What is claimed is:

1. A conjugate comprising (i) a target binding moiety, (ii) at least one toxin, and (iii) optionally at least one linker connecting said target binding moiety with said at least one toxin, wherein said target binding moiety binds to CD20 and wherein said at least one toxin is an amatoxin.

2. Conjugate according to claim 1, wherein said target binding moiety is selected from the group consisting of
(i) an antibody, preferably a monoclonal antibody,
(ii) an antigen-binding fragment thereof, preferably a variable domain (Fv), a Fab fragment or an $F(ab)_2$ fragment,
(iii) an antigen-binding derivative thereof, preferably a single-chain Fv (scFv), and
(iv) an antibody-like protein,
each binding to CD20, respectively.

3. Conjugate according to claim 2, wherein said antibody, or antigen-binding fragment thereof or antigen-binding derivative thereof, is a murine, a chimeric, a humanized or a human antibody, or antigen-binding fragment or antigen-binding derivative thereof, respectively.

4. Conjugate according to claim 2, wherein said antibody, or antigen-binding fragment thereof, or antigen-binding derivative thereof, respectively, is selected from the group consisting of rituximab, obinutuzumab, ibritumomab, tositumomab, ofatumumab, ocrelizumab, and ublituximab.

5. Conjugate according to any one of claims 2 – 4, wherein said antibody has been genetically engineered to comprise a heavy chain 118Cys, a heavy chain 239Cys, or heavy chain 265Cys according to the EU numbering system, preferably a heavy chain 265Cys according to the EU numbering system, and wherein said linker, if present, or said amatoxin is connected to said antibody via said heavy chain 118Cys, or said heavy chain 239Cys, or heavy chain 265Cys residue, respectively.

6. Conjugate according to any one of claims 2 – 4, wherein said linker, if present, or said amatoxin is connected to said antibody via any of the natural Cys residues of said antibody, preferably via a disulfide linkage.

7. Conjugate according to any one of claims 4 – 6, wherein said antibody is rituximab or rituximab that has been genetically engineered to comprise a heavy chain 265Cys according to the EU numbering system.

8. Conjugate according to any one of claims 4 – 6, wherein said antibody is rituximab and wherein the said linker, if present, or said amatoxin is connected to rituximab via any of the naturally occuring Cys residues which form the interchain disulfide bonds of rituximab.

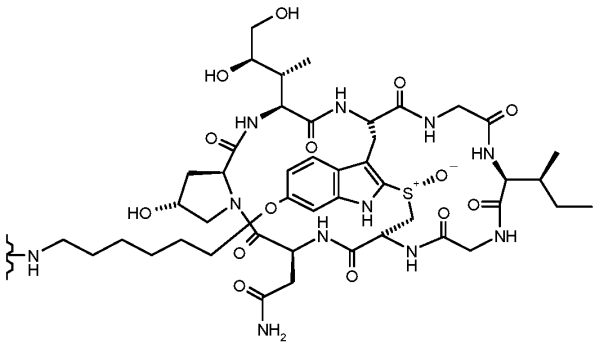
9. Conjugate according to any one of claims 1 – 8, wherein said linker is a non-cleavable or a cleavable linker.

10. Conjugate according to claim 9, wherein said cleavable linker is selected from the group consisting of an enzymatically cleavable linker, preferably a protease-cleavable linker, and a chemically cleavable linker, preferably a linker comprising a disulfide bridge.

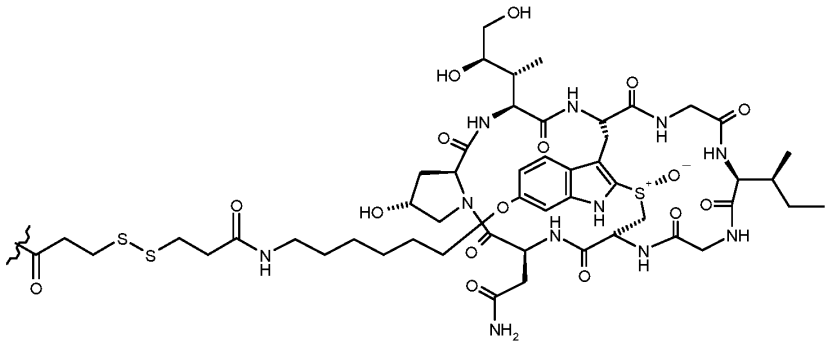
11. Conjugate according to any one of claims 1 – 10, wherein said amatoxin comprises (i) an amino acid 4 with a 6'-deoxy position and (ii) an amino acid 8 with an S-deoxy position.

