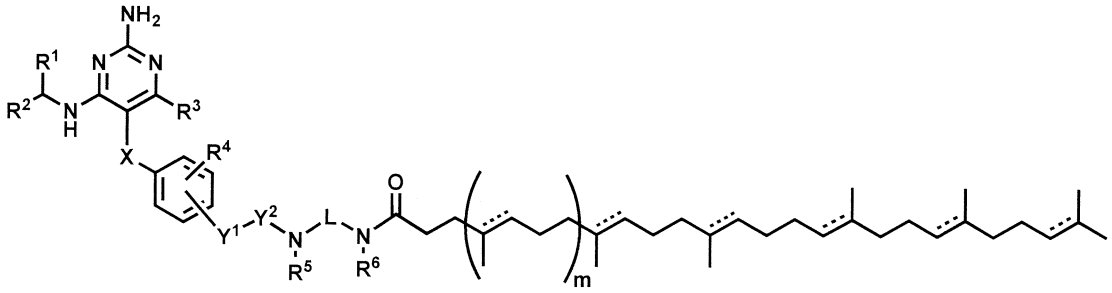
CLAIMS

1. A compound of the formula (1) or a pharmaceutically acceptable salt thereof:



(1)

wherein

X is methylene, oxygen atom, sulfur atom, SO, SO_2 or NR^7 wherein R^7 is hydrogen atom or an alkyl group of 1 to 3 carbon atoms;

R^1 and R^2 are independently hydrogen atom or a substituted or unsubstituted alkyl group of 1 to 6 carbon atoms, provided that when the alkyl group is substituted, it is substituted with 1 to 4 same or different substituents selected from the group consisting of hydroxy group, halogen atom and an alkoxy group of 1 to 6 carbon atoms;

R^3 is an alkyl group of 1 to 6 carbon atoms, an alkoxy group of 1 to 6 carbon atoms or an alkylthio group of 1 to 6 carbon atoms;

R^4 is hydrogen atom, halogen atom, hydroxy group, an alkyl group of 1 to 6 carbon atoms, an alkoxy group of 1 to

6 carbon atoms or cyano group;

Y^1 is a single bond, $-(CR^9R^{10})_p-$, $-CH=CH-(CR^9R^{10})_q-$, $-C\equiv C-(CR^9R^{10})_{q'}-$ or $-(CR^9R^{10})_r-O-(CR^{9'}R^{10'})_{r'}-$ wherein R^9, R^{10}, $R^{9'}$, and $R^{10'}$ are independently hydrogen atom or an alkyl group of 1 to 4 carbon atoms;

Y^2 is a single bond or $-C(O)-$;

L is a substituted or unsubstituted straight chain alkylene of 2 to 6 carbon atoms or a divalent group derived from 4- to 8-membered cycloalkane, provided that when the straight chain alkylene or the cycloalkane is substituted, it is substituted with 1 to 4 same or different substituents selected from the group consisting of alkyl group of 1 to 5 carbon atoms, hydroxy group and halogen atom, and any one of the methylene group in the straight chain alkylene of L is optionally replaced with carbonyl group;

R^5 and R^6 are independently hydrogen atom or a substituted or unsubstituted alkyl group of 1 to 6 carbon atoms, or either R^5 or R^6 is bonded to any carbon atom of L to form a 4- to 8-membered nitrogen-containing saturated heterocycle, or R^5 and R^6 are taken together to form a substituted or unsubstituted 5- to 8-membered nitrogen-containing saturated heterocycle; provided that when the alkyl group is substituted, it is substituted with same or different 1 to 4 substituents selected from the group

consisting of hydroxy group and halogen atom; when the 4- to 8-membered nitrogen-containing saturated heterocycle or the 5- to 8-membered nitrogen-containing saturated heterocycle is substituted, it is substituted with same or different 1 to 4 substituents selected from the group consisting of methyl group, ethyl group, propyl group, hydroxymethyl group, hydroxyethyl group, carbonyl group, hydroxy group and halogen atom;

m is 0 or 1;

p is an integer of 1 to 6;

q and q' are independently an integer of 0 to 4;

r is an integer of 0 to 5, and r' is an integer of 1 to 5, provided that r' is an integer of 2 or more when the sum of r and r' is 5 or less and Y^2 is a single bond; and

------ is independently a single bond or a double bond.

