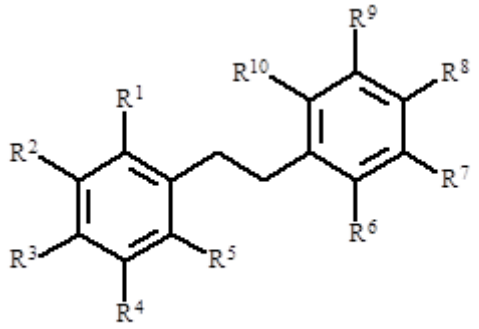
CLAIMS:

1. A compound of formula (4):



(4) ,

wherein

R^2, R^4, and R^8 are each independently selected from $-OR^{11}$, $-OCH_2R^{12}$, $-OC(O)R^{11}$, $-OCH_2C(O)OR^{12}$ and $-OC(O)CH_2R^{12}$;

R^1, R^3, R^5, R^6, R^7, R^9 and R^{10} are each independently selected from hydrogen, halogen, trifluoromethyl, $-OR^{12}$ and $-OC(O)R^{12}$; or R^2 and R^3, or R^7 and R^8 are taken together with the carbon atoms to which they are attached to form a cyclic group;

R^{11} is independently selected from $-(CH_2)$-hydrocarbyl, C_{2-10} alkyl, alkenyl, cycloalkyl, aryl and heterocyclyl, each of these groups is optionally substituted with 1, 2, 3, 4 or 5 R^{13};

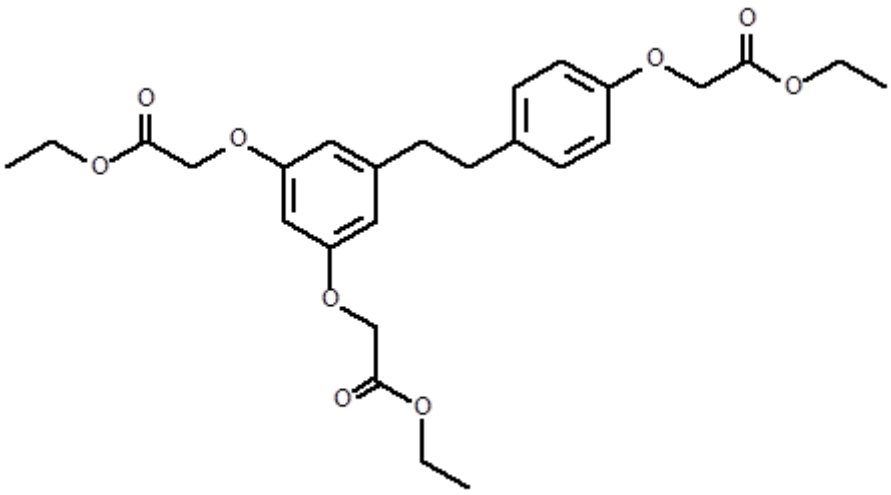
R^{12} is independently selected from hydrocarbyl and heterocyclyl, either of which is optionally substituted with 1, 2, 3, 4 or 5 R^{13};

R^{13} is independently selected from halogen, trifluoromethyl, cyano, nitro, oxo, $-OR^{14}$, $-C(O)R^{15}$, $-C(O)N(R^{14})R^{15}$, $-C(O)OR^{14}$, $-OC(O)R^{15}$, $-S(O)_2R^{14}$, $-S(O)_2N(R^{14})R^{15}$, $-N(R^{14})R^{15}$;

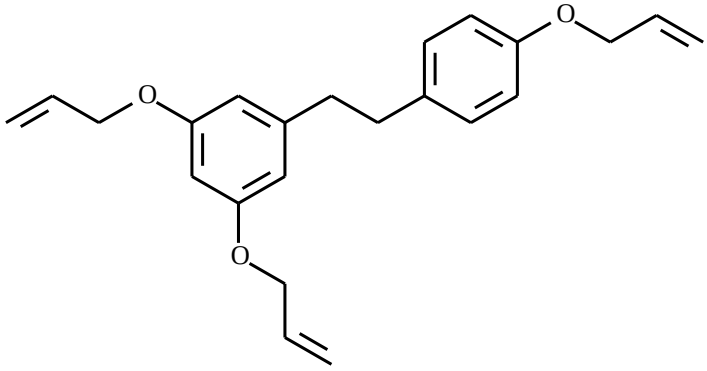
R^{14} and R^{15} are each independently hydrogen or selected from hydrocarbyl and heterocyclyl, either of which is optionally substituted with 1, 2, 3, 4 or 5 substituents independently selected from halogen, cyano, amino, hydroxy, C_{1-6} alkyl and C_{1-6} alkoxy;

or a pharmaceutically acceptable salt thereof.

