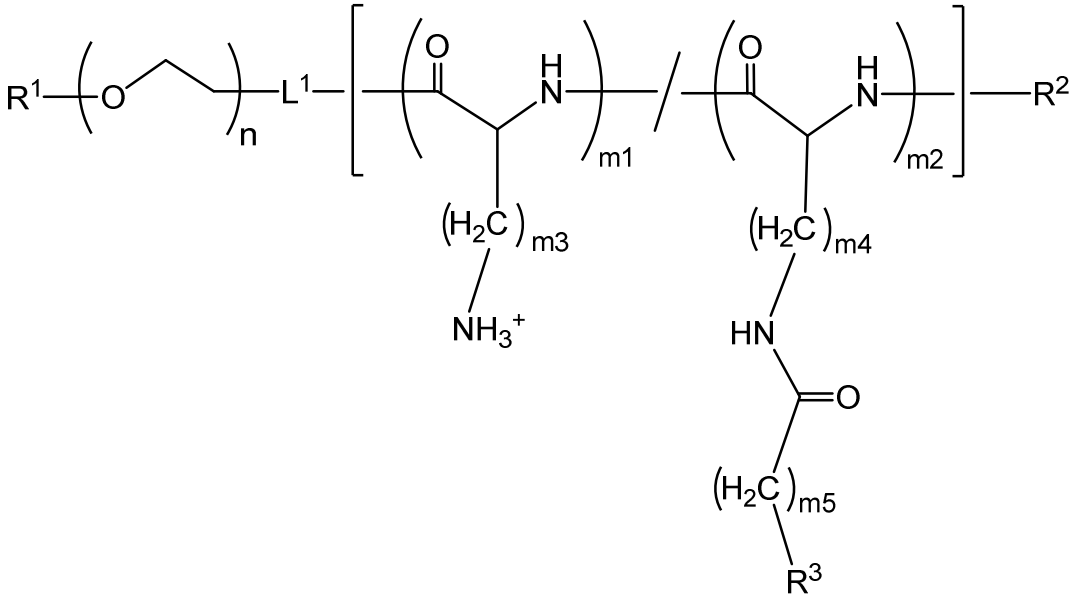
CLAIMS

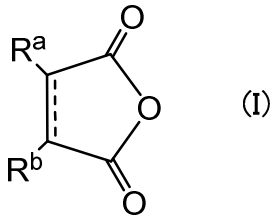
1. A polymeric complex comprising a protein and a block copolymer represented by the following formula (1):



(1)

[wherein R^1 and R^2 each independently represent a hydrogen atom, or an optionally substituted linear or branched alkyl group containing 1 to 12 carbon atoms, or an azide, an amine, maleimide, a ligand or a labeling agent,

R^3 represents a compound represented by the following formula (I):



(I)

(wherein R^a and R^b each independently represent a hydrogen atom, or an optionally substituted alkyl group, an alkenyl group, a cycloalkyl group, an aryl group, an aralkyl group, an acyl group, a heterocyclic group, a heterocyclic alkyl group, a hydroxy group, an alkoxy group or an aryloxy group. Alternatively, R^a and R^b may be joined with each other to form an aromatic ring or a cycloalkyl ring together with the carbon atoms to which they are attached respectively. The bond between the carbon atoms to which R^a and R^b are attached respectively may be a single bond or a double bond),

L^1 represents NH, CO, or a group represented by the following formula (11):

$$-(CH_2)_{p1}-NH- \qquad (11)$$

(wherein p1 represents an integer of 1 to 6), or

a group represented by the following formula (12):

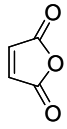
$$-L^{2a}-(CH_2)_{q1}-L^{3a}- \qquad (12)$$

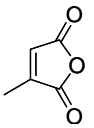
(wherein L^{2a} represents OCO, OCONH, NHCO, NHCOO, NHCONH, CONH or COO, L^{3a} represents NH or CO, and q1 represents an integer of 1 to 6),

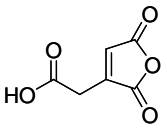
m1 and m2 each independently represent an integer greater than 0 and up to 500 provided that the sum of m1 and m2 represents an integer of 10 to 500, m3, m4 and m5 each independently represent an integer of 1 to 5, and n represents an integer greater than 0 and up to 500, and

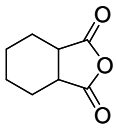
the symbol "/" means that (m1 + m2) units of the respective monomer units shown on the left and right sides of this symbol may be in any sequence].

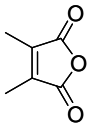
wherein the compound represented by formula (I) is at least one of compounds represented by the following formulae (Ia) to (Ig).