2. The compound or a pharmaceutically acceptable salt thereof according to claim 1 wherein X is methylene, oxygen atom or NR^7 wherein R^7 is hydrogen atom or an alkyl group of 1 to 3 carbon atoms; R^1 and R^2 are independently hydrogen atom or a substituted or unsubstituted alkyl group of 1 to 6 carbon atoms, provided that when the alkyl group is substituted, it is substituted with 1 to 4 same or different substituents selected from the group consisting of hydroxy group and halogen atom; R^3 is an alkyl group of

1 to 6 carbon atoms; and R^4 is hydrogen atom, halogen atom, hydroxy group, an alkyl group of 1 to 3 carbon atoms or an alkoxy group of 1 to 3 carbon atoms.

3. The compound or a pharmaceutically acceptable salt thereof according to claim 1 or 2 wherein ------ are all single bonds or all double bonds.

4. The compound or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 3 wherein Y^1 is a single bond or $-(CR^9R^{10})_p-$ wherein R^9 and R^{10} are independently hydrogen atom or an alkyl group of 1 to 4 carbon atoms; and Y^2 is a single bond or -C(O)-.

5. The compound or a pharmaceutically acceptable salt thereof according to claim 4 wherein Y^1 is a single bond; and Y^2 is -C(O)-.

6. The compound or a pharmaceutically acceptable salt thereof according to claim 4 wherein Y^1 is $-(CR^9R^{10})_p-$ wherein R^9 and R^{10} are independently hydrogen atom or an alkyl group of 1 to 4 carbon atoms; p is an integer of 1 to 3; and Y^2 is a single bond.

7. The compound or a pharmaceutically acceptable salt

thereof according to claim 3 wherein Y^1 is $-(CR^9R^{10})_r-O-(CR^{9'}R^{10'})_{r'}-$ wherein R^9, R^{10}, $R^{9'}$ and $R^{10'}$ are independently hydrogen atom or an alkyl group of 1 to 4 carbon atoms; r is 0 or 1; and r' is 1 or 2.

8. The compound or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 7 wherein L is a straight chain alkylene of 2 or 3 carbon atoms.

9. The compound or a pharmaceutically acceptable salt thereof according to claim 1

wherein

X is methylene;

R^1 is hydrogen atom or an alkyl group of 1 to 3 carbon atoms optionally substituted with hydroxyl group;

R^2 is hydrogen atom or an alkyl group of 1 to 6 carbon atoms;

R^3 is an alkyl group of 1 to 3 carbon atoms;

R^4 is hydrogen atom, halogen atom, hydroxy group, an alkyl group of 1 to 3 carbon atoms or an alkoxy group of 1 to 3 carbon atoms;

Y^1 is a single bond or methylene;

Y^2 is a single bond or $-C(O)-$;

L is a straight chain alkylene of 2 or 3 carbon atoms;

R^5 and R^6 are independently hydrogen atom or an alkyl

group of 1 to 3 carbon atoms, or R^5 and R^6 are taken together to form a substituted or unsubstituted 5- to 8-membered nitrogen-containing saturated heterocycle, provided that when the 5- to 8-membered nitrogen-containing saturated heterocycle is substituted, it is substituted with same or different 1 to 4 substituents selected from the group consisting of hydroxy group and halogen atom;

m is 0 or 1; and

$\overline{\overline{\text{------}}}$ are all double bond.

10. A pharmaceutical composition comprising the compound or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 9.

11. The pharmaceutical composition according to claim 10 comprising further an antigen.

12. The pharmaceutical composition according to claim 11 wherein the antigen is a pathogen-derived antigen or a tumor antigen.

13. The pharmaceutical composition according to claim 11 or 12 wherein the antigen is a peptide or a protein.

14. A vaccine adjuvant comprising the compound or a

pharmaceutically acceptable salt thereof according to any one of claims 1 to 9.

15. The compound or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 9 for use as a vaccine adjuvant.

16. Use of the compound or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 9 in the manufacture of a medicament for enhancing an antigen-specific immune reaction in a mammal.

17. Use of the compound or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 9 in the manufacture of a medicament for improving the immune response ability of a mammal.

18. Use of the compound or a pharmaceutically acceptable salt thereof according to any one of claims 1 to 9 for the manufacture of a vaccine adjuvant.