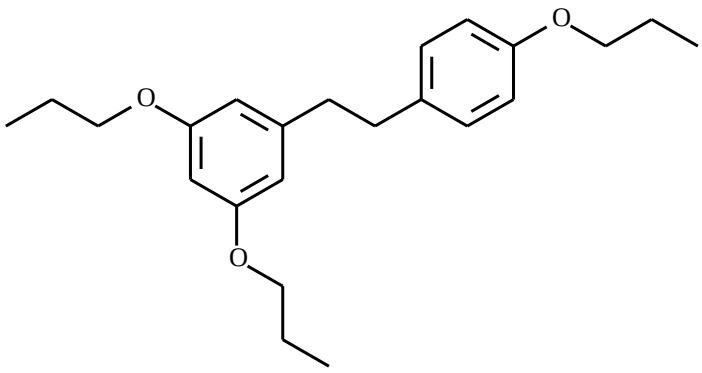
2. The compound of claim 1, wherein said compound is selected from DR1, DR2, DR3, DR4, DR5, DR6, DR7, DR8, DR9, DR10 or DR11 with the following formulae respectively:



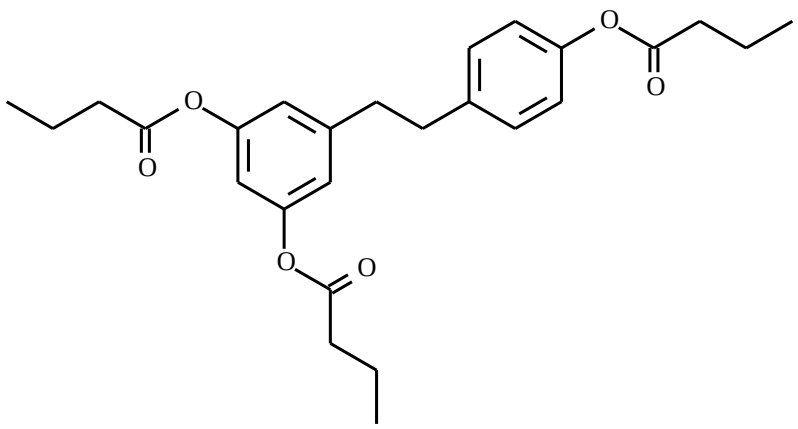
DR1;



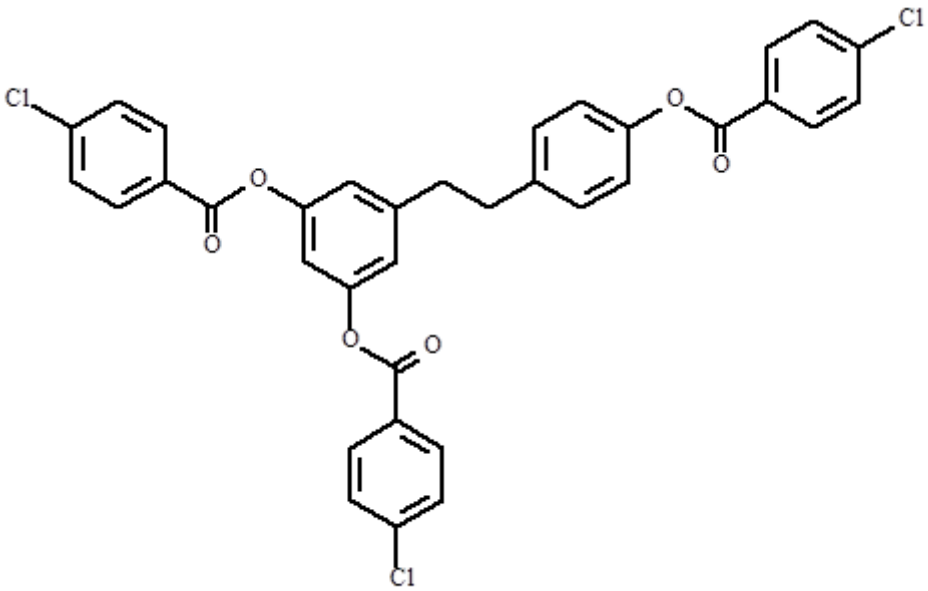
DR2;