12. Conjugate according to any one of claims 1 – 11, wherein said linker, if present, or said target binding moiety is connected to said amatoxin via (i) the γ C-atom of amatoxin amino acid 1, or (ii) the δ C-atom of amatoxin amino acid 3, or (iii) the 6'-C-atom of amatoxin amino acid 4.

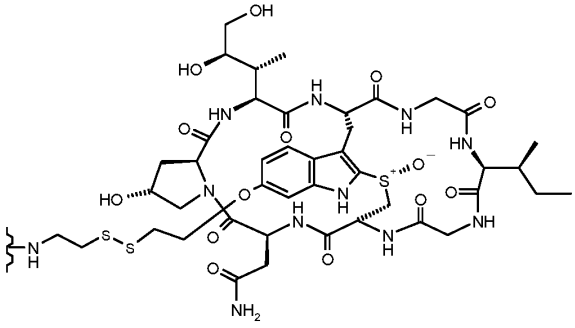
13. Conjugate according to any one of claims 1 – 11, wherein said conjugate is comprising any of the following compounds of formulas (I) to (XII), respectively, as linker-amatoxin moieties:



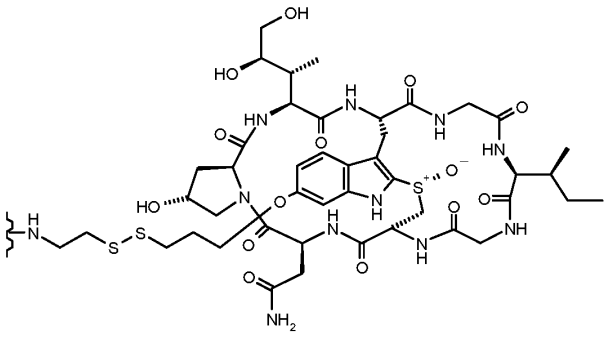
(I)



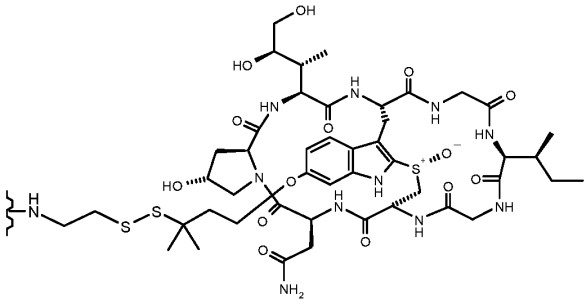
(II)



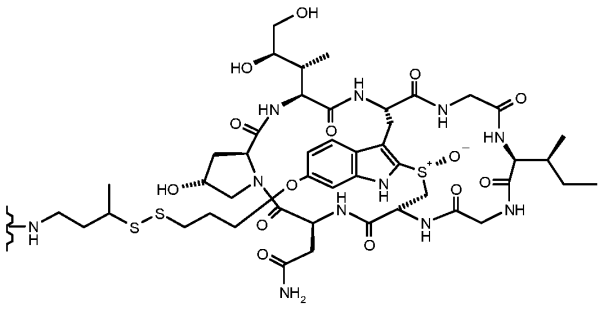
(III)



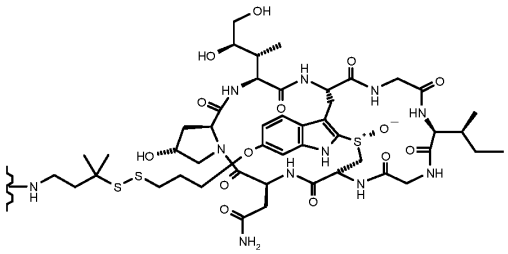
(IV)