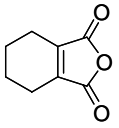

(Ia)

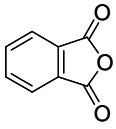

(Ib)


(Ic)

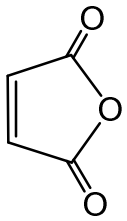

(Id)

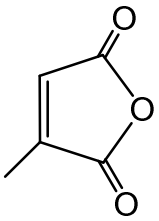

(Ie)


(If)

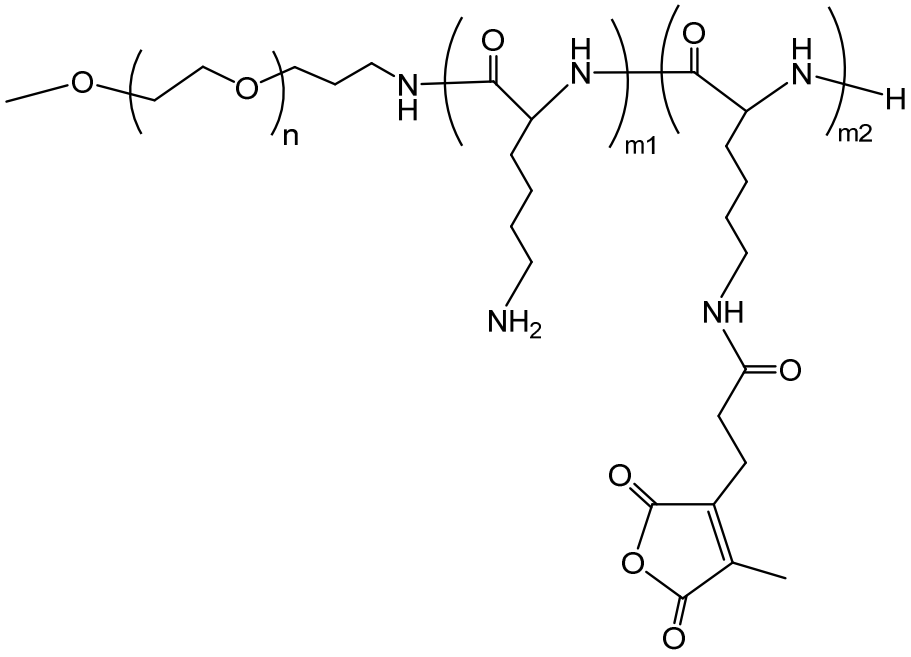

(Ig)

2. The complex according to claim 1, wherein the compound represented by formula (I) is a compound represented by the following formula (Ia) or (Ib).


(Ia)


(Ib)

3. The complex according to claim 1, wherein the block copolymer represented by formula 1 is a block copolymer represented by the following formula (2).



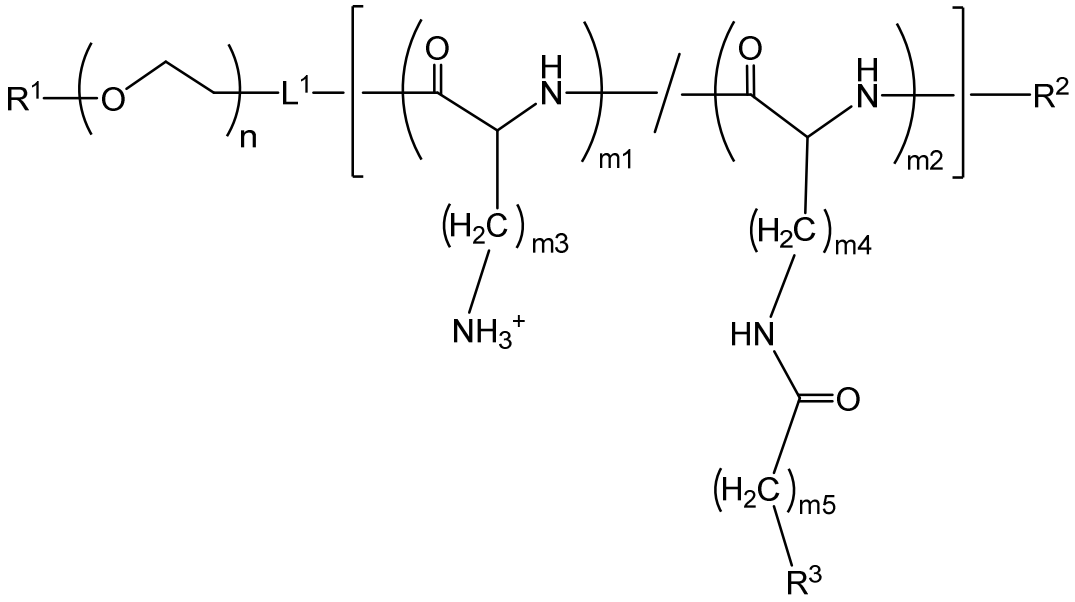
(2)

4. The complex according to claim 1, wherein the protein is covalently bonded to the block copolymer represented by formula 1.

5. The complex according to claim 4, wherein the covalent bond is cleaved in a pH-dependent manner.

6. A protein delivery device comprising the polymeric complex according to any one of claims 1 to 5 for use in protein delivery to any site selected from a cell surface site, an intracellular site and an extracellular site.