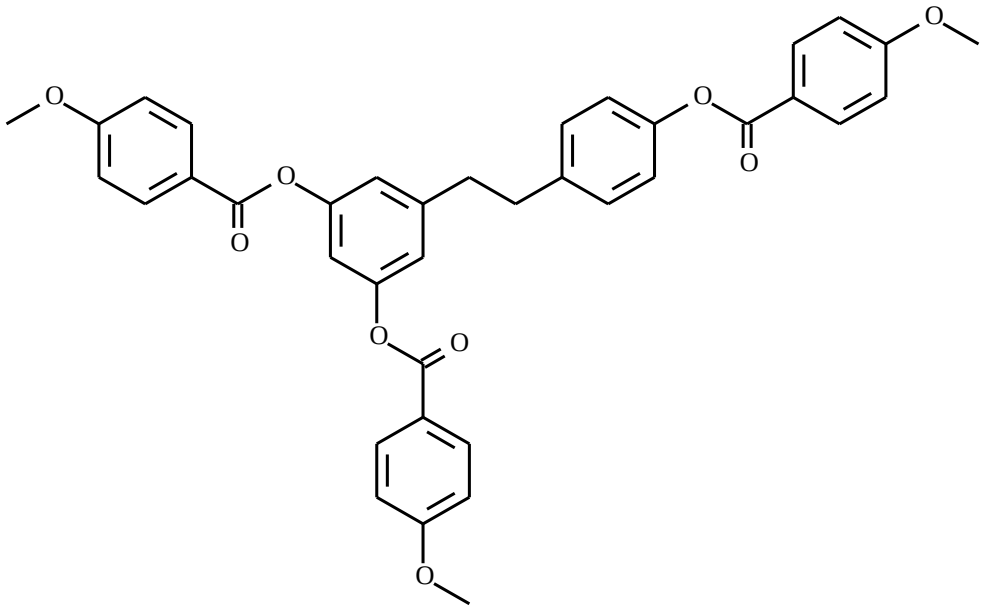
DR3;



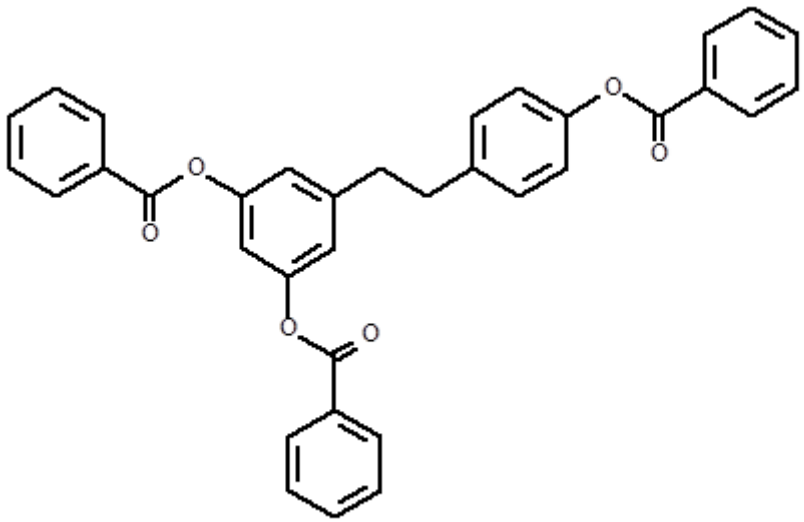
DR4;



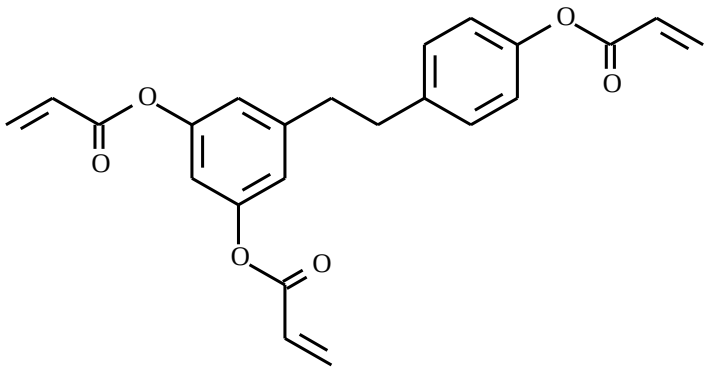
DR5;



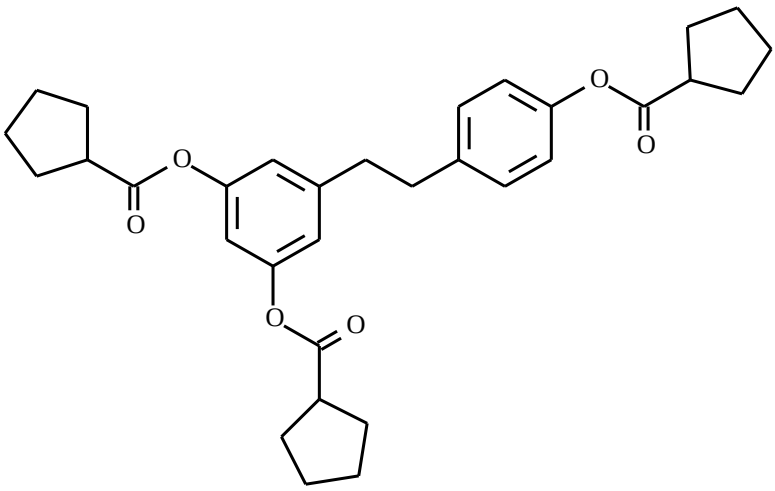
DR6;