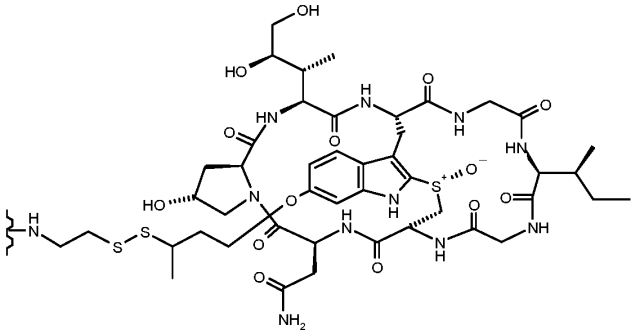
(V)



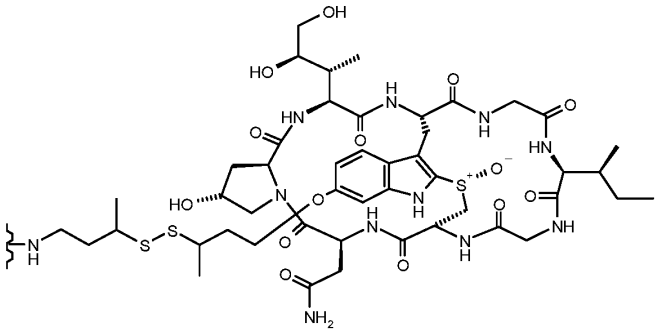
(VI)



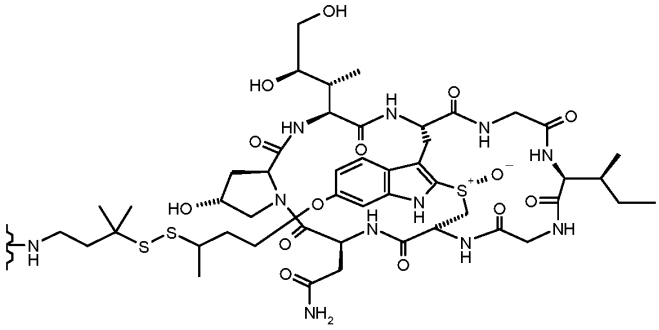
(VII)



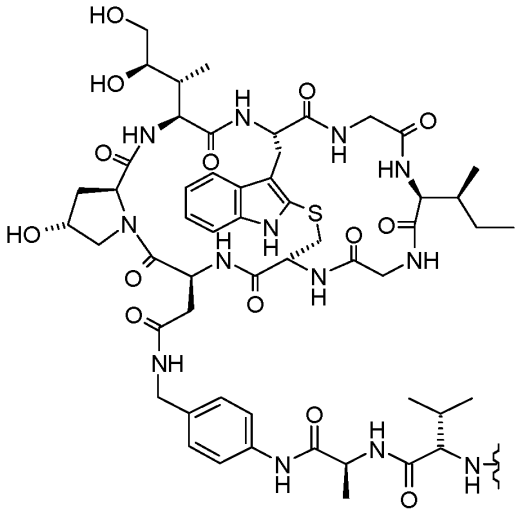
(VIII)



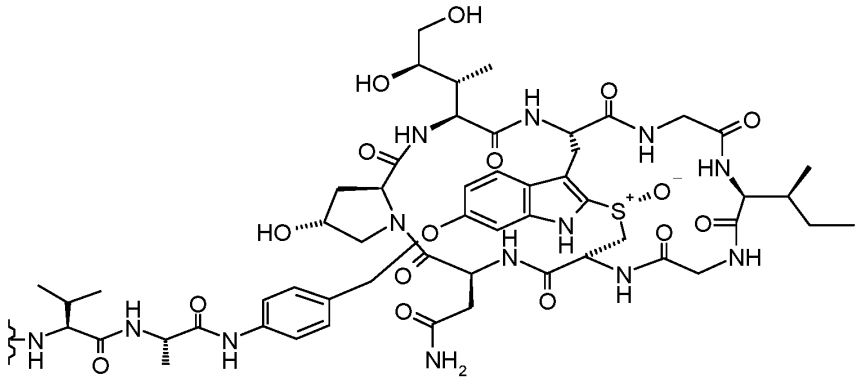
(IX)



(X)

