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(72) MIHELICH, EDWARD DAVID, US

(72) PHILLIPS, MICHAEL LEROY, US

(72) WARSHAWSKY, ALAN M., US

(71) ELI LILLY AND COMPANY, US

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(54) INDOLE sPLA₂ INHIBITORS

(57) A class of novel acylsulfonamide substituted indole compounds is disclosed together with the use of such compounds for inhibiting sPLA₂ mediated release of fatty acids for treatment of inflammatory diseases such as septic shock.

PCT

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(22) International Filing Date:	2 August 1999 (02.08.99)		(75) Inventors/Applicants (for US only): MIHELICH, Edward, David [US/US]; 10998 Spring Mill Lane, Carmel, IN 46032 (US). PHILLIPS, Michael, LeRoy [US/US]; 8754 Southcreek Court, Indianapolis, IN 46217 (US). WARSHAWSKY, Alan, M. [US/US]; 13828 Spring Mill Ponds Circle, Carmel, IN 46032 (US).
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(71) Applicant (for all designated States except US):	ELI LILLY AND COMPANY [US/US]; Lilly Corporate Center, Indianapolis, IN 46285 (US).		
(54) Title:	INDOLE sPLA ₂ INHIBITORS		
(57) Abstract	<p>A class of novel acylsulfonamide substituted indole compounds is disclosed together with the use of such compounds for inhibiting sPLA₂ mediated release of fatty acids for treatment of inflammatory diseases such as septic shock.</p>		
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INDOLE sPLA₂ INHIBITORS

Field of the Invention

5 This invention relates to novel indole compounds useful for inflammatory diseases.

Background of the Invention

The structure and physical properties of human
10 non-pancreatic secretory phospholipase A₂ (hereinafter called, "sPLA₂") has been thoroughly described in two articles, namely, "Cloning and Recombinant Expression of Phospholipase A₂ Present in Rheumatoid Arthritic Synovial Fluid" by Seilhamer, Jeffrey J.; Pruzanski, Waldemar; Vadas Peter; Plant, Shelley; Miller, Judy A.; Kloss, Jean; and Johnson, Lorin K.; The Journal of Biological Chemistry, Vol. 264, No. 10, Issue of April 5, pp. 5335-5338, 1989; and "Structure and Properties of a Human Non-pancreatic Phospholipase A₂" by Kramer, Ruth M.; Hession, Catherine; Johansen, Berit; Hayes, Gretchen; McGraw, Paula; Chow, E. Pingchang; Tizard, Richard; and Pepinsky, R. Blake; The Journal of Biological Chemistry, Vol. 264, No. 10, Issue of April 5, pp. 5768-5775, 1989; the disclosures of which are
20 incorporated herein by reference.

25

Indole type sPLA₂ inhibitors having gyloxylamide, acetamide and hydrazide substituents are described in United States Patent Nos. 5,654,326; 5,684,034; and 5,578,634 respectively.

30 It is believed that sPLA₂ is a rate limiting enzyme in the arachidonic acid cascade which hydrolyzes membrane phospholipids. Thus, it is important to develop compounds which inhibit sPLA₂ mediated release of fatty acids (e.g., arachidonic acid). Such
35 compounds would be of value in general treatment of

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conditions induced and/or maintained by overproduction of sPLA₂; such as sepsis or rheumatoid arthritis.

It is desirable to develop new compounds and treatments for sPLA₂ induced diseases.

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Summary of the Invention

This invention is a class of novel indole compounds to inhibit mammalian sPLA₂ mediated release of fatty acids.

10 This invention is also a novel class of indole compounds having potent and selective effectiveness as inhibitors of mammalian sPLA₂.

This invention is also a indole compound useful in the treatment of Inflammatory Diseases.

15 This invention is also a pharmaceutical composition containing novel indoles of the invention.

This invention is also a method of preventing and treating Inflammatory Diseases in mammals by administration of a therapeutically effective amount of 20 the indole of the invention.

This invention is also the indole compounds of the invention or compositions comprising the compounds of the invention as active ingredient for use as a medicament in the treatment of Inflammatory Diseases.

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Definitions:

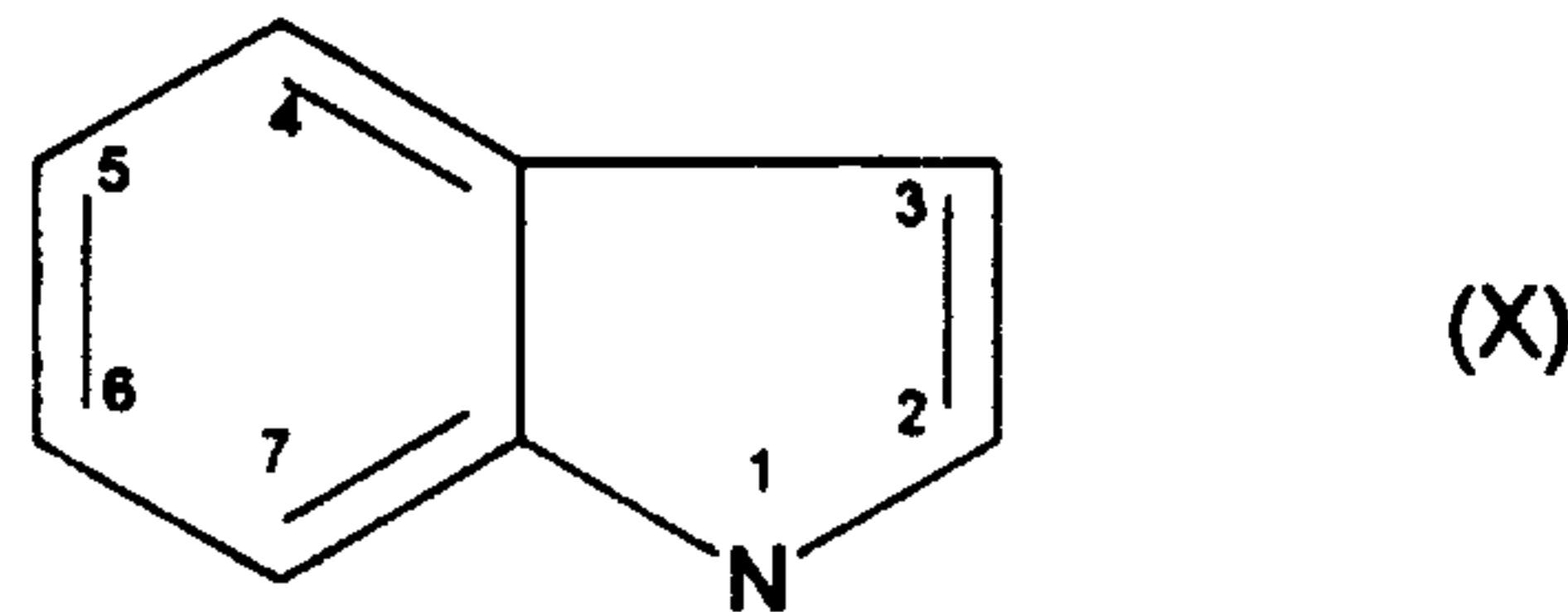
The term, "Inflammatory Diseases" refers to diseases such as inflammatory bowel disease, sepsis, septic shock, adult respiratory distress syndrome, 30 pancreatitis, trauma-induced shock, bronchial asthma, allergic rhinitis, rheumatoid arthritis, cystic fibrosis, stroke, acute bronchitis, chronic bronchitis, acute bronchiolitis, chronic bronchiolitis, osteoarthritis, gout, spondylarthropathis, ankylosing

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spondylitis, Reiter's syndrome, psoriatic arthropathy, enteropathic spondylitis, Juvenile arthropathy or juvenile ankylosing spondylitis, Reactive arthropathy, infectious or post-infectious arthritis, gonococcal 5 arthritis, tuberculous arthritis, viral arthritis, fungal arthritis, syphilitic arthritis, Lyme disease, arthritis associated with "vasculitic syndromes", polyarteritis nodosa, hypersensitivity vasculitis, Luegenec's granulomatosis, polymyalgia rheumatica, 10 joint cell arteritis, calcium crystal deposition arthropathitis, pseudo gout, non-articular rheumatism, bursitis, tenosynovitis, epicondylitis (tennis elbow), carpal tunnel syndrome, repetitive use injury (typing), miscellaneous forms of arthritis, neuropathic joint 15 disease (charco and joint), hemarthrosis (hemarthrosic), Henoch-Schonlein Purpura, hypertrophic osteoarthropathy, multicentric reticulohistiocytosis, arthritis associated with certain diseases, surcoilosis, hemochromatosis, sickle cell disease and 20 other hemoglobinopathies, hyperlipoproteinemia, hypogammaglobulinemia, hyperparathyroidism, acromegaly, familial Mediterranean fever, Behat's Disease, systemic lupus erythrematosis, or relapsing polychondritis and related diseases which comprises administering to a 25 mammal in need of such treatment a therapeutically effective amount of the compound of formula I in an amount sufficient to inhibit sPLA₂ mediated release of fatty acid and to thereby inhibit or prevent the arachidonic acid cascade and its deleterious products.

30 The term, "indole nucleus" refers to a nucleus (having numbered positions) with the structural formula (X):

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The indole compounds of the invention employ certain defining terms as follows:

The term, "alkyl" by itself or as part of another 10 substituent means, unless otherwise defined, a straight or branched chain monovalent hydrocarbon radical such as methyl, ethyl, n-propyl, isopropyl, n-butyl, tertiary butyl, sec-butyl, n-pentyl, and n-hexyl.

The term, "alkenyl" employed alone or in 15 combination with other terms means a straight chain or branched monovalent hydrocarbon group having the stated number range of carbon atoms, and typified by groups such as vinyl, propenyl, crotonyl, isopentenyl, and various butenyl isomers.