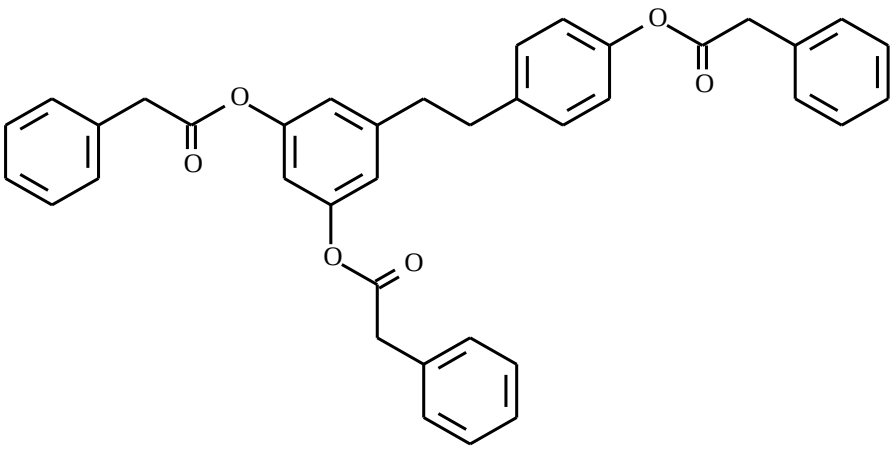
DR7;



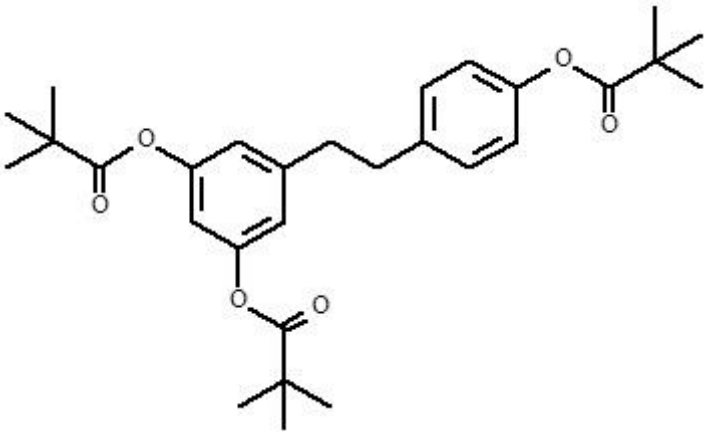
DR8;



DR9;



DR10;



DR11;

or a pharmaceutically acceptable salt thereof.

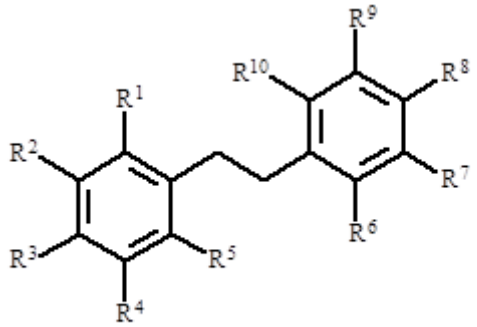
3. A composition for treating, preventing and/or delaying progress of skin darkening comprising an effective amount of the compound of claim 1 or 2 and a pharmaceutically acceptable carrier thereof.

4. A comestic, non-therapeutic method for skin whitening or delay of progression of a skin darkening in a subject comprising using a composition comprising the compound of claim 1 or 2 and/or the derivatives or chemical variants thereof alone and/or in combination with one or more other pharmaceutically acceptable skin-whitening and skin-protection agent(s).

5. The method of claim 4, wherein said composition is applied topically to said subject.

6. The method of claim 4 or 5, wherein said subject is human.

7. A cosmetic, non-therapeutic method for skin whitening, skin protection against UV exposure, skin damage and aging in a subject comprising using a topical formulation comprising the compound:



(5) ,

wherein

R^2, R^4, and R^8 are each independently selected from $-OR^{11}$, $-OCH_2R^{11}$, $-OC(O)R^{11}$, $-OCH_2C(O)OR^{11}$ and $-OC(O)CH_2R^{11}$;

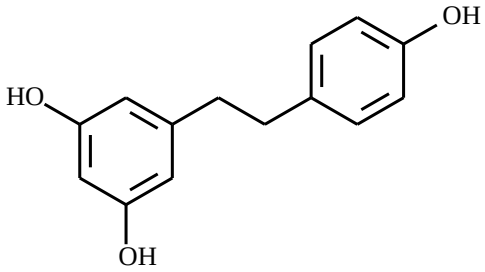
R^1, R^3, R^5, R^6, R^7, R^9 and R^{10} are each independently selected from hydrogen, halogen, trifluoromethyl, $-OR^{11}$ and $-OC(O)R^{11}$; or R^2 and R^3, or R^7 and R^8 are taken together with the carbon atoms to which they are attached to form a cyclic group;

