CLAIMS

1. A pharmaceutical composition, comprising:

one or more liposome suspended in an external medium, said liposome comprising:

(a) an external lipid bilayer, comprising at least one vesicle-forming phospholipid and less than 15 mole % of sterol and

(b) an internal aqueous medium, comprising a weak acid drug and a weak acid salt, wherein less than 65% of the weak acid drug is released into the external medium within 1 hour after the administration of the pharmaceutical composition to a subject.

2. The pharmaceutical composition of claim 1, wherein the external lipid bilayer comprises less than 10 mole % of sterol.

3. The pharmaceutical composition of claim 1, wherein the external lipid bilayer is free of sterol.

4. The pharmaceutical composition of claim 1, wherein the sterol is cholesterol, cholesterol hemisuccinate, ergosterol, lanosterol, or any combination thereof.

5. The pharmaceutical composition of claim 1, wherein the vesicle-forming lipid is a mixture of a first phospholipid and a second phospholipid or a mixture of a first phospholipid and a charged lipid.

6. The pharmaceutical composition of claim 1, wherein the weak acid salt is carboxylic acid salt or bicarbonate salt.

7. The pharmaceutical composition of claim 6, wherein the carboxylic acid salt is formate, acetate, propionate, butyrate, isobutyrate, valerate, isovalerate, benzoate or any combination thereof.

8. The pharmaceutical composition of claim 6, wherein the bicarbonate salt is potassium bicarbonate, sodium bicarbonate, calcium bicarbonate, magnesium bicarbonate, cesium bicarbonate, lithium bicarbonate, nickel bicarbonate, ferrous iron bicarbonate or any combination thereof.

9. The pharmaceutical composition of claim 1, wherein the internal aqueous medium further comprising cyclodextrin.

10. The pharmaceutical composition of claim 9, wherein the molar ratio of the weak acid drug to cyclodextrin (drug/CD ratio) is less than or equal to 0.06.

11. The pharmaceutical composition of claim 9, wherein the molar ratio of the weak acid drug to cyclodextrin (drug/CD ratio) is less than or equal to 0.03.

12. The pharmaceutical composition of claim 1, wherein the weak acid drug is prostaglandin, prostacyclin receptor agonist, steroid, non-steroidal anti-inflammatory drug (NSAID), anticoagulant, endothelin (ET) receptor antagonist or any combination thereof.

13. The pharmaceutical composition of claim 12, wherein the prostaglandin is iloprost.

14. The pharmaceutical composition of claim 12, wherein the ET receptor antagonist is ambrisentan.

15. The pharmaceutical composition of claim 1, wherein the external lipid bilayer comprises less than 13 mole % of sterol.

16. Use of the pharmaceutical composition of any one of claims 1-15, in the manufacture of a medicament for the treatment of a respiratory disease.

17. Use of the pharmaceutical composition of any one of claims 1-15, in the manufacture of a medicament for reducing the side effect of a weak acid drug.

18. The use of claim 17, wherein the pharmaceutical composition is to be inhaled to reduce the side effect of the weak acid drug in the upper respiratory tract.

19. The pharmaceutical composition of any one of claims 1-15, for use in therapy.