SELENIUM NANOPARTICLES CONJUGATED WITH *Scutellaris barbata D. Don* POLYSACCHARIDES: SYNTHESIS, OPTIMIZATION, STRUCTURAL CHARACTERIZATION AND EVALUATION OF ANTI-HEPATOMA ACTIVITY *IN VITRO*

Shan Rong[1], Jun Liang[2], Xiaoyi Xu[3], Yongkui Yi[4], Hui Yuan[2] Xiaoyan Gao[2], Qingxue Zhao[5], Gaochen Song[2]*, Imre Miklós Szilágyia[1]

[1]Institute of Physical Metallurgy, Metal Forming and Nanotechnology, University of Miskolc, Miskolc-Egyetemvaros H-3515, Hungary
[2]College of Basic Medicine, Mudanjiang Medical University, Mudanjiang 157011, China
[3]The First Clinical College of Medicine, Mudanjiang Medical University, Mudanjiang 157011, China;
[4]College of Life Science, Mudanjiang Medical University, Mudanjiang 157011, China
[5]College of Basic Medicine, Heilongjiang University of Chinese Medicine, Harbin 150040, China
e-mail: rong.shan@student.uni-miskolc.hu

Introduction

In this study, SBP was conjugated with SeNPs to synthesize SBP selenium nanoparticles (SBP-Se), and response surface methodology (RSM) was employed to optimize the synthesis conditions of SBP-Se. The structural properties of SBP-Se were characterized by multiple analytical techniques, and its anti-hepatoma activity was evaluated both in vitro. The results demonstrated that SBP is primarily bound to SeNPs through the adsorption of phenolic hydroxyl groups, forming stable SBP-Se containing elemental selenium. Cell based assays revealed that SBP-Se exhibited significantly enhanced antiproliferative effects against HepG2 cells than SBP or SeNPs alone. These findings suggest that SBP-Se is a promising candidate for the development of antitumor pharmaceuticals, providing a theoretical foundation for the design of novel selenium-based structures and elucidating their anti-liver cancer mechanisms.

Experimental

The SBP was purified by the water extraction and alcohol precipitation method, and SBP-Se was synthesized by chemical synthesis. The synthesis parameters of SBP-Se were optimized through CCD and RSM, and the material structure was characterized by UV-Vis, FTIR, XRD and SEM etc. The anti-liver cancer ability of SBP-Se was verified by CCK8 and clone formation experiments.

Results

Polysaccharides are highly effective stabilizers for SeNPs synthesis due to their abundant hydroxyl groups, complex branching structures, and large surface area, which significantly improve stability. The relatively stable SBP-Se complex is formed through C-O/Se linkages or strong interactions with hydroxyl groups. Although the structure of SBP-Se is predominantly amorphous, certain polysaccharides adopt a microcrystalline during the selenization of SBP. Cellular assays demonstrated that SBP-Se significantly reduced the survival rate of HepG2 cells and inhibited the migration of liver cancer cells in *vitro*. In summary, the conjugation of SBP with SeNPs represents a novel strategy for polysaccharide modification and its application in cancer therapy, demonstrating potential as a promisinig anticancer therapeutic agent.