R^{11} is independently hydrogen or selected from hydrocarbyl and heterocyclyl, either of which is optionally substituted with 1, 2, 3, 4 or 5 R^{12};

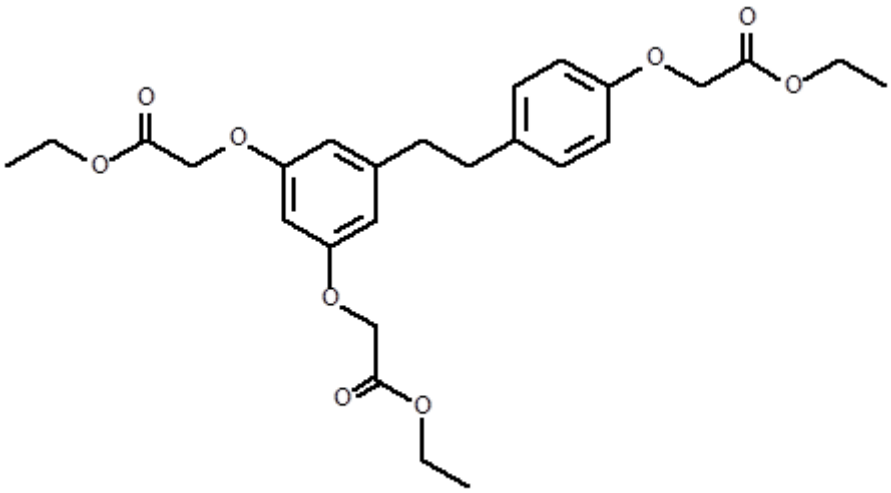
R^{12} is independently selected from halogen, trifluoromethyl, cyano, nitro, oxo, $-OR^{13}$, $-C(O)R^{14}$, $-C(O)N(R^{13})R^{14}$, $-C(O)OR^{13}$, $-OC(O)R^{14}$, $-S(O)_2R^{13}$, $-S(O)_2N(R^{13})R^{14}$, $-N(R^{13})R^{14}$;

R^{13} and R^{14} are each independently hydrogen or selected from hydrocarbyl and heterocyclyl, either of which is optionally substituted with 1, 2, 3, 4 or 5 substituents independently selected from halogen, cyano, amino, hydroxy, C_{1-6} alkyl and C_{1-6} alkoxy;

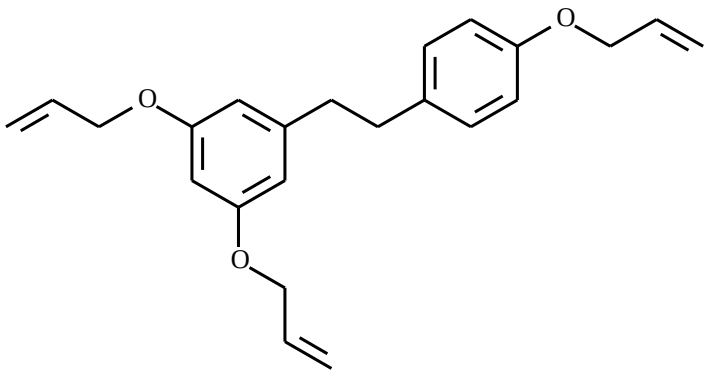
or a pharmaceutically acceptable salt thereof; or



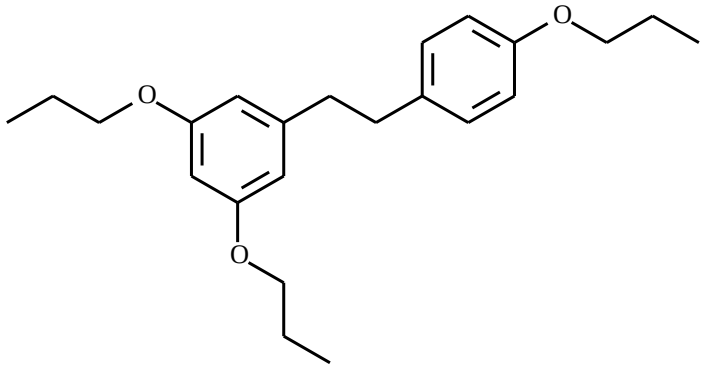
Dihydro-resveratrol ;



