taxol at a high level of 227 mg l⁻¹ after UV and nitrosoguanidine mutagenesis. Taxol was discovered to have anti-tumour action after being separated from the bark of the Pacific yew tree, but it required six 100-year-old trees to cure one cancer patient. Today, it's generated through plant cell culture or semisynthesis from *Taxus* species' taxoids. More than 350 taxoid chemicals have been identified in these species.

Etoposide and teniposide

These two chemicals are semisynthetic derivatives of podophyllotoxin, an antimetabolic metabolite found in the roots of *Podophyllum peltatum*, a mayapple plant. Mayapple is traditional herbal medicine. Etoposide is an inhibitor of topoisomerase II. This important enzyme helps eukaryotic cells thrive by controlling DNA supercoiling levels. Lung cancer, choriocarcinoma, ovarian and testicular cancer, lymphoma, and acute myeloid leukaemia were all authorised for etoposide. Teniposide is a drug that

has been authorised to treat central nervous system malignancies, malignant lymphoma, and bladder cancer.

Other compounds

The naphthoquinone pigment shikonin, a herbal medicine cure, is generated primarily for cosmetic purposes by cell culture of the plant *Lithospermum erythrorhizon*. Shikonin and two derivatives were shown to decrease tumour development in animals with Lewis Lung Carcinoma, which was unexpected. Other plant natural compounds known to prevent cancer cell proliferation include the isoflavone genistine, indole-3-carbinol, 3,3'- diindolylmethane, curcumin (-)-epigallocatechin-3-gallate, resveratrol, and lycopene (Sarkar et al., 2009). These natural substances appear to work by interfering with several cellular signalling pathways, triggering cell death signals, and causing cancer cells to apoptosis without harming healthy cells.