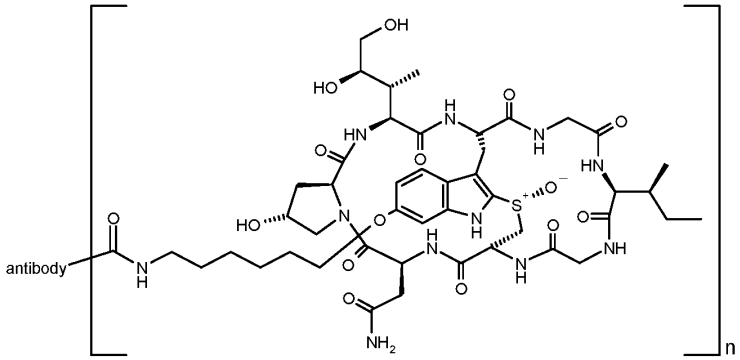


(XI)

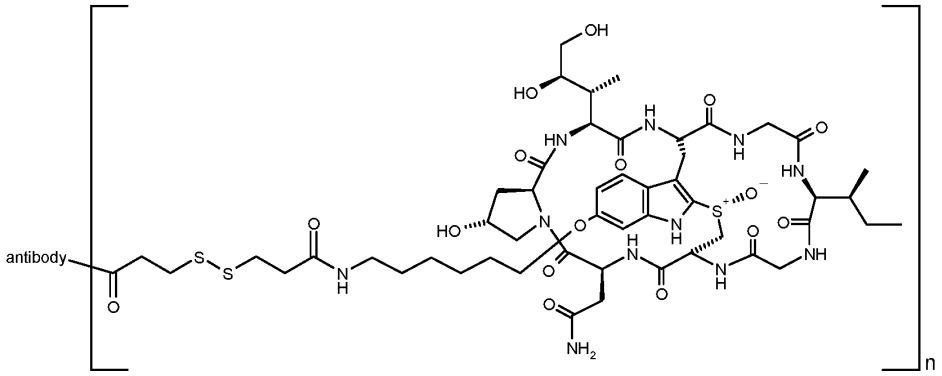


(XII)

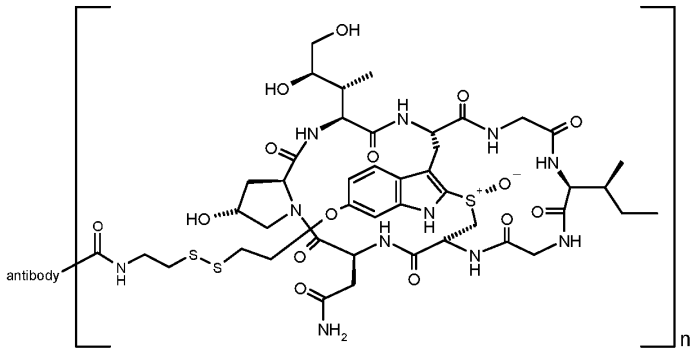
14. Conjugate according to any one of claims 2 – 5, wherein said conjugate is comprising an antibody as target binding moiety conjugated to amatoxin linker moieties according to any one of formula XIII to XXII



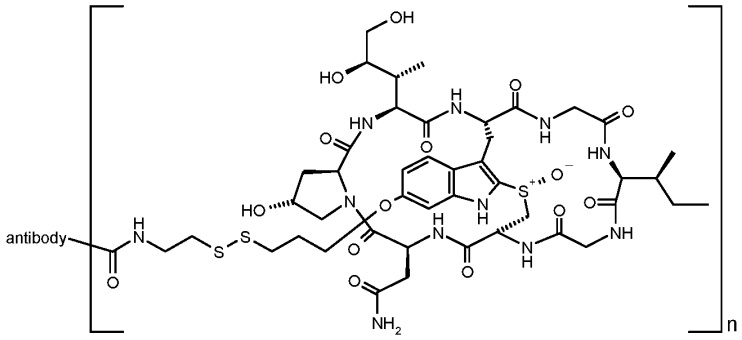
(XIII)



