Claims

1. An engineered immune cell comprising a polynucleotide sequence encoding a chimeric antigen receptor, wherein the chimeric antigen receptor comprises a CD7-targeted antigen recognition domain, the antigen recognition domain is a part or all of the sequences of a human CD7-L extracellular domain, or has at least 90% sequence identity to the human CD7-L extracellular domain, and the amino acid sequence of the human CD7-L extracellular domain is as shown in SEQ ID NO. 5.

2. The engineered immune cell of claim 1, wherein the chimeric antigen receptor further comprises a hinge and transmembrane domain, an intracellular co-stimulatory domain, and an intracellular primary stimulatory domain.

3. The engineered immune cell of claim 2, wherein:

the hinge and transmembrane domain in the chimeric antigen receptor comprises at least one amino acid sequence selected from the following group: amino acid sequences of α and β chains from T cell receptors, CD3δ, CD3ε, CD3γ, CD3ζ chain, CD4, CD5, CD8α, CD8β, CD9, CD16, CD22, CD28, CD32, CD33, CD34, CD35, CD37, CD45, CD64, CD80, CD86, CD137, ICOS, CD154, FAS, FGFR2B, OX40, or VEGFR2; or the intracellular co-stimulatory domain in the chimeric antigen receptor comprises at least one selected from the following group: CD2, CD4, CD5, CD8α, CD8β, CD27, CD28, CD30, CD40, 4-1BB (CD137), ICOS, OX40, LIGHT (CD258) or NKG2C; or the intracellular primary stimulatory domain in the chimeric antigen receptor comprises at least one selected from the following group: CD3δ, CD3ε, CD3γ, CD3ζ, FcRβ, FcRγ, CD5, CD66d, CD22, CD79a or CD79b.

4. The engineered immune cell of claim 1, wherein the engineered immune cell further comprises a CD7 blocking molecule, which can prevent the transport and expression of the CD7 protein on the cell surface; or the engineered immune cells are

deprived of the gene expression of CD7 through gene knockout technology.

5. The engineered immune cell of claim 4, wherein the CD7 blocking molecule prevents the CD7 protein from being transported to the cell surface specifically by connecting a CD7 binding domain to an intracellular anchoring domain.

6. The engineered immune cell of claim 5, wherein the CD7 binding domain is a part or all of the sequences of a human CD7-L extracellular domain, or is a protein having at least 90% sequence identity to the human CD7-L extracellular domain, and the amino acid sequence of the human CD7-L extracellular domain is as shown in SEQ ID NO. 5; or the CD7 binding domain is a scFv of an anti-CD7 monoclonal antibody TH69.

7. An engineered immune cell comprising a polynucleotide sequence encoding a chimeric antigen receptor, wherein the chimeric antigen receptor comprises a CD7-targeted antigen recognition domain, wherein the CD7-targeted antigen recognition domain in the chimeric antigen receptor is a scFv of an anti-CD7 monoclonal antibody TH69, or has at least 90% sequence identity to the scFv of the anti-CD7 monoclonal antibody TH69, and the amino acid sequence of the scFv of the anti-CD7 monoclonal antibody TH69 is as shown in SEQ ID NO. 8; and the engineered immune cell further comprises a CD7 blocking molecule, which can prevent the transport and expression of the CD7 protein on the cell surface, or the engineered immune cells are deprived of the gene expression of CD7 through gene knockout technology.

8. The engineered immune cell of claim 7, wherein the CD7 blocking molecule prevents the CD7 protein from being transported to the cell surface by connecting a CD7 binding domain to an intracellular anchoring domain.

9. The engineered immune cell of claim 8, wherein the CD7 binding domain

is a part or all of the sequences of a human CD7-L extracellular domain, or has at least 90% sequence identity to the human CD7-L extracellular domain, and the amino acid sequence of the human CD7-L extracellular domain is as shown in SEQ ID NO. 5.

10. A nucleic acid molecule, comprising:

(1) a polynucleotide sequence encoding the chimeric antigen receptor described in claim 1; and

(2) a nucleic acid sequence encoding a CD7 blocking molecule, wherein, the CD7 binding domain of the CD7 blocking molecule is a part or all of the sequences of a human CD7-L extracellular domain, or is a protein having at least 90% sequence identity to the human CD7-L extracellular domain; or the CD7 binding domain of the CD7 blocking molecule is a scFv of an anti-CD7 monoclonal antibody TH69, or has at least 90% sequence identity to the scFv of the anti-CD7 monoclonal antibody TH69.

11. A recombinant vector, comprising the nucleic acid molecule of claim 10.

12. The recombinant vector of claim 11, wherein the vector is selected from a retrovirus, a lentivirus, or a transposon.

13. The recombinant vector of claim 11, wherein the nucleic acid molecule encoding the chimeric antigen receptor is connected to the nucleic acid molecule encoding the CD7 blocking molecule in the vector via an internal ribosome entry site or a ribosomal codon skipping site.

14. A reagent combination, comprising:

(1) the recombinant vector comprising a polynucleotide sequence encoding the chimeric antigen receptor described in claim 1, and

(2) the recombinant vector comprising a nucleic acid sequence encoding a CD7 blocking molecule, wherein, the CD7 binding domain of the CD7 blocking molecule is a part or all of the sequences of a human CD7-L extracellular domain, or is a protein

having at least 90% sequence identity to the human CD7-L extracellular domain; or the CD7 binding domain of the CD7 blocking molecule is a scFv of an anti-CD7 monoclonal antibody TH69, or has at least 90% sequence identity to the scFv of the anti-CD7 monoclonal antibody TH69.

15. The engineered immune cell of claim 6, wherein:

the nucleotide sequence of the nucleic acid molecule encoding the CD7-targeted antigen recognition domain in the chimeric antigen receptor is as shown in SEQ ID NO. 9,

the coding sequence of the nucleic acid molecule of the CD7 blocking molecule is as shown in SEQ ID NO. 10 or is as shown in SEQ ID NO. 11.

16. The engineered immune cell of claim 7, wherein:

the nucleotide sequence of the nucleic acid molecule encoding the CD7-targeted antigen recognition domain in the chimeric antigen receptor is as shown in SEQ ID NO. 18,

the coding sequence of the nucleic acid molecule of the CD7 blocking molecule is as shown in SEQ ID NO. 10.

17. The nucleic acid molecule of claim 10, wherein:

the nucleotide sequence of the nucleic acid molecule encoding the CD7-targeted antigen recognition domain in the chimeric antigen receptor is as shown in SEQ ID NO. 9,

the coding sequence of the nucleic acid molecule of the CD7 blocking molecule is as shown in SEQ ID NO. 10 or is as shown in SEQ ID NO. 11.

18. The reagent combination of claim 14, wherein:

the nucleotide sequence of the nucleic acid molecule encoding the CD7-targeted antigen recognition domain in the chimeric antigen receptor is as shown in SEQ ID NO. 9,

the coding sequence of the nucleic acid molecule of the CD7 blocking molecule

is as shown in SEQ ID NO. 10 or is as shown in SEQ ID NO. 11.

19. A method of treating CD7-positive hematological malignancies, wherein, the method comprises administering to a subject in need thereof the engineered immune cell of claim 1.

20. A method of treating CD7-positive hematological malignancies, wherein, the method comprises administering to a subject in need thereof the engineered immune cell of claim 7.