The term, "halo" means fluoro, chloro, bromo, or 20 iodo. The term, heterocyclic radical, refers to radicals derived from monocyclic or polycyclic, saturated or unsaturated, substituted or unsubstituted heterocyclic nuclei having 5 to 14 ring atoms and containing from 1 to 25 3 hetero atoms selected from the group consisting of nitrogen, oxygen or sulfur. Typical heterocyclic

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radicals are pyrrolyl, pyrrolodinyl, piperidinyl, furanyl, thiophenyl, pyrazolyl, imidazolyl, phenylimidazolyl, triazolyl, isoxazolyl, oxazolyl, thiazolyl, thiadiazolyl, indolyl, carbazolyl, 5 norharmanyl, azaindolyl, benzofuranyl, dibenzofuranyl, dibenzothiophenyl, indazolyl, imidazo(1.2-A)pyridinyl, benzotriazolyl, anthranilyl, 1,2-benzisoxazolyl, benzoxazolyl, benzothiazolyl, purinyl, pyridinyl, dipyridylyl. phenylpyridinyl, benzylpyridinyl, 10 pyrimidinyl, phenylpyrimidinyl, pyrazinyl, 1,3,5-triazinyl, quinolinyl, phthalazinyl, quinazolinyl, morpholino, thiomorpholino, homopiperazinyl, tetrahydrofuranyl, tetrahydropyranyl, oxacanyl, 1,3-dioxolanyl, 1,3-dioxanyl, 1,4-dioxanyl, 15 tetrahydrothiophenyl, pentamethylenesulfadyl, 1,3-dithianyl, 1,4-dithianyl, 1,4-thioxanyl, azetidinyl, hexamethyleneiminium, heptamethyleneiminium, piperazinyl and quinoxaliny.

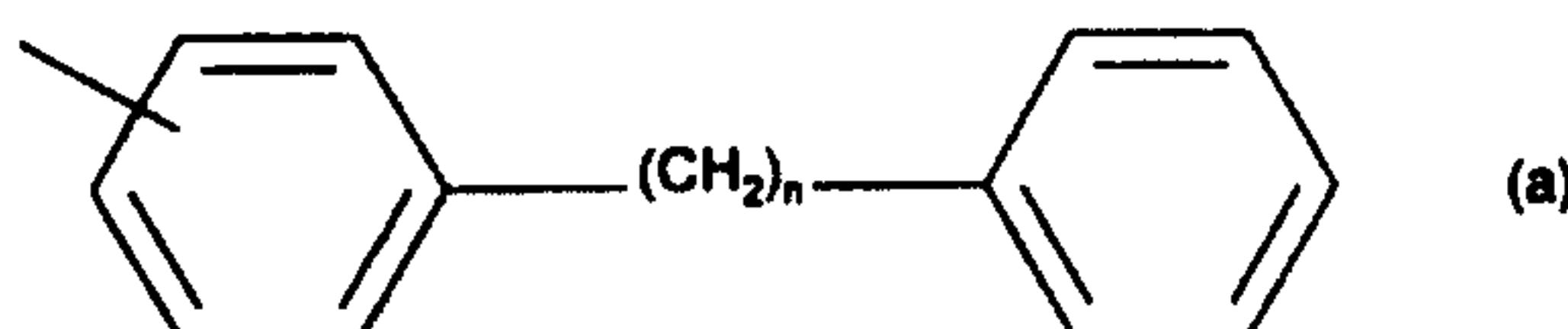
The term, "carbocyclic radical" refers to radicals 20 derived from a saturated or unsaturated, substituted or unsubstituted 5 to 14 membered organic nucleus whose ring forming atoms (other than hydrogen) are solely carbon atoms. Typical carbocyclic radicals are cycloalkyl, cycloalkenyl, phenyl, spiro[5.5]undecanyl, naphthyl, 25 norbornanyl, bicycloheptadienyl, tolulyl, xlenyl, indenyl, stilbenyl, terphenylyl, diphenylethylenyl, phenyl-cyclohexenyl, acenaphthylenyl, and anthracenyl, biphenyl, bibenzylyl and related bibenzylyl homologues represented by the formula (a):

30

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5



where n is a number from 1 to 8.

10 The term, "non-interfering substituent", refers to radicals suitable for substitution at positions 4,5,6 and/or 7 of the indole nucleus and on other nucleus substituents (as hereinafter described for Formula I), and radicals suitable for substitution on the

15 heterocyclic radical and carbocyclic radical as defined above. Illustrative non-interfering radicals are C₁-C₈ alkyl, C₂-C₈ alkenyl, C₂-C₈ alkynyl, C₇-C₁₂ aralkyl, C₇-C₁₂ alkaryl, C₃-C₈ cycloalkyl, C₃-C₈ cycloalkenyl, phenyl, tolyl, xylentyl, biphenyl, C₁-C₈ alkoxy, C₂-C₈ alkenyloxy, C₂-C₈ alkynyloxy, C₂-C₁₂ alkoxyalkyl, C₂-C₁₂ alkoxyalkyloxy, C₂-C₁₂ alkylcarbonyl, C₂-C₁₂ alkylcarbonylamino, C₂-C₁₂ alkoxyamino, C₂-C₁₂ alkoxyaminocarbonyl, C₁-C₁₂ alkylamino, C₁-C₆ alkylthio, C₂-C₁₂ alkylthiocarbonyl, C₁-C₈ alkylsulfinyl, C₁-C₈ alkylsulfonyl, C₂-C₈ haloalkoxy, C₁-C₈ haloalkylsulfonyl, C₂-C₈ haloalkyl, C₁-C₈ hydroxyalkyl, -C(O)O(C₁-C₈ alkyl), -(CH₂)_n-O-(C₁-C₈

