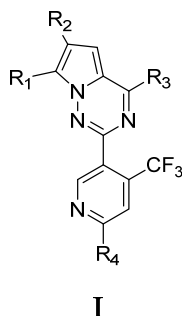


CLAIMS

1. A 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by a general formula I or a pharmaceutically acceptable salt thereof:



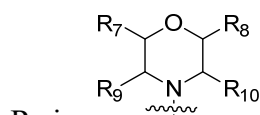
wherein,

R₁ is halogen, or C₁₋₆ alkyl or C₃₋₈ cycloalkyl which is unsubstituted or substituted with at least one substituent, wherein the substituent is halogen;

R₂ is: -C(OH)R₅R₆; -COC₁₋₆ alkyl; -CN; or, unsubstituted or at least one substituent substituted C₁₋₆ alkyl, -CH₂NH-C₁₋₆ alkyl, -CH₂N(C₁₋₆ alkyl) (C₁₋₆ alkyl), X-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), X-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms)-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), X-(saturated spiro-bicyclic group containing 1 to 2 heteroatoms and 4 to 8 carbon atoms), X-(saturated bicyclic bridged ring group containing 1 to 2 heteroatoms and 3 to 8 carbon atoms)-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), or X-(saturated bicyclic bridged ring group containing 1 to 2 heteroatoms and 3 to 8 carbon atoms); wherein the substituent is: halogen; -N(C₁₋₄ alkyl)(C₁₋₄ alkyl); -O-C₁₋₄ alkyl; -CN; -COOH; -CHO; -NHS(O)₂-C₁₋₄ alkyl; -N(C₁₋₄ alkyl)C(C₁₋₄ alkyl)(C₁₋₄ alkyl)-CONH₂; =O; -OH; -S(O)₂N(C₁₋₄ alkyl)(C₁₋₄ alkyl); -S-C₁₋₄ alkyl; -S(O)₂-C₁₋₄ alkyl; -CO-C₃₋₆ cycloalkyl; oxetanyl; morpholinyl; C₃₋₆ cycloalkyl; -C₁₋₄ alkyl-N(C₁₋₄ alkyl) (C₁₋₄ alkyl); C₁₋₄ alkyl-O-C₁₋₄ alkyl which is unsubstituted or substituted with at least one methyl; -CONH₂ which is unsubstituted or substituted with at least one methyl; C₁₋₄ alkyl-CONH₂ which is unsubstituted or substituted with at least one methyl; -COO-C₁₋₄ alkyl which is unsubstituted or substituted with at least one methyl; -NH₂ which is unsubstituted or substituted with at least one methyl; -NHCO-C₁₋₄ alkyl which is unsubstituted or substituted with at least one methyl; -CO-C₁₋₄ alkyl which is unsubstituted or substituted with at least one substituent A, wherein the substituent A is hydroxyl or methyl; or C₁₋₄ alkyl which is unsubstituted or substituted with at least one substituent B, wherein the substituent B is -NH₂, -OCH₃, -CONH₂, -OH or -CF₃;

in R₂, the heteroatom is selected from at least one of N, O and S, wherein X is CH₂, and wherein the heterocyclyl, the spirocyclic group and the bridged ring group, when present and directly bonding to the X, each contains at least one N atom and one of the N atom is connected to the X;

R₅ and R₆ are each independently hydrogen or C₁₋₆ alkyl;



, wherein R₇, R₈, R₉ and R₁₀ are each independently hydrogen or C₁₋₆ alkyl which is unsubstituted or substituted with at least one substituent, wherein the substituent is halogen

or hydroxyl;

R₄ is -NH₂, -NHCONHR₁₁ or -NHCO₂R₁₂, wherein R₁₁ and R₁₂ are each independently C₁₋₆ alkyl, C₃₋₈ cycloalkyl or phenyl which is unsubstituted or substituted with at least one substituent selected from at least one of halogen and -C(O)OR₁₃, wherein R₁₃ is C₁₋₆ alkyl which is unsubstituted or substituted with at least one substituent, and the substituent in the R₁₃ is halogen.

2. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 1 or a pharmaceutically acceptable salt thereof, wherein R₁ is halogen, or C₁₋₄ alkyl or C₃₋₆ cycloalkyl which is unsubstituted or substituted with at least one substituent.

3. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 2 or a pharmaceutically acceptable salt thereof, wherein R₁ is -Cl, -F, methyl, trifluoromethyl or difluoromethyl.

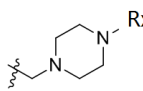
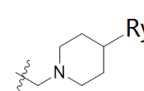
4. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 1 or a pharmaceutically acceptable salt thereof, wherein R₂ is: -C(OH)R₅R₆; -COC₁₋₄ alkyl; -CN; or, unsubstituted or at least one substituent substituted C₁₋₄ alkyl, -CH₂NH-C₁₋₄ alkyl, -CH₂N(C₁₋₄ alkyl)(C₁₋₄ alkyl), -X-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), -X-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms)-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), -X-(saturated bicyclic spirocyclic group containing 1 to 2 heteroatoms and 4 to 8 carbon atoms), -X-(saturated bicyclic bridged ring group containing 1 to 2 heteroatoms and 3 to 8 carbon atoms)-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), or -X-(saturated bicyclic bridged ring group containing 1 to 2 heteroatoms and 3 to 8 carbon atoms), wherein X is CH₂, and wherein the heterocyclyl, spirocyclic group and bridged ring group are connected to X via an N atom, R₅ and R₆ are each independently hydrogen or C₁₋₄ alkyl.

5. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 1 or a pharmaceutically acceptable salt thereof, wherein R₂ is: -C(OH)R₅R₆; -COC₁₋₄ alkyl; -CN; or, unsubstituted or at least one substituent substituted C₁₋₄ alkyl, -CH₂NH-C₁₋₄ alkyl, -CH₂N(C₁₋₄ alkyl)(C₁₋₄ alkyl), -X-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), -X-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms)-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), -X-(saturated bicyclic spirocyclic group containing 1 to 2 heteroatoms and 4 to 8 carbon atoms), -X-(saturated bicyclic bridged ring group containing 1 to 2 heteroatoms and 3 to 8 carbon atoms)-(saturated four- to six-membered heterocyclyl containing 1 to 2 heteroatoms), or -X-(saturated bicyclic bridged ring group containing 1 to 2 heteroatoms and 3 to 8 carbon atoms), wherein X is CH₂, and wherein the heterocyclyl, spirocyclic group and bridged ring group, when directly bonding to the X, are connected to X via an N atom, R₅ and R₆ are each independently hydrogen or C₁₋₄ alkyl;

wherein the substituent is -F, -Cl, -Br, -I, -CH₃, -CH₂CH₃, -CH₂CH(CH₃)₂, -CH₂NH₂, -CH₂N(CH₃)₂, -CH₂CH₂NH₂, -CH₂CH₂N(CH₃)₂, -CH₂OH, -CH₂OCH₃, -CH₂CH₂OH, -C(CH₃)₂OH, -C(CH₃)(CF₃)OH, -C(CF₃)₂OH, -C(CH₃)₂OCH₃, -C(CH₃)₂NH₂, -CH₂C(CH₃)₂OH, -CH(OH)CH(CH₃)₂, -C(CH₃)₂CH₂OH, -C(CH₃)₂CH₂OCH₃, -CN, -CF₃, -CO₂H, -CHO, -COCH₃, -CO₂CH₃, -CO₂C(CH₃)₃, -COCH₂OH, -COC(OH)(CH₃)₂, -COCH(OH)CH₃, -CONH₂, -CONHCH₃, -CON(CH₃)₂, -CH₂CONH₂, -CH₂CON(CH₃)₂, -C(CH₃)₂CONH₂, -NH₂, -NHCH₃, -N(CH₃)₂, -NHCOCH₃, -N(CH₃)COCH₃,

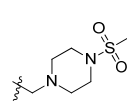
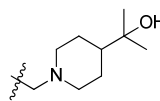
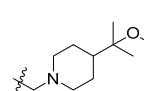
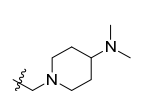
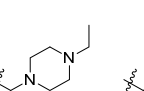
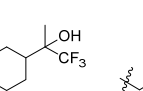
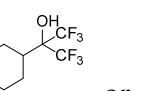
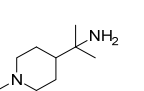
-NHS(O)₂CH₃, -N(CH₃)C(CH₃)₂CONH₂, =O, -OH, -OCH₃, -S(O)₂N(CH₃)₂, -SCH₃, -S(O)₂CH₃, -C(O)-cyclopropyl, cyclopropyl, cyclobutyl, oxetanyl or morpholinyl.

6. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I

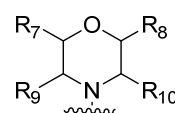
of claim 1 or a pharmaceutically acceptable salt thereof, wherein R₂ is  or ,

5 Rx and Ry are each -N(CH₃)₂, -S(O)₂CH₃ or C₁₋₄ alkyl, wherein the C₁₋₄ alkyl is unsubstituted or substituted with at least one substituent, the substituent is hydroxyl, -CONH₂, -CF₃, amino or -OCH₃.

7. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I

of claim 1 or a pharmaceutically acceptable salt thereof, wherein R₂ is , , , , , ,  or .

10 8. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I

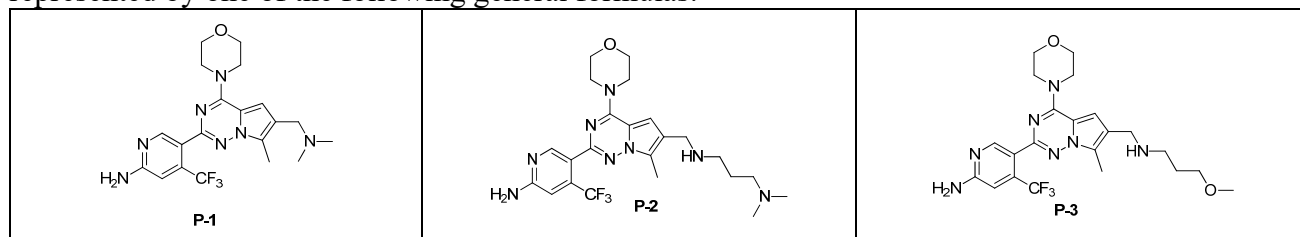
of claim 1 or a pharmaceutically acceptable salt thereof, wherein R₃ is , and wherein R₇, R₈, R₉ and R₁₀ are each independently hydrogen or C₁₋₄ alkyl.