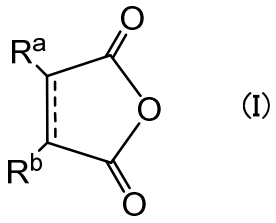
7. A protein delivery kit comprising a block copolymer represented by the following formula (1) for use in protein delivery to any site selected from a cell surface site, an intracellular site and an extracellular site:



(1)

[wherein R^1 and R^2 each independently represent a hydrogen atom, or an optionally substituted linear or branched alkyl group containing 1 to 12 carbon atoms, or an azide, an amine, maleimide, a ligand or a labeling agent,

R^3 represents a compound represented by the following formula (I):



(I)

(wherein R^a and R^b each independently represent a hydrogen atom, or an optionally substituted alkyl group, an alkenyl group, a cycloalkyl group, an aryl group, an aralkyl group, an acyl group, a heterocyclic group, a heterocyclic alkyl group, a hydroxy group, an alkoxy group or an aryloxy group. Alternatively, R^a and R^b may be joined with each other to form an aromatic ring or a cycloalkyl ring together with the carbon atoms to which they are attached respectively. The bond between the carbon atoms to which R^a and R^b are attached respectively may be a single bond or a double bond),

L^1 represents NH, CO, or a group represented by the following formula (11):

$$-(CH_2)_{p1}-NH- \qquad (11)$$

(wherein p1 represents an integer of 1 to 6), or
a group represented by the following formula (12):

$$-L^{2a}-(CH_2)_{q1}-L^{3a}- \qquad (12)$$

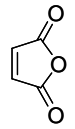
(wherein L^{2a} represents OCO, OCONH, NHCO, NHCOO, NHCONH, CONH or COO, L^{3a} represents NH or CO, and q1 represents an integer of 1 to 6),

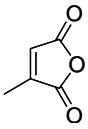
m1 and m2 each independently represent an integer greater than 0 and up to 500 (provided that the sum of m1 and m2 represents an integer of 10 to 500), m3, m4 and m5 each independently represent an integer of 1 to 5, and n represents an integer greater than

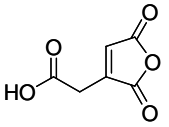
0 and up to 500, and

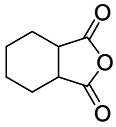
the symbol "/" means that (m1 + m2) units of the respective monomer units shown on the left and right sides of this symbol may be in any sequence] ,

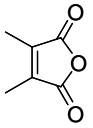
wherein the compound represented by formula (I) is at least one of compounds represented by the following formulae (Ia) to (Ig).

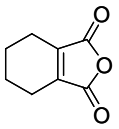

(Ia)

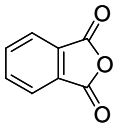

(Ib)


(Ic)

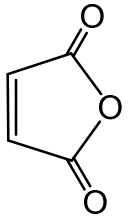

(Id)

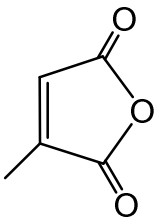

(Ie)


(If)

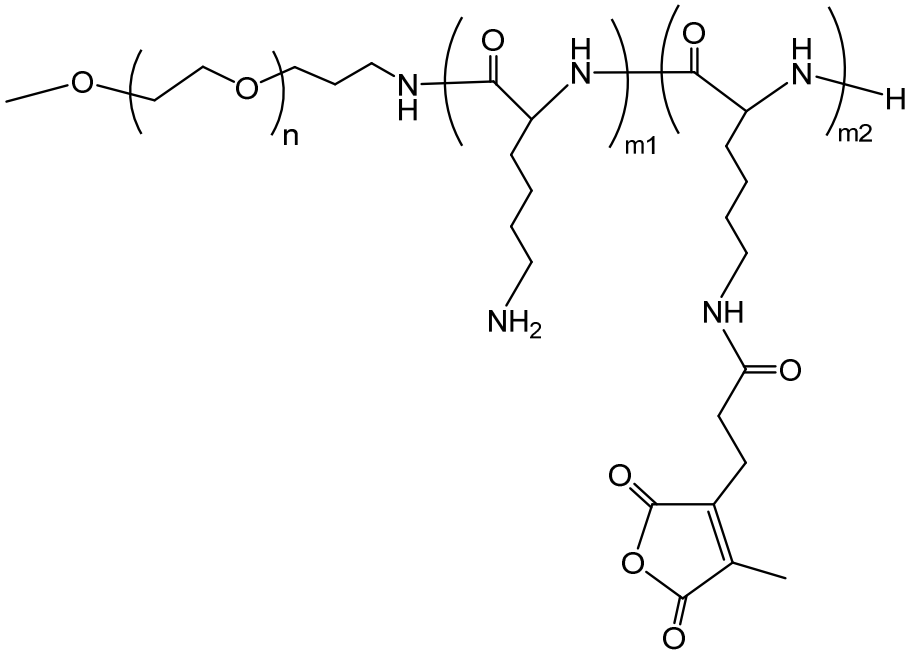

(Ig)

8. The kit according to claim 7, wherein the compound represented by formula (I) is a compound represented by the following formula (Ia) or (Ib).


(Ia)


(Ib)

9. The kit according to claim 7, wherein the block copolymer represented by formula 1 is a block copolymer represented by the following formula (2).



(2)