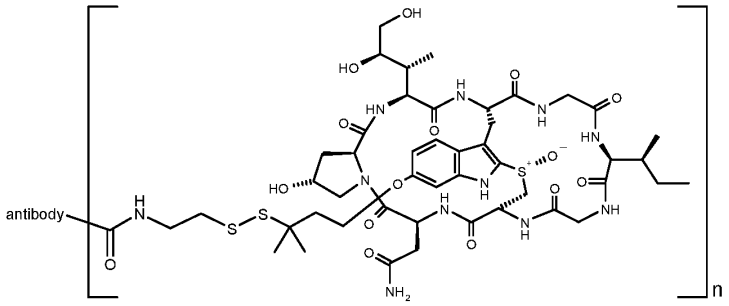
(XIV)



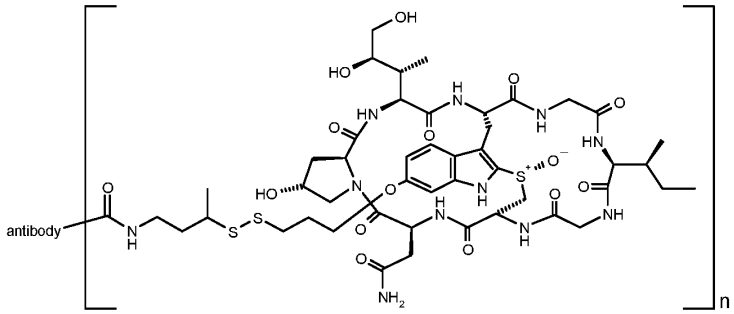
(XV)



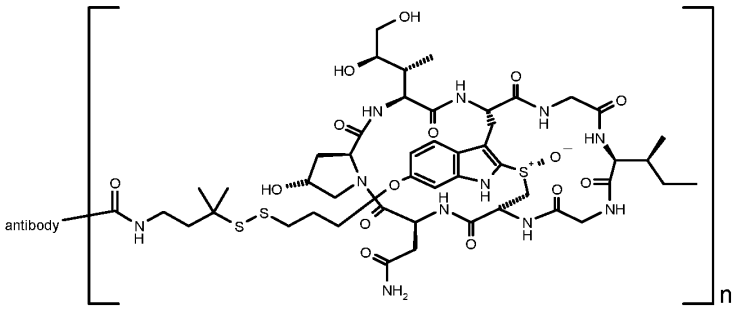
(XVI)



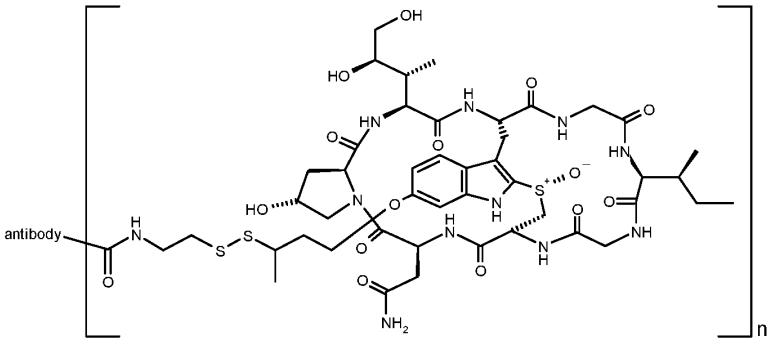
(XVII)



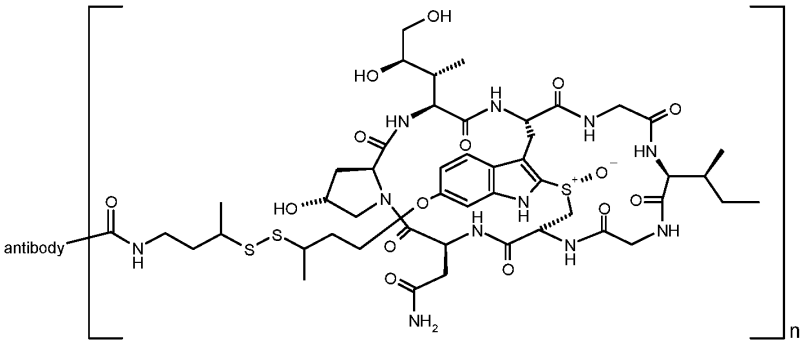
(XVIII)