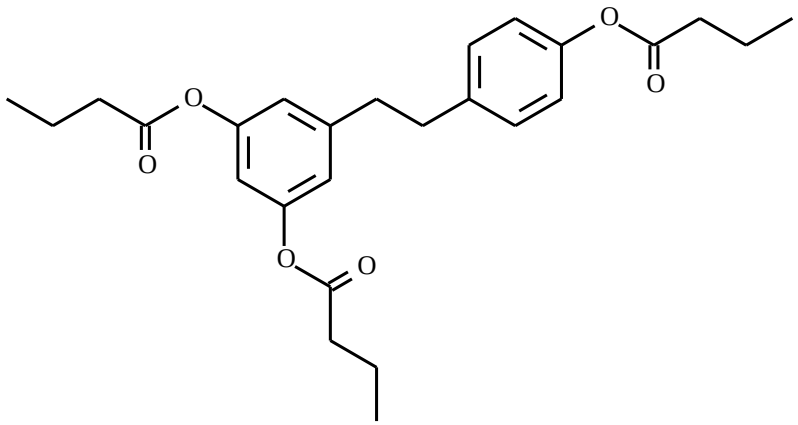
DR1;



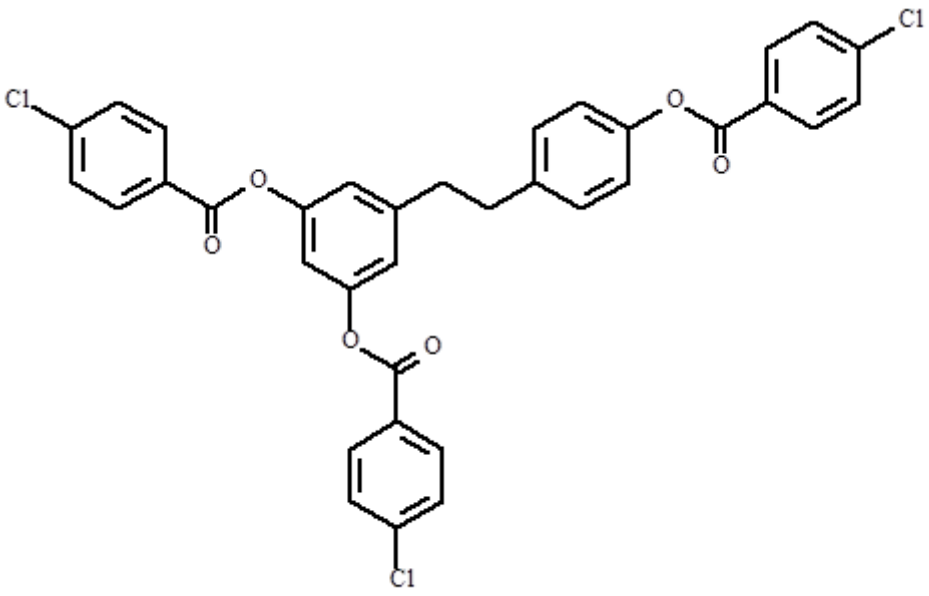
DR2;



DR3;

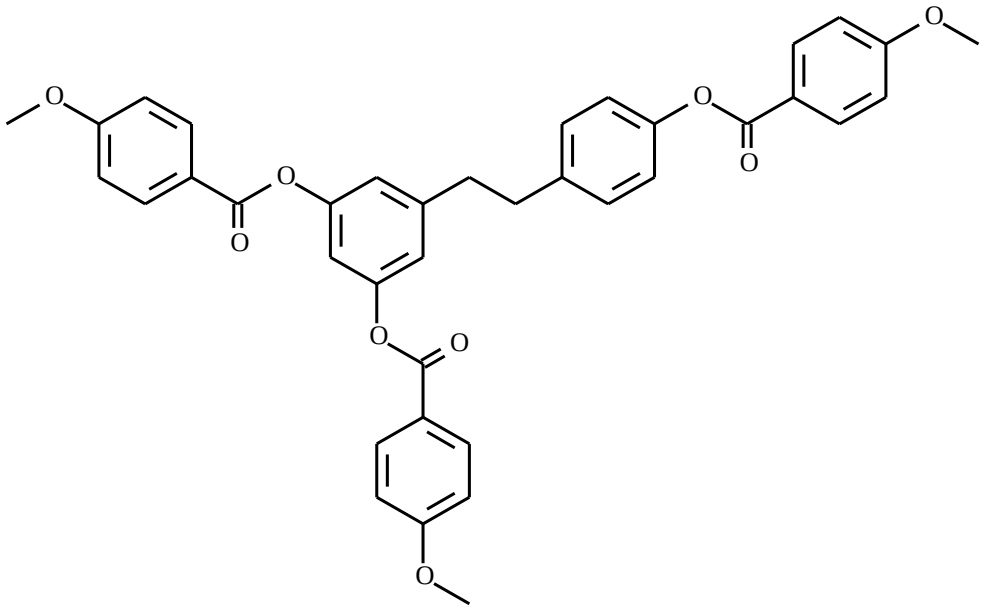


DR4;

