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Functional Characterization of Antimicrobial Peptide Nisin Toward Development of Cancer Therapy

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Abstract:

Currently, chemotherapy is the main treatment for most types of cancer but it has non-specific toxicity that associates with severe side effects and may lead to drug resistance. Therefore, it is necessary to seek novel therapeutic approaches for cancer treatment. Due to high proportion of negative charges on cancer cell membranes distinguishing from the normal cells, cationic antimicrobial peptides, particularly bacteriocins have been proposed as alternative anticancer agents. Nisin is an antimicrobial peptide known for preventing bacterial growth in food and recently been reported for anticancer activity. Thus, membrane permeabilization and anticancer activity of nisin was examined by using liposomal dye leakage assay and 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay, respectively. The results showed that nisin permeabilized through liposomal membranes containing negatively charged phospholipids, (phosphatidylglycerol; PG or phosphatidylserine; PS) more effectively than the liposome containing zwitterionic phospholipid (phosphatidylcholine; PC only), especially when the peptide:lipid ratio was 1:1000. In addition, the anticancer activity of nisin against breast cancer cell lines was confirmed with the IC_{50} of 2.56 and 5.78 µM for MCF-7 and MDA-MB231, respectively, while nisin exhibited low toxicity against normal fibroblast cell line (L-929). Altogether, the studies suggested that cationic nisin has a preference on permeabilizing through negatively charged membranes and can be potentially used for selectively killing cancer cells.

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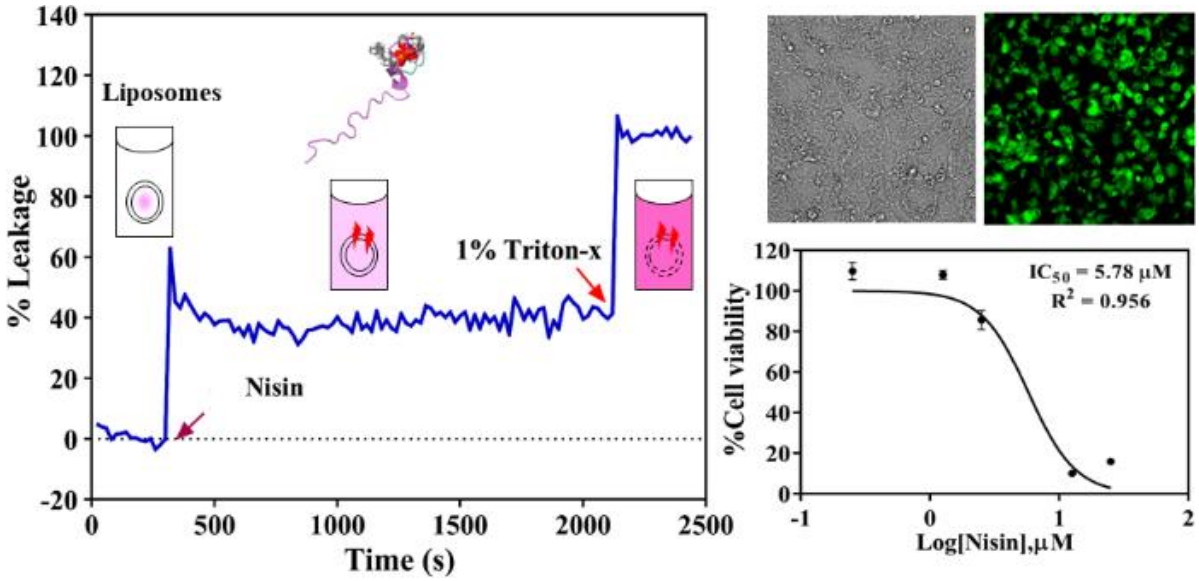
Graphical abstract



The research scope of the MRG 6280104 project