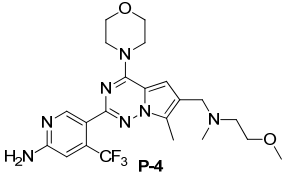
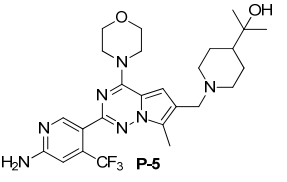
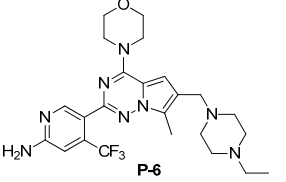
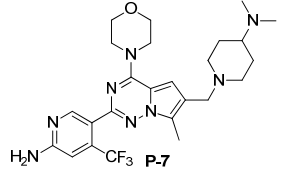
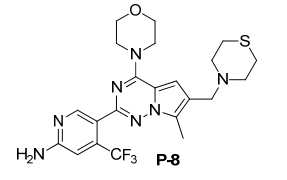
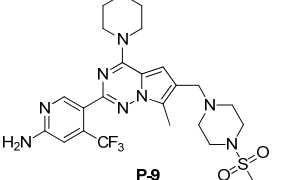
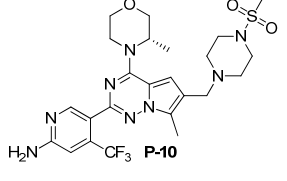
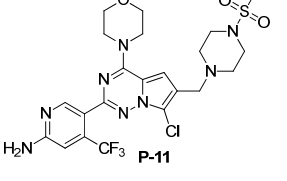
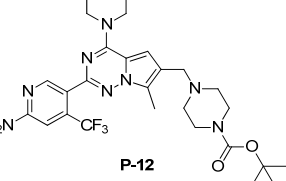
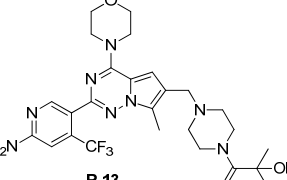
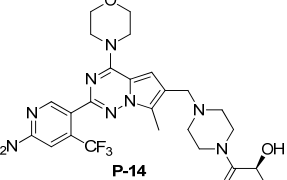
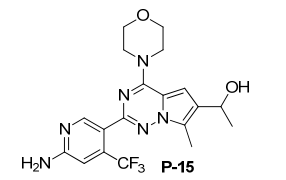
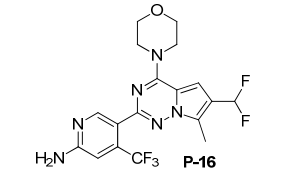
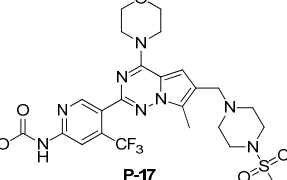
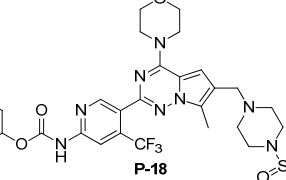
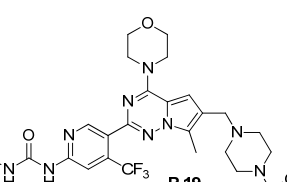
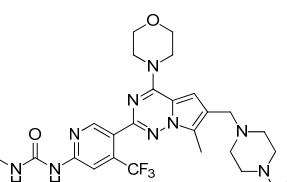
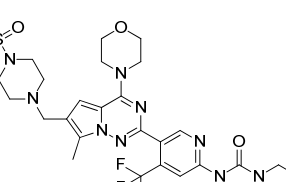
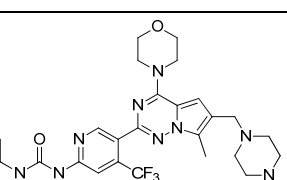
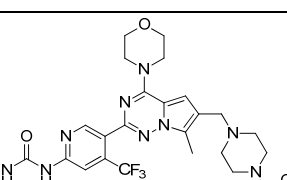
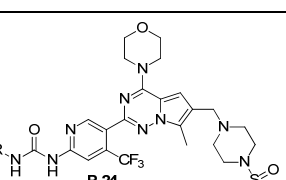
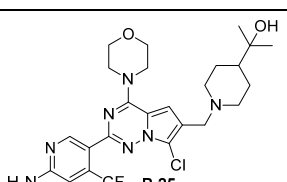
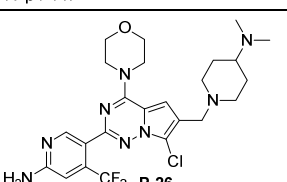
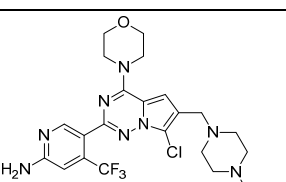
15 9. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 8 or a pharmaceutically acceptable salt thereof, wherein R₃ is morpholinyl or (S)-3-methylmorpholinyl.