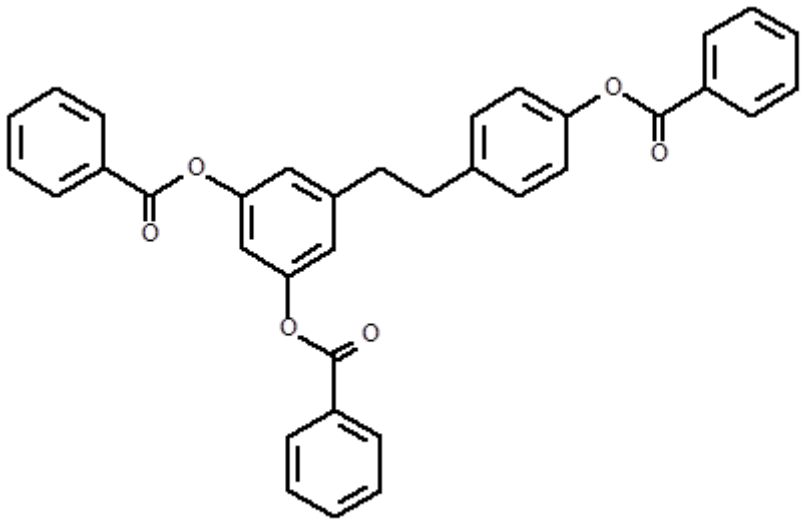


DR5;

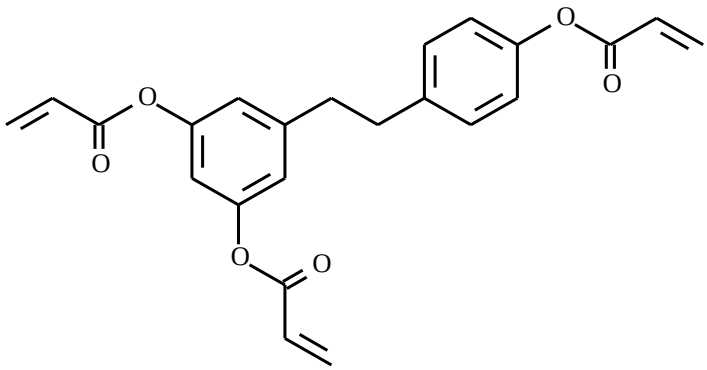
5



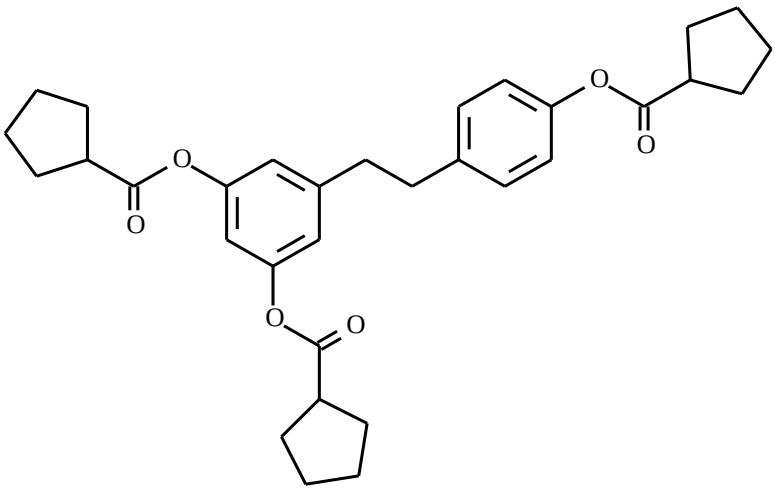
DR6;



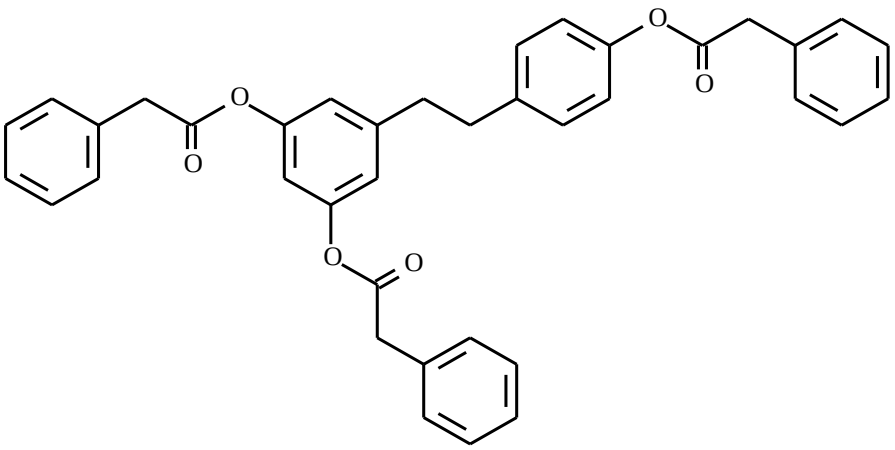
DR7;



