Use of Bacterial Ghosts as Novel Drug Delivery Systems to Improve Cancer Treatment

Amin Afkhami[1], Maryam M. Matin[2]

1. Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran
2. Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran#Cell and Molecular Biotechnology Research Group, Institute of Biotechnology, Ferdowsi University of Mashhad, Mashhad, Iran#Stem Cell and Regenerative Medicine Research Group, Iranian Academic Center for Education, Culture and Research (ACECR), Khorasan Razavi Branch, Mashhad, Iran

Abstract

Despite the large number of various anti-cancer drugs on the market, proper delivery systems are needed to decrease serious toxic and non-curative side effects. In order to enhance compliance, several delivery systems such as polymeric micro- and nanoparticles, liposomal systems and erythrocyte ghosts have been developed. Bacterial ghosts (BG) represent novel advanced delivery and targeting vehicles suitable for delivery of hydrophobic or water-soluble drugs. BGs are empty bacterial envelopes of Gram-negative bacteria produced by controlled expression of cloned gene E, forming a lysis tunnel structure within the envelope of the living bacteria. BGs are devoid of cytoplasmic content and possess all bacterial bio-adhesive surface properties in their original state while not posing any infectious threat. BGs are ideally suited as an advanced drug delivery system for toxic substances in tumor therapy. The inner space of BGs can be loaded with either single components or combinations of peptides, drugs or DNA which provides an opportunity to design new types of (polyvalent) drug delivery vehicles. In particular, Doxorubicin-loaded bacterial ghosts have been used to target colon carcinoma cell. DOX, a cytotoxic drug commonly used in cancer therapy, was used as a model substance to demonstrate the delivery of moderate water-soluble drugs by BGs. The application of DOX with BGs increased the efficacy of treatment by two folds. The same effect was observed after incubation of leukemia cells and melanoma cells with Dox loaded BG. These observations indicate high capacity of BGs to target various histological types of cancer. Optimization and improvement of the selected prospective model type of BGs would help to progress the development of microbial-mediated diseases treatment and drug delivery systems and their application in future clinical trials.

Keywords: Bacterial Ghost (BG), Drug Delivery, Tumor Therapy, Doxorubicin Loaded BG, Colon Carcinoma Cell

Corresponding Author: Maryam M. Matin

Email: a.afkhami.p@gmail.com