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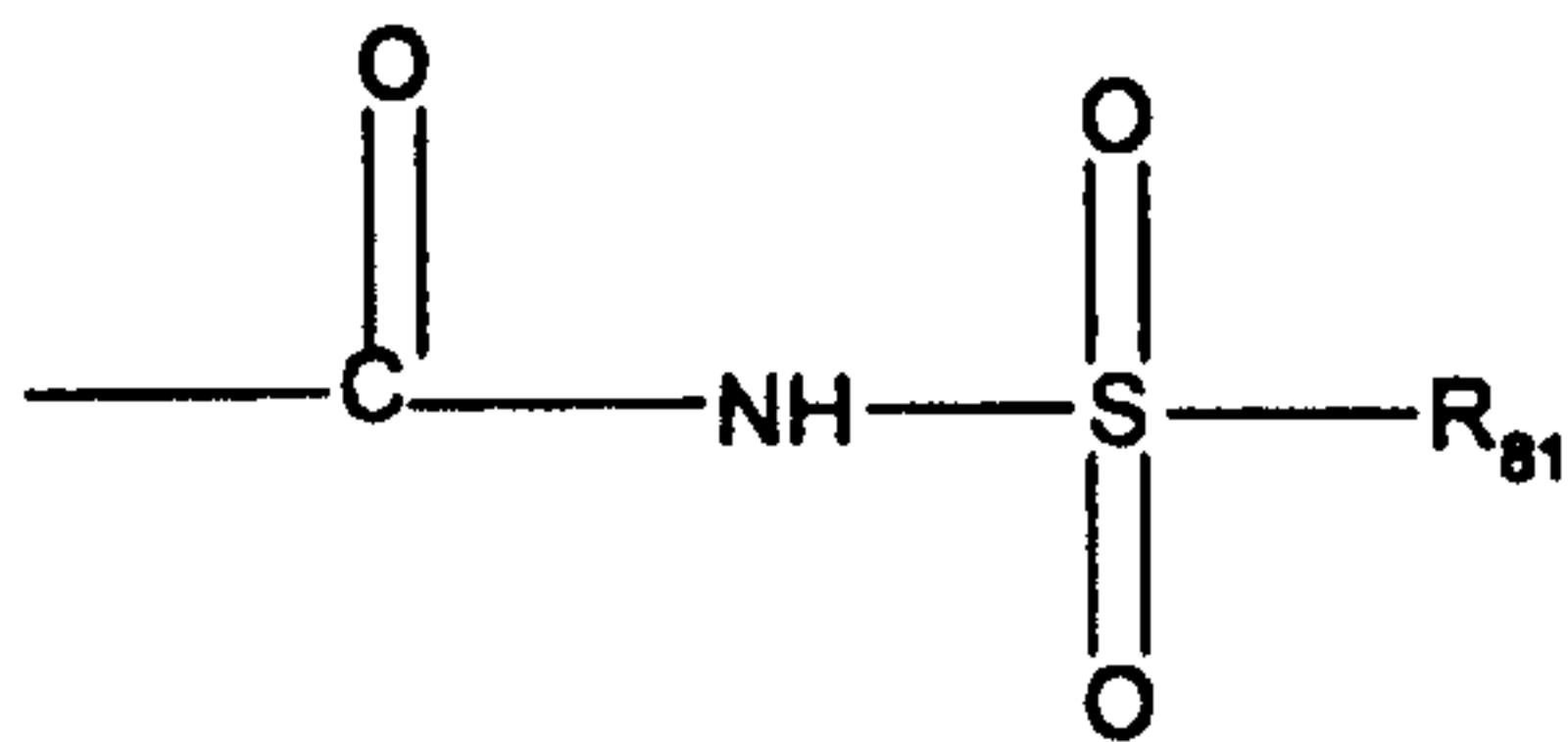
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alkyl), benzyloxy, phenoxy, phenylthio, -(CONHSO₂R), -CHO, amino, amidino, bromo, carbamyl, carboxyl, carbalkoxy, -(CH₂)_n-CO₂H, chloro, cyano, cyanoguanidinyl, fluoro, guanidino, hydrazide, 5 hydrazino, hydrazido, hydroxy, hydroxyamino, iodo, nitro, phosphono, -SO₃H, thioacetal, thiocarbonyl, and C₁-C₈ carbonyl; ; where R is C₁-C₈ alkyl and n is from 1 to 8.