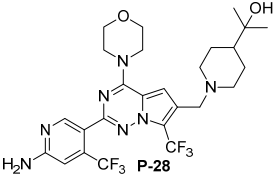
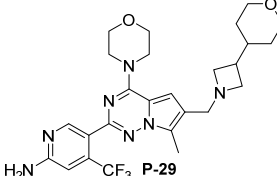
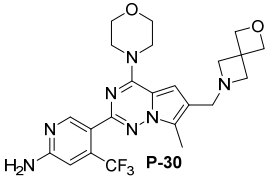
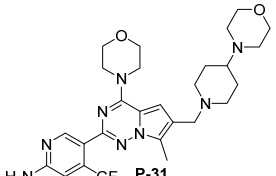
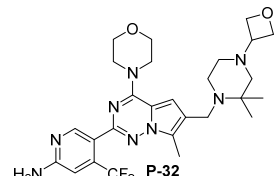
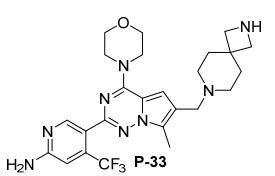
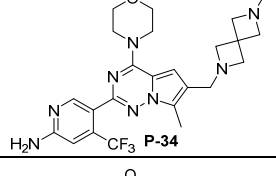
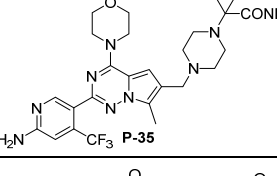
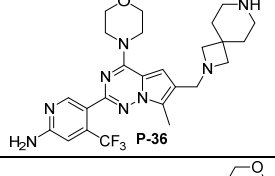
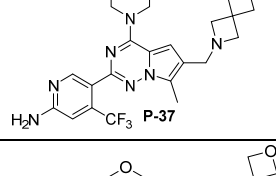
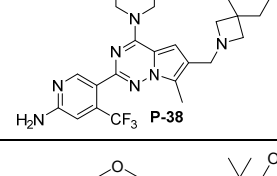
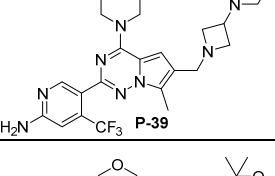
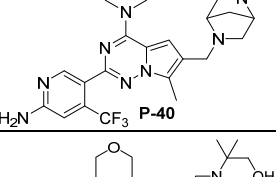
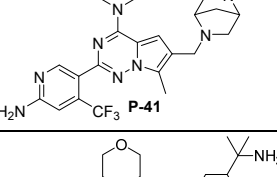
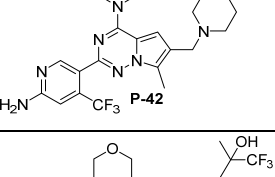
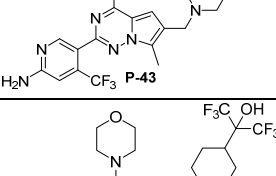
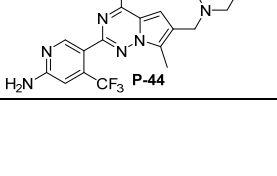
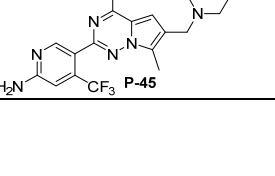
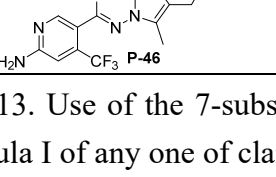
20 10. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 1 or a pharmaceutically acceptable salt thereof, wherein R₄ is -NH₂, -NHCONHR₁₁ or -NHCO₂R₁₂, wherein R₁₁ and R₁₂ are each independently C₁₋₄ alkyl, C₃₋₆ cycloalkyl or phenyl which is unsubstituted or substituted with at least one substituent selected from at least one of fluoro, chloro, bromo and -C(O)OR₁₃, wherein R₁₃ is C₁₋₄ alkyl.

11. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 10 or a pharmaceutically acceptable salt thereof, wherein R₁₁ and R₁₂ are each independently methyl, ethyl, isopropyl, cyclopropyl, phenyl, -Ph-CO₂Et-p or 4-fluorophenyl.

25 12. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of claim 1 or a pharmaceutically acceptable salt thereof, wherein the compound has a structure represented by one of the following general formulas:



 P-4	 P-5	 P-6
 P-7	 P-8	 P-9
 P-10	 P-11	 P-12
 P-13	 P-14	 P-15
 P-16	 P-17	 P-18
 P-19	 P-20	 P-21
 P-22	 P-23 R=F-Ph	 P-24 R=p-EtOCOPh
 P-25	 P-26	 P-27

 P-28	 P-29	 P-30
 P-31	 P-32	 P-33
 P-34	 P-35	 P-36
 P-37	 P-38	 P-39
 P-40	 P-41	 P-42
 P-43	 P-44	 P-45
 P-46		

13. Use of the 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of any one of claims 1 to 12 or a pharmaceutically acceptable salt thereof in the preparation of an inhibitor of PI3K.

14. The use of the 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I or a pharmaceutically acceptable salt thereof in the preparation of an inhibitor of PI3K according to claim 13, wherein the inhibitor of PI3K has a selective inhibitory effect on PI3K δ .

15. The 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of any one of claims 1 to 12 or a pharmaceutically acceptable salt thereof for use as a medicament.

16. Use of the 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I according to any one of claims 1 to 12 or a pharmaceutically acceptable salt thereof in the preparation of a medicament, for treatment of tumors, leukemias, and autoimmune diseases, wherein the medicament is an inhibitor of PI3K.

17. A pharmaceutical composition for treating a disease related to PI3K pathway, comprising a therapeutically effective amount of the 7-substituted pyrrolo[2,1-f][1,2,4]triazine compound represented by the general formula I of any one of claims 1 to 12 or a pharmaceutically acceptable salt thereof.