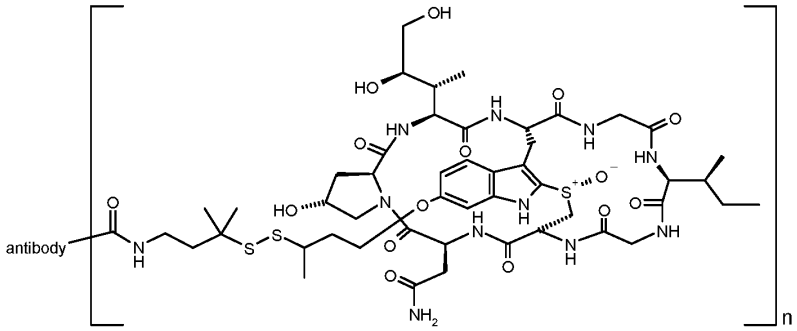
(XIX)



(XX)



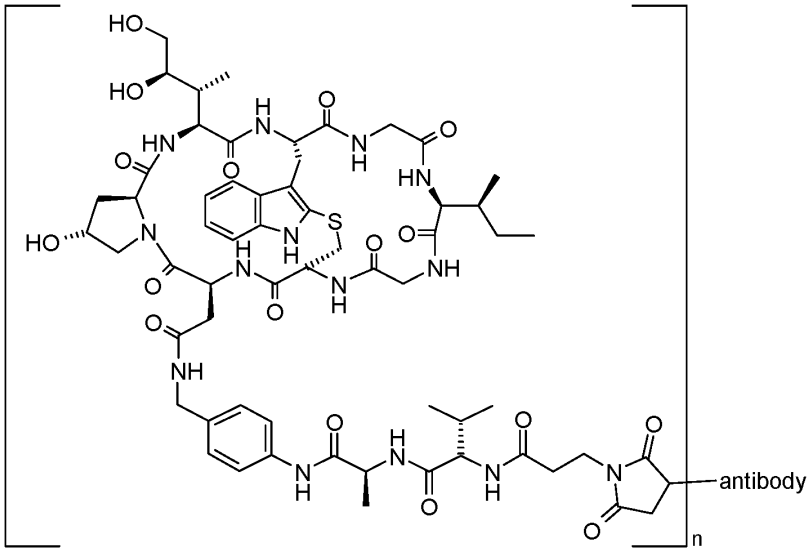
(XXI)



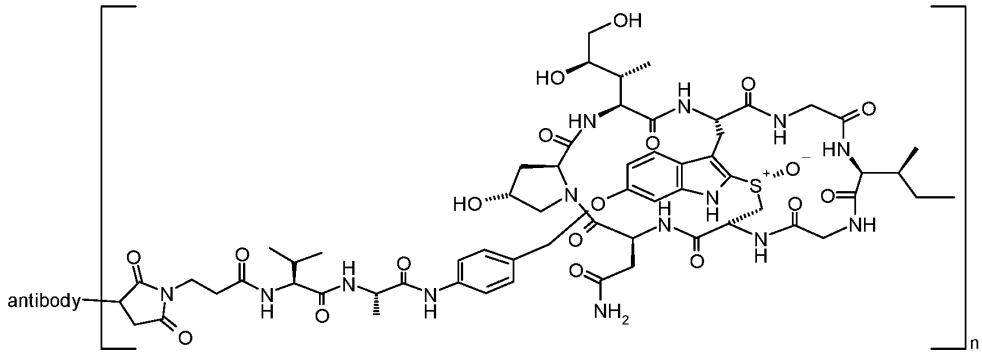
(XXII)

wherein said amatoxin linker moieties are coupled to ε-amino groups of naturally occurring lysine residues of said antibody, and wherein n is preferably from 1 to 7.

