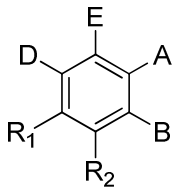
CLAIMS:

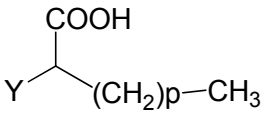
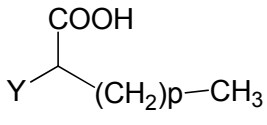
1. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof for the preparation of a medicament for preventing and/or treating of osteoporosis, wherein Formula I is:



Formula I

wherein:

R_1 and R_2 are independently equal to H, F or OH;

A is $(CH_2)_mCOOH$, $W(CH_2)_mCOOH$ or  when B is H; or B is $(CH_2)_mCOOH$, $W(CH_2)_mCOOH$ or  when A is H; or

A and B are covalently bonded to form a five (5), six (6) or seven (7)-membered cycloalkyl substituted with COOH;

where:

Y is O, S, NH, or CH_2;

W is O, S, or NH;

m is 0-2; and

p is 3-7;

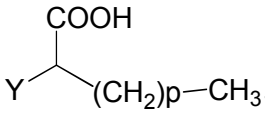
D is $CO(CH2)_nCH3$ or $CHOH(CH2)_nCH3$ or $O(CH2)_nCH3$ where n is 2-6; and

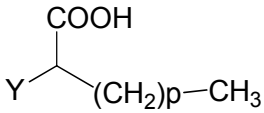
E is H or F.

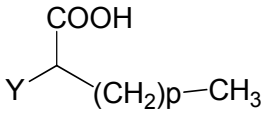
2. The use of claim 1, wherein R_1 is H and R_2 is H.

3. The use of any one of claims 1 or 3, wherein m is 1 or 2.

4. The use of any one of claims 1 or 3, wherein m is 1 or 2.

5. The use of claim 1 to 3, wherein A is H and B is  wherein Y is O, and p is 5-7.

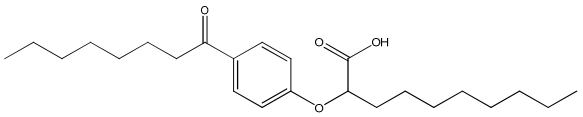
6. The use of claim 1, wherein R_1 and R_2 are H; B is H; A is  wherein p is 5-7; Y is O; and E is H

7. The use of claim 1, wherein R_1 and R_2 are H; A is H; B is  wherein p is 5-7; Y is O; and E is H.

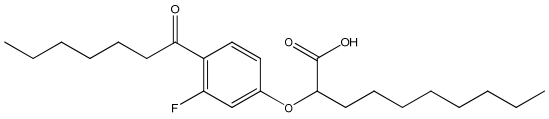
8. The use of any one of claims 1 to 7, wherein D is $CO(CH_2)_nCH_3$.

9. The use of any one of claims 1 to 8, wherein n is 4-6.

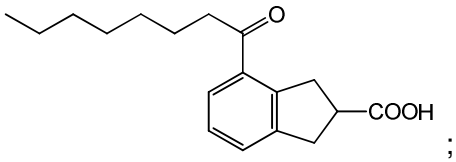
10. The use of claim 1, wherein said compound is selected from the group consisting of the compounds represented by the following structures:

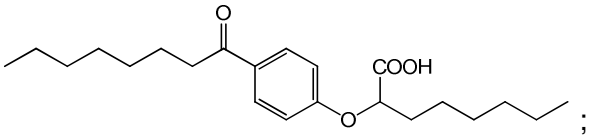


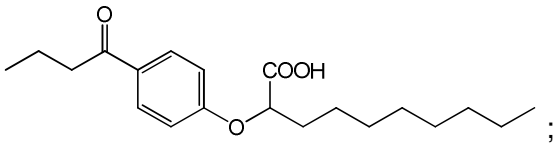
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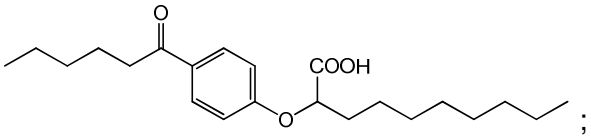


