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Mini Review

Peptide-based Drug Delivery for Curing Cancer

Wenzhe Huang

State Key Laboratory of New-tech for Chinese Medicine Pharmaceutical Process, Jiangsu Kanion Pharmaceutical Co. Ltd., Lianyungang, 222001, China

ABSTRACT

Peptides have numerous advantages as the chains help treat cancer, tumor and several complex diseases. The review details on the different structures of peptides that can ensure actual and efficient delivery of therapy to tumor and cancer cases. The co-delivery system mainly aims to improve the therapeutic delivery process regarding manufacturing, targeting, and impact.

Keywords: Nanotechnology, Peptide-based Drug Delivery, cancer

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*Address for Correspondence:

Wenzhe Huang, State Key Laboratory of New-tech for Chinese Medicine Pharmaceutical Process, Jiangsu Kanion Pharmaceutical Co. Ltd., Lianyungang, 222001, China

Introduction

With the introduction of new drugs to improve the health status of patients, peptides are found to be better ingredients to enhance the overall drug delivery process¹⁻⁵. Peptides are identified as amino acid monomer chains that can offer better effects on the patients. The first section of this review details about the assembly of peptides while the next part discusses more on the influence of peptide-based ligand on the health of the patient. Peptides quickly turn into proteins and can penetrate to the top layer of the patient's skin thereby having a long-term impact of the medicine⁶⁻¹¹. The final part of this report discusses how peptides can serve as better drug delivery mechanism leaving a significant development in the health aspect of the person.

Assembly of Peptides

Self-assembly is a particular feature of peptides. In this case, self-assembly enables the development of nanoscale structures comprising of nucleotides, amino acids or phospholipids¹²⁻¹⁴. This assembly can manage the non-covalent interaction between attractive and repulsive forces. In the field of material science, nanostructure made of hydrogel has an excessive capacity to retain the water content and build rigid structures. It is observed that peptide-based hydrogel is effective in maintaining the

intermolecular interaction and enabling the biocompatibility between the bonds¹⁵⁻¹⁸.

The other advantage with the peptide comprising of the hydrogel is the formation of nanofibers and crosslinks even in the aqueous media. This structure is already found to be useful in the field of *in vitro* cell imaging research¹⁹⁻²². Further, this form of peptide delivery is found to enable better blood circulation thereby curing tumor and arthritis. Drug delivery is a critical process where it can have numerous side effects if the amino acids react differently. When self-assembled peptide combined with the hydrogel is introduced, it can have antifungal, antibiotic, anticoagulation and anti-inflammatory properties. This is also photostable, and this structure of peptide can have a great future in the biomedical field.

Peptide-based ligand

In the medical field, the targeted ligand includes peptides, proteins, and antibodies. For better therapeutic delivery, ligands comprising of liposomes have better consistency regarding purity and binding affinity²³⁻²⁹. RGD peptide, which is a combination of arginine, glycine and aspartic acids, takes the responsibility to anchor the cells. To treat the tumor cases, doxorubicin (DOX) is widely used. This RGD peptide is known to increase the delivery of doxorubicin with stabilized cells and activated performance of the drug.

RGD PEPTIDE-BASED TARGET DRUG DELIVERY

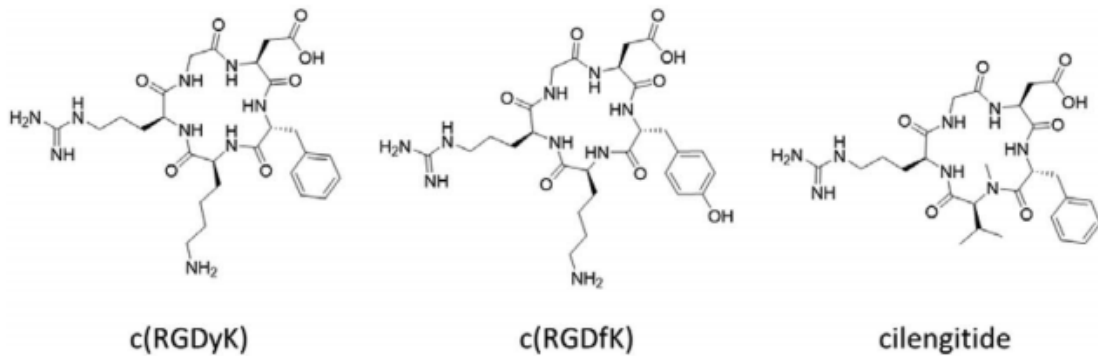


Fig. 1. Chemical structures of commonly used targeting RGD peptides.

The advantage with RGD peptide is its flexibility in the structures. While the natural structure is advantageous, the mimetic version of RGD can improve stability and affinity. The other famous structure of RGD is cyclic which targets the ligands and binds its relationship with integrin³⁰⁻³³. In the field of biomedicine, many biologists face difficulties in the penetration of internal cells and this is feasible with the cell penetrating peptide in place. This has a high affinity, and its impact is much visible in treating cancer cases.

Usually, the cancer cells are difficult to target, and the dual ligand enables the target on cancer cells and the transfer time is quick. Liposomes have been regarded as an effective drug delivery system³⁴⁻³⁶. The problem with the present system is the inability to target the active ligands. With the use of DOX, there is undoubtedly a need to activate the active ligands so peptides can work on binding the tissues and cancer cells and enrich the efficiency of the overall process. The peptide ligand assures to offer a long-term impact in usage for a shorter period.

Peptide-based drug delivery

The recent treatments available for cancer have had problems in the activation of cancer cells and targeting. Nanotechnology has proved to be a better method to treat the cancer patients and reduce the toxicity of the chemicals used^{7,23}. Amphiphilic dendrimer including hydrophilic dendritic shell tends to promise a better drug delivery system due to the ease in preparation and high biocompatibility. With the introduction of this acid promoted drug, it is possible to improve the efficiency of 5-Fu/Dox-DNM in the patient's body.

The process of preparation of 5-Fu/Dox-loaded micelles follows ultrasonication dialysis method. This is highly suitable to treat cases requiring dialysis and also cancer. Both Dox and 5-Fu will have to be loaded into micelles, and they improve hydrogen bond and electrostatic interactions. The co-delivery of 5-Fu and Dox is found to reduce the duration of tumor in the body and also minimize cancer-causing agents^{37,38}. The enhanced process of drug release is found to target the affected cells and induce the toxics that can help achieve a reduced cancer effect.

Peptides can replace the traditional chemotherapeutic drugs with a powerful method to target and eliminate the presence of cancer. This also improves the resistance of the affected patient and turns dormant cells invisible. Peptide treatment with the co-delivery of 5-Fu and Dox can promise a better choice of cancer therapy^{30,32}.

Conclusion

Peptides are known to be a chain of amino acids that have antioxidant and antifungal properties and help coagulate between the cells. In recent time, the rate of patients affected with cancer is increasing for which co-delivery or peptide ligands can be of greater use. The advantage with this therapeutic system is the improved resistance and stability on the targeted bodies. It can help in targeting the specific cells, and the cost of manufacturing is less. This is found to be the future of biomedicine to treat cancer cases.

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