15. Conjugate according to any one of claims 2 – 5, wherein said conjugate is comprising an antibody as target binding moiety conjugated to amatoxin linker moieties according to any one of formula XXIII to XXIV



(XXIII)

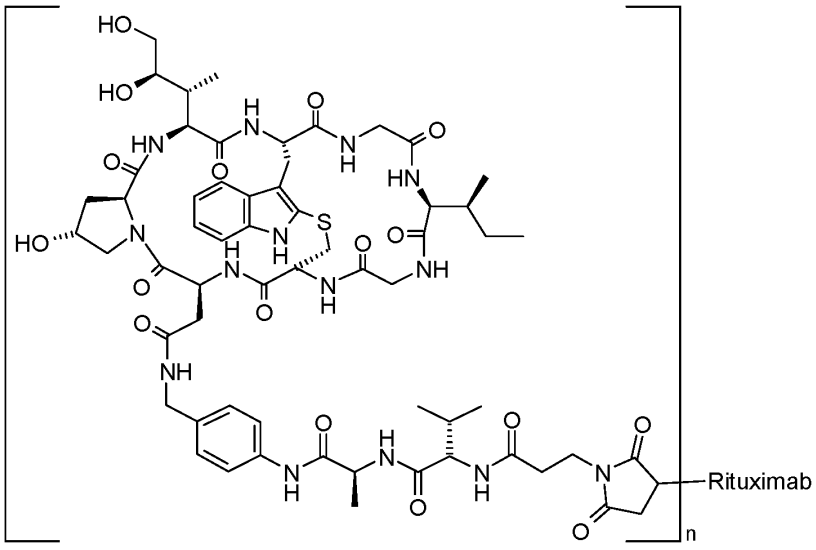


(XXIV)

wherein said amatoxin linker moieties are coupled to the thiol groups of cysteine residues of the antibody, and wherein n is preferably from 1 to 7.

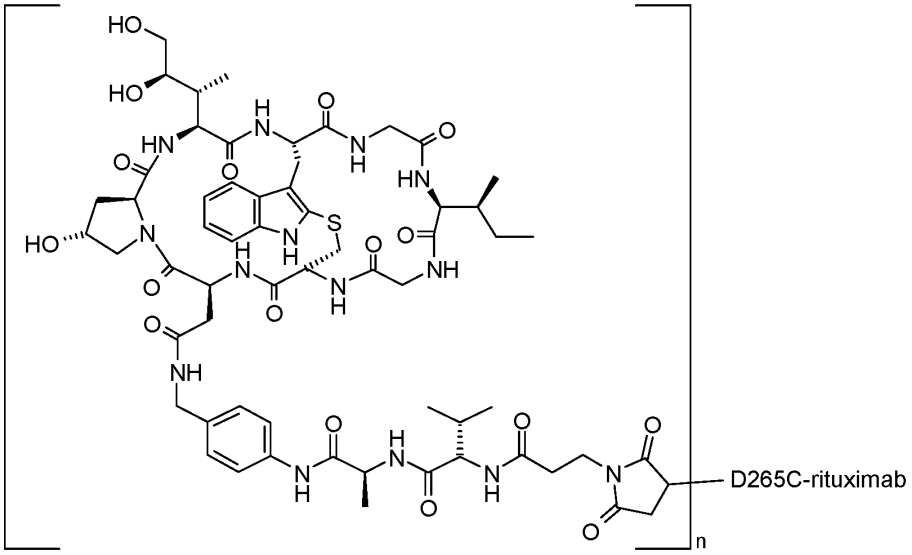
16. Conjugate according to claim 2, wherein said conjugate is selected from the group consisting of

(i) a conjugate comprising the antibody rituximab as target binding moiety conjugated to at least one amatoxin-linker moiety of formula (XI) via thioether linkage to at least one naturally occuring Cys residue of rituximab, according to formula XXV