10 The term "substituted group" is an organic group substituted with one or more non-interfering substituents.

The term, "(acylsulfonamide group)" is a group represented by the formula:

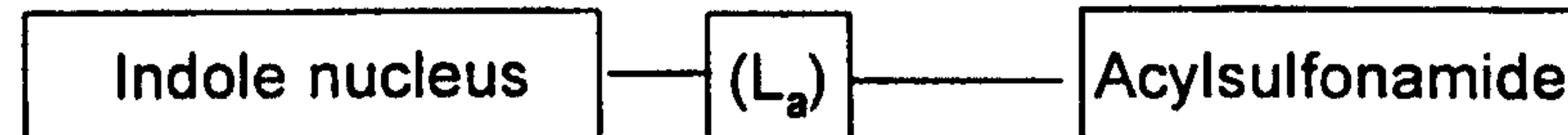
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where R₈₁ is -CF₃ or an organic substituent consisting of carbon and hydrogen with or without oxygen, 20 nitrogen, sulfur, halogen or other elements.

The term "indole acylsulfonamide compound" is synonymous with the term "indole compound."

The words, "linker" refer to a divalent linking group symbolized as, -(L_a)-, which has the function of 25 joining the 4 or 5 position of the indole nucleus to an acylsulfonamide group in the general relationship:

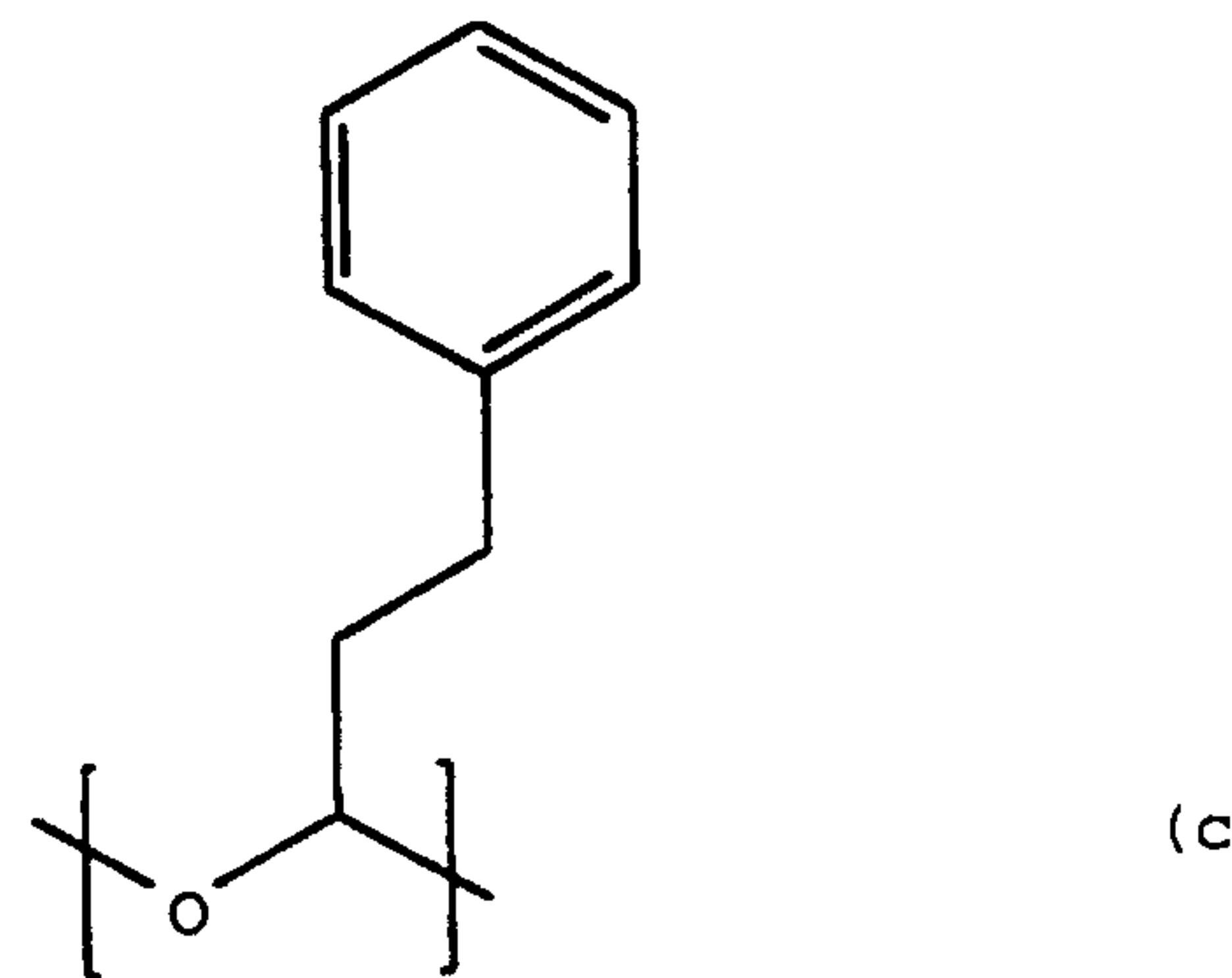
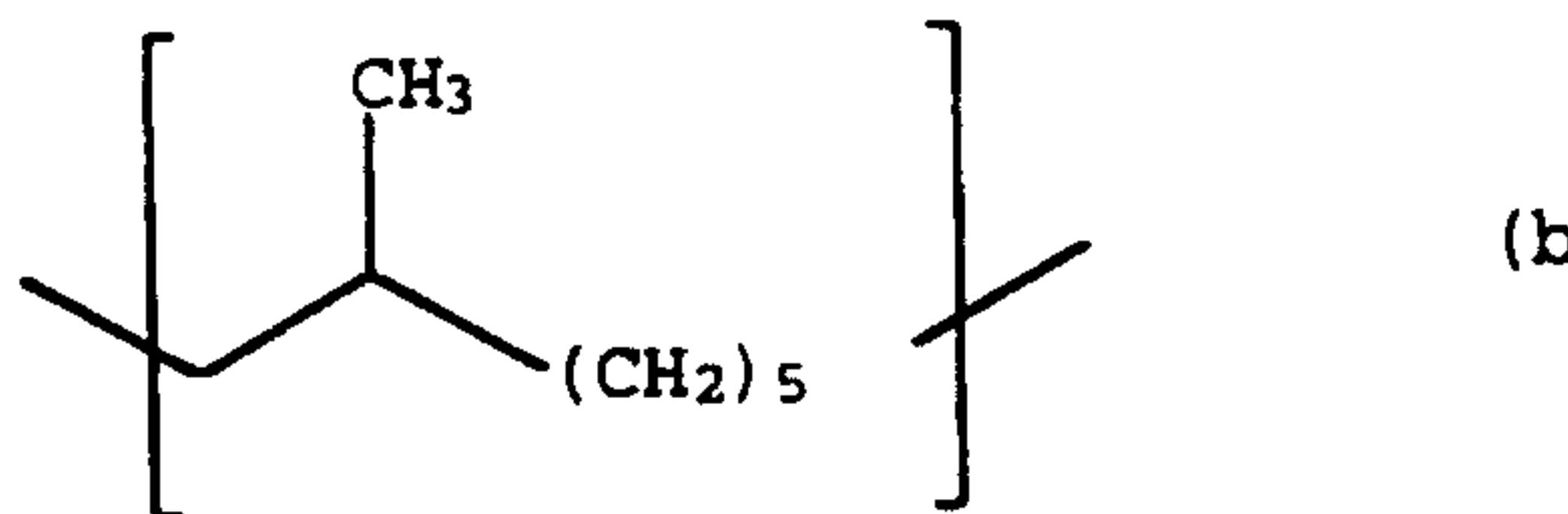
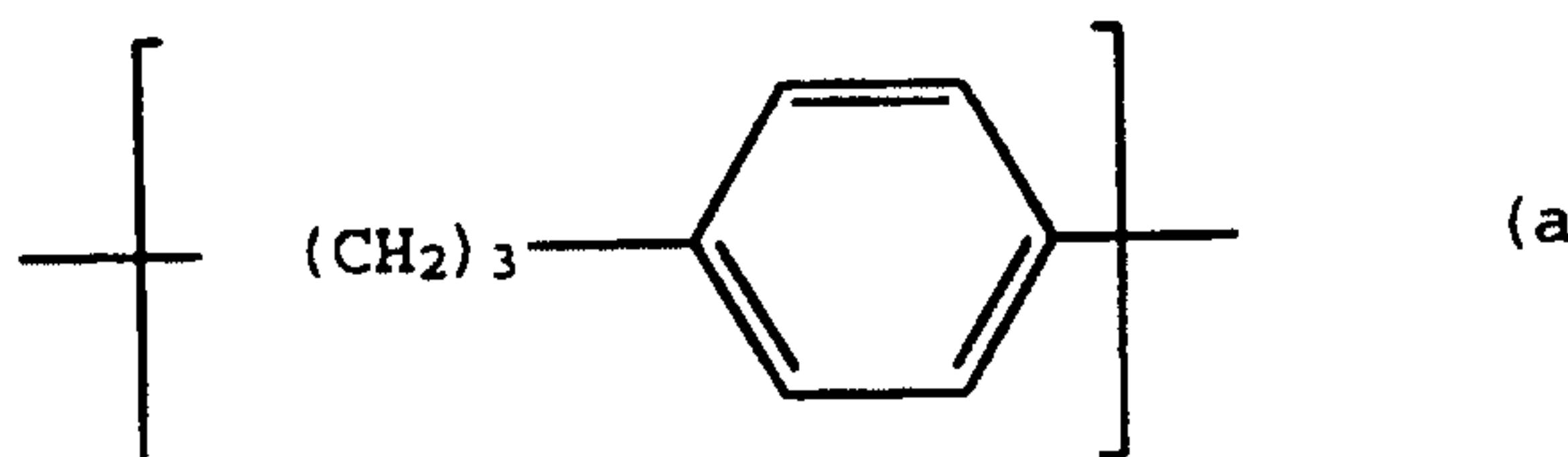


The words, "linker length", refer to the number of 30 atoms (excluding hydrogen) in the shortest chain of the linking group -(L_a)- that connects the 4 or 5 position of

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the indole nucleus with the acylsulfonamide group. The presence of a carbocyclic ring in -(La)- counts as the number of atoms approximately equivalent to the calculated diameter of the carbocyclic ring. Thus, a 5 benzene or cyclohexane ring in the linker counts as 2 atoms in calculating the length of -(La)-. Illustrative linker groups are;



10

wherein, groups (a), (b), and (c) have linker lengths of 5, 7, and 2, respectively.

The term, "amine", includes primary, secondary and tertiary amines.

15 The terms, "mammal" and "mammalian" include human.

The term, "alkylene chain of 1 or 2 carbon atoms" refers to the divalent radicals, -CH₂-CH₂- and -CH₂-.

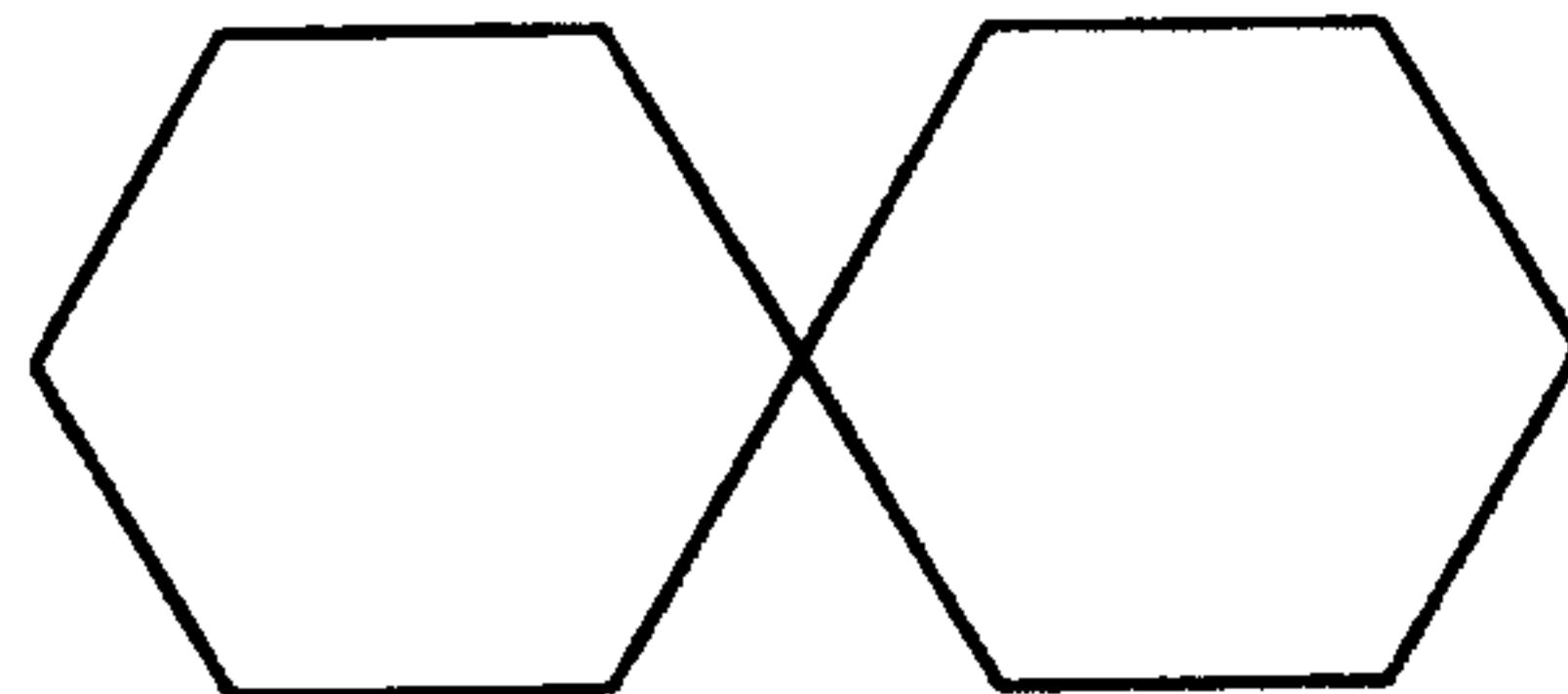
The term, "group containing 1 to 4 non-hydrogen atoms" refers to relatively small groups which form

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substituents at the 2 position of the indole nucleus, said groups may contain non-hydrogen atoms alone, or non-hydrogen atoms plus hydrogen atoms as required to satisfy the unsubstituted valence of the non-hydrogen atoms, for example; (i) groups absent hydrogen which contain no more than 4 non-hydrogen atoms such as -CF₃, -Cl, -Br, -NO₂, -CN, -SO₃; and (ii) groups having hydrogen atoms which contain less than 4 non-hydrogen atoms such as -CH₃, -C₂H₅, and -CH=CH₂.