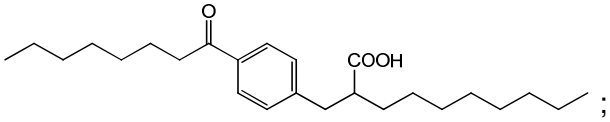
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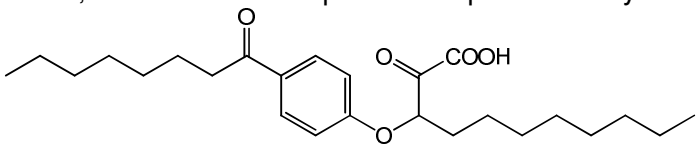

;


;


;

and pharmaceutical acceptable salts thereof.

11. The use of claim 10, wherein said compound is represented by the following structure:



or pharmaceutical acceptable salt thereof.

12. The use of any one of claims 1-11, wherein the pharmaceutically acceptable salt is a base addition salt comprising a metal counterion selected from the group consisting of sodium, potassium, calcium, magnesium lithium, ammonium, manganese, zinc, iron, or copper.

13. The use of any one of claims 1-11, wherein the pharmaceutically acceptable salt is sodium.

14. The use of claim 14, wherein the osteoporosis is selected from the group consisting of primary type 1 osteoporosis, primary type 2 osteoporosis, secondary osteoporosis abnormally high osteoclastogenesis, osteomalacia-like osteoporosis, osteopenia, osteogenesis imperfecta, osteopetrosis, osteonecrosis, Paget's disease of bone, hypophosphatemia and combinations thereof.

15. The use of claim 14, wherein osteoporosis is post-menopausal osteoporosis (primary type 1), primary type 2 osteoporosis or secondary osteoporosis.

16. The use of claims 14, wherein osteoporosis is post-menopausal osteoporosis (primary type 1).

17. The use of any one of claims 1 to 16, wherein the compound has one or more of the following activities in the subject.

- inhibition of osteoclastogenesis;
- stimulating interleukin-12 (IL-12) production in bone;
- reduction of acid phosphatase activity in bone;
- reduction of Receptor activator of NF-κB ligand/ Osteoprotegerin ratio (RANKL/OPG ratio) in bone;
- increase of collagen content in bone.

18. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof as defined in any one of claims 1 to 13, for the preparation of a medicament for preventing and/or reducing bone loss in a subject in need thereof.

19. The use of claim 18, wherein said compound reduces loss of calcium.

20. The use of claim 18 or 19, wherein the subject is afflicted by or susceptible of osteoporosis.

21. The use of any one of claims 18 to 20, wherein the subject is a postmenopausal women.

22. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof as defined in any one of claims 1 to 13, for inhibiting osteoclastogenesis, wherein said compound inhibits differentiation of the osteoclast precursor cell into an osteoclast cell.

23. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof as defined in any one of claims 1 to 13, for the preparation of a medicament for stimulating interleukin-12 (IL-12) production by a stimulated osteoclast precursor cell, wherein an increased IL 12 production is measured in the stimulated osteoclast precursor cell.

24. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof as defined in any one of claims 1 to 13, for the preparation of a medicament for reducing acid phosphatase activity in bone cells, wherein a reduced phosphatase activity is measurable in bone cells.

25. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof as defined in any one of claims 1 to 13, for the preparation of a medicament, for reducing expression and/or activity of receptor activator of NF-κB ligand/Osteoprotegerin ratio (RANKL /OPG ratio) in bone cells.

26. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof as defined in any one of claims 1 to 13, for the preparation of a medicament for increasing collagen content in bone in a subject in need thereof.

27. A use of a compound represented by Formula I or a pharmaceutical acceptable salt thereof as defined in any one of claims 1 to 13 for the preparation of a medicament for stimulating bone formation and/or for stimulating bone remodeling and/or for stimulating the differentiation and mineralization of osteoblasts and/or for inhibiting bone resorption in a subject in need thereof.

28. The use of any one of claims 1 to 27, wherein the compound is used in combination with a drug selected from the group consisting of: bisphosphonates, Odanacatib, Alendronate, Risedronate, Etidronate, Zoledronate, Pamidronate, Teriparatide, Tamoxifen, Raloxifene, and Denosumab.