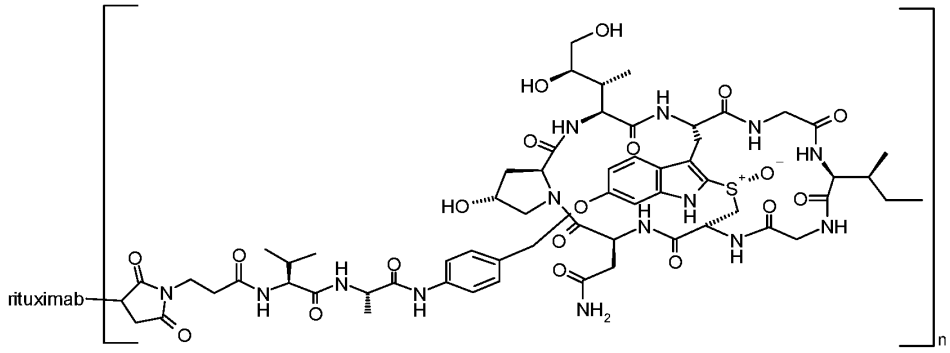
(XXV),

(ii) a conjugate comprising the antibody rituximab genetically engineered to comprise a heavy chain 265Cys according to the EU numbering system as target binding moiety conjugated to an amatoxin linker moiety of formula (XI) via thioether linkage to said heavy chain 265Cys residue of said genetically engineered rituximab, according to formula XXVI



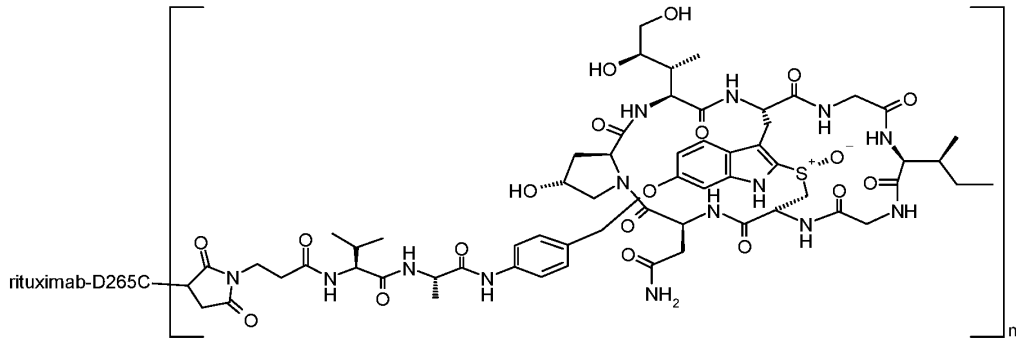
(XXVI),

(iii) a conjugate comprising the antibody rituximab as target binding moiety conjugated to at least one amatoxin-linker moiety of formula (XII) via thioether linkage to at least one naturally occuring Cys residue of rituximab, according to formula XXVII



(XXVII), and

(iv) a conjugate comprising the antibody rituximab genetically engineered to comprise a heavy chain 265Cys according to the EU numbering system as target binding moiety conjugated to an amatoxin linker moiety of formula (XII) via thioether linkage to said heavy chain 265Cys residue of said genetically engineered rituximab, according to formula XXVIII



(XXVIII),

wherein n is 1 to 7 for (i), (iii), and n is 1 to 2 for (ii), (iv).

17. A pharmaceutical composition comprising the conjugate of any one of claims 1 – 16.

18. The pharmaceutical composition according to claim 17, further comprising one or more pharmaceutically acceptable buffers, surfactants, diluents, carriers, excipients, fillers, binders, lubricants, glidants, disintegrants, adsorbents, and/or preservatives.

19. The conjugate of any one of claims 1 – 16 or the pharmaceutical composition of any of claims 17 – 18 for use in the treatment of B lymphocyte-associated malignancies or B cell-mediated autoimmune diseases, in particular for use in the treatment of non-Hodgkin's lymphoma, follicular lymphoma, diffuse large B cell non-Hodgkin's lymphoma, chronic lymphocytic leukaemia, Richter syndrome, rheumatoid arthritis, granulomatosis with polyangiitis and microscopic polyangiitis and pemphigus vulgaris.

20. Use of the conjugate of any one of claims 1 – 16 or the pharmaceutical composition of any one of claims 17 – 18 for treatment of B lymphocyte-associated malignancies or B cell-mediated autoimmune diseases, in particular for treatment of non-Hodgkin's lymphoma, follicular lymphoma, diffuse large B cell non-Hodgkin's lymphoma, chronic lymphocytic leukaemia, Richter syndrome, rheumatoid arthritis, granulomatosis with polyangiitis and microscopic polyangiitis and pemphigus vulgaris.

21. A method of treating a patient suffering from a B lymphocyte-associated malignancy or B cell-mediated autoimmune disease, comprising administering an effective amount of a conjugate according to any one of claims 1-16 or the pharmaceutical composition of any one of claims 17 – 18 to the patient.