

Technical Brief

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Sustainable production of camptothecin from a high yielding endophyte

Technology Summary

A high camptothecin-yielding endophyte from *Nothapodytes nimmoniana* reports the highest yield reported till date in any native strain of endophytes, and can be used for the fast, sustainable production of camptothecin with good yields.

Background

Camptothecin is an anticancer alkaloid that is commercially produced from plants. It inhibits DNA topoisomerase I in cancer cells leading to cell death. Owing to the high demand of camptothecin, its source plants are endangered and overharvested. Thus, a sustainable means of camptothecin production is needed. Endophytes, the microorganisms that reside within plants, are reported to have the ability to produce host-plant associated metabolites. However, the commercial production of bioactive compounds using endophytes has not yet been established. The bottleneck has been the inconsistent product yield, which decreases rapidly with successive subculture under axenic state.

Technology Description

Endophytes from *Nothapodytes nimmoniana* were isolated from various parts of the plant, such as leaves, stem, and bark. The isolated endophytes were individually screened for their ability to produce camptothecin in suspension, which was confirmed by tandem mass spectrometry (LC-MS/MS) and thin layer chromatography (TLC). Sustainable production of camptothecin in the two highest camptothecin yielding endophytes was assessed in suspension culture generated from the 1st through the 12th generation slants. The strain (*A. burnsii* NCIM1409) could demonstrate sustainable production of camptothecin in culture even from its 12th generation slant used as inoculum. The cytotoxicity of the crude extract of camptothecin from *A. burnsii* was tested on various cancer cell lines, including breast, ovarian, lung etc.

Market Potential

The global oncology drugs market was valued at \$128 billion in 2019, and is projected to reach \$222 billion by 2027, at a CAGR of 7.4%. Camptothecin market is probably in the range of 500- 1000 m\$.

Value Proposition

- Sustainable production of Camptothecin in axenic state (~2 mg/L; 250 µg/L/d) in batch
- Uniform and consistent product quality with less impurities than in natural plant extracts
- Faster, cost effective, continuous production with better yield
- 100% similarity to marketed/plant derived camptothecin molecule
- Microbial source is non-pathogenic to healthy humans
- Highest yield in any native strain of endophyte reported to date
- Camptothecin extract demonstrates high sensitivity to Colon, Ovary and Lung cancer

Applications

The camptothecin topoisomerase I-targeting agents are new class of antitumor drugs with demonstrated clinical activity in human malignancies, such as colorectal cancer and ovarian cancer

Technology Status

- Demonstrated at lab scale using a 3 L fermenter
- Patent protected
- Seeking interested industry partners

References

Sustainable production of camptothecin from an *Alternaria* sp. isolated from *Nothapodytes nimmoniana*. I.A. H. Khwajah Mohinudeen, Rahul Kanumuri, K. N. Soujanya, R. Uma Shaanker, Suresh Kumar Rayala & Smita Srivastava. *Sci. Rep. (Nature research publication)* (2021) 11:1478.

<https://www.alliedmarketresearch.com/oncology-cancer-drugs-market>