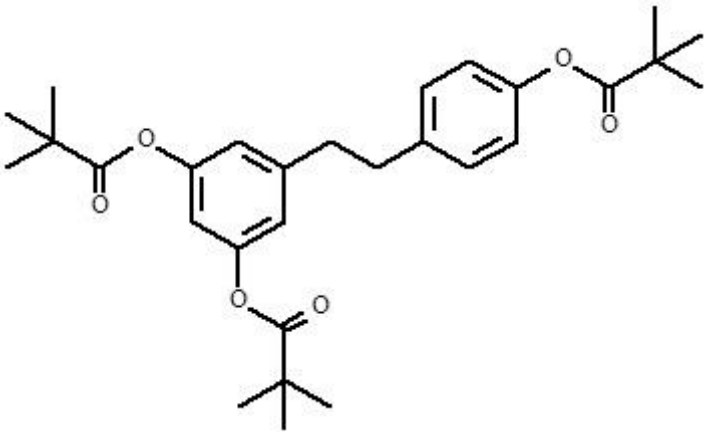
DR8;



DR9;



DR10;



DR11;

or a pharmaceutically acceptable salt thereof.

8. The method of claim 7, wherein said topical formulation is in a form of a paste, solid, powder, particle, emulsion, day cream, night cream, face lotion, body lotion, body butter, skin peel, mask, shower gel, sun cream, sun lotion, after sun cream, after sun lotion, lip balm, or

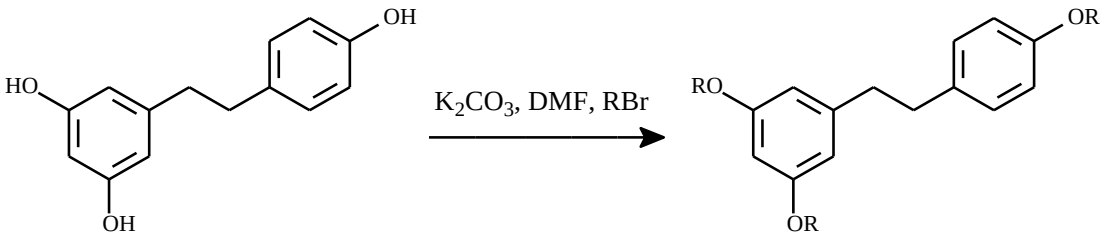
lip gloss, or alike.

9. The method of claim 7 or 8, wherein said subject is human.

10. The composition of claim 3, wherein the composition is in the form of a paste, solid, powder, particle, emulsion, day cream, night cream, face lotion, body lotion, body butter, skin peel, mask, shower gel, sun cream, sun lotion, after sun cream, or after sun lotion.

11. A method of synthesizing the compound of claim 2 from dihydro-resveratrol comprising the following two synthesis schemes:

Scheme 1 for said DR1 to DR3:



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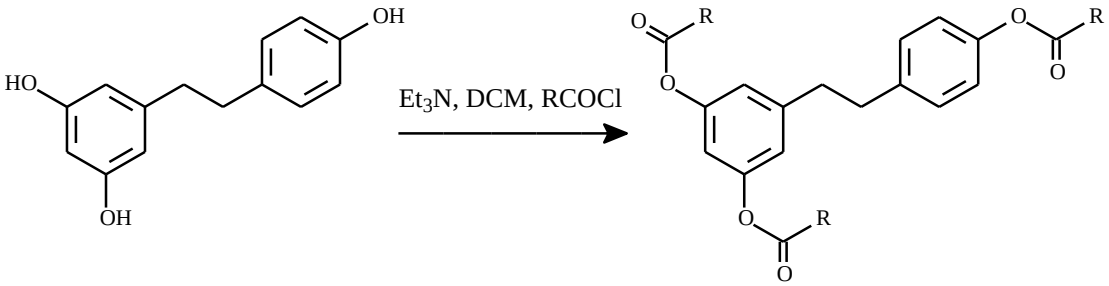
wherein

R is $-OR^{11}$, $-OCH_2R^{11}$ or $-OCH_2C(O)OR^{11}$;

R^{11} is hydrocarbyl;

and

Scheme 2 for said DR4 to DR11:



wherein

R is $-R^{11}$ or $-CH_2R^{11}$;

R^{11} is hydrocarbyl, which is optionally substituted with 1, 2, 3, 4 or 5 R^{12};

R^{12} is halogen or $-OR^{13}$; and

R^{13} is hydrogen or hydrocarbyl.