10

The term "spiro[5.5]undecanyl" refers to the group represented by the formula;



15 The term "organic substituent" is a monovalent radical consisting of carbon and hydrogen with or without oxygen, nitrogen, sulfur, halogen or other element. Illustrative organic substituents are -CH₃, -C₂H₅, -CH₂OCH₃, and

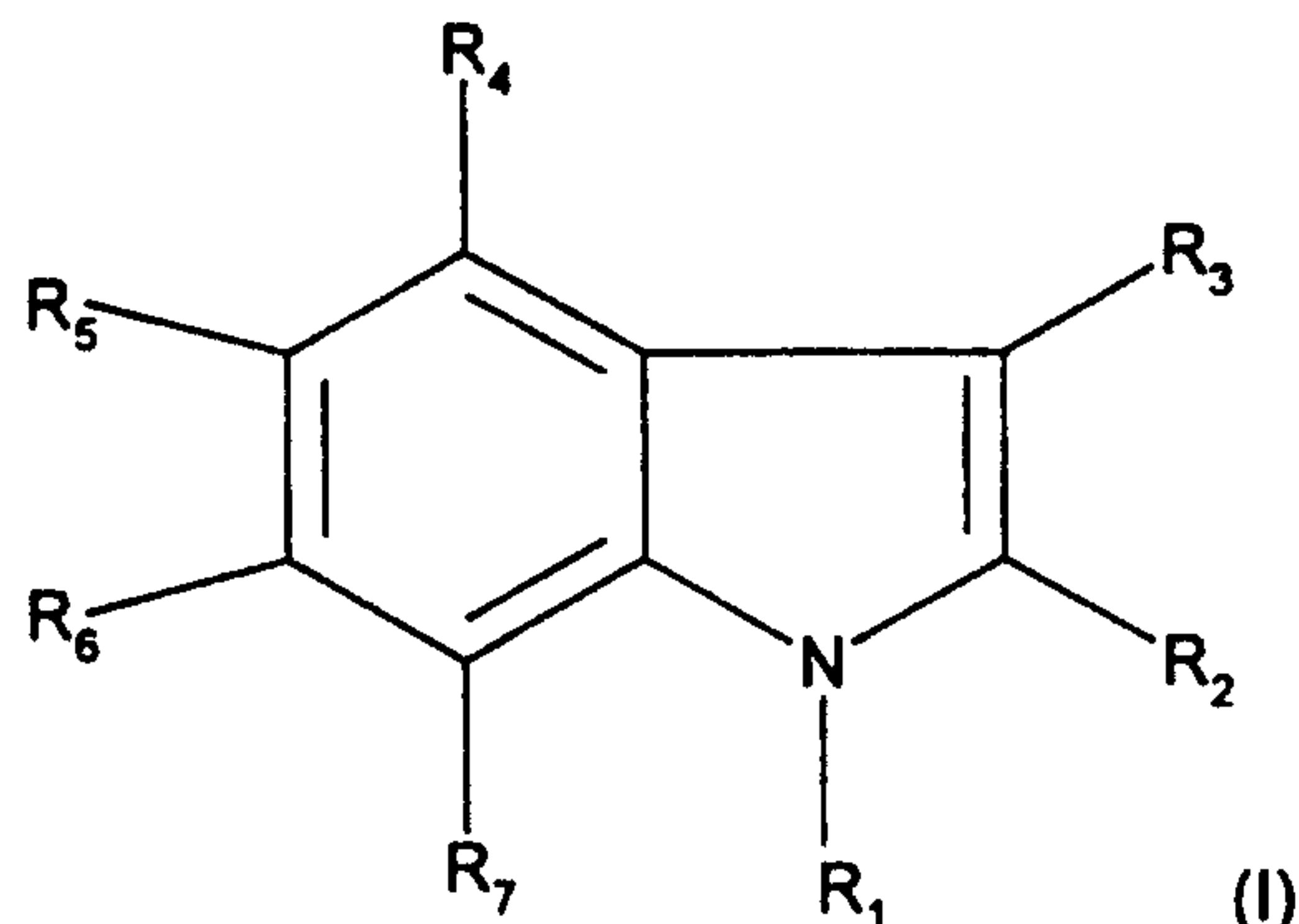
20 -CH₂SCH₃.

The indole Compounds of the Invention:

The compounds of the invention have the general formula (I) or a pharmaceutically acceptable salt or

25 solvate thereof;

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wherein ;

each X is independently oxygen or sulfur;

5 R₁ is selected from groups (a), (b) and (c)

wherein;

(a) is C₇-C₂₀ alkyl, C₇-C₂₀ haloalkyl, C₇-C₂₀ alkenyl, C₇-C₂₀ alkynyl, carbocyclic radical, or heterocyclic radical, or

10 (b) is a member of (a) substituted with one or more independently selected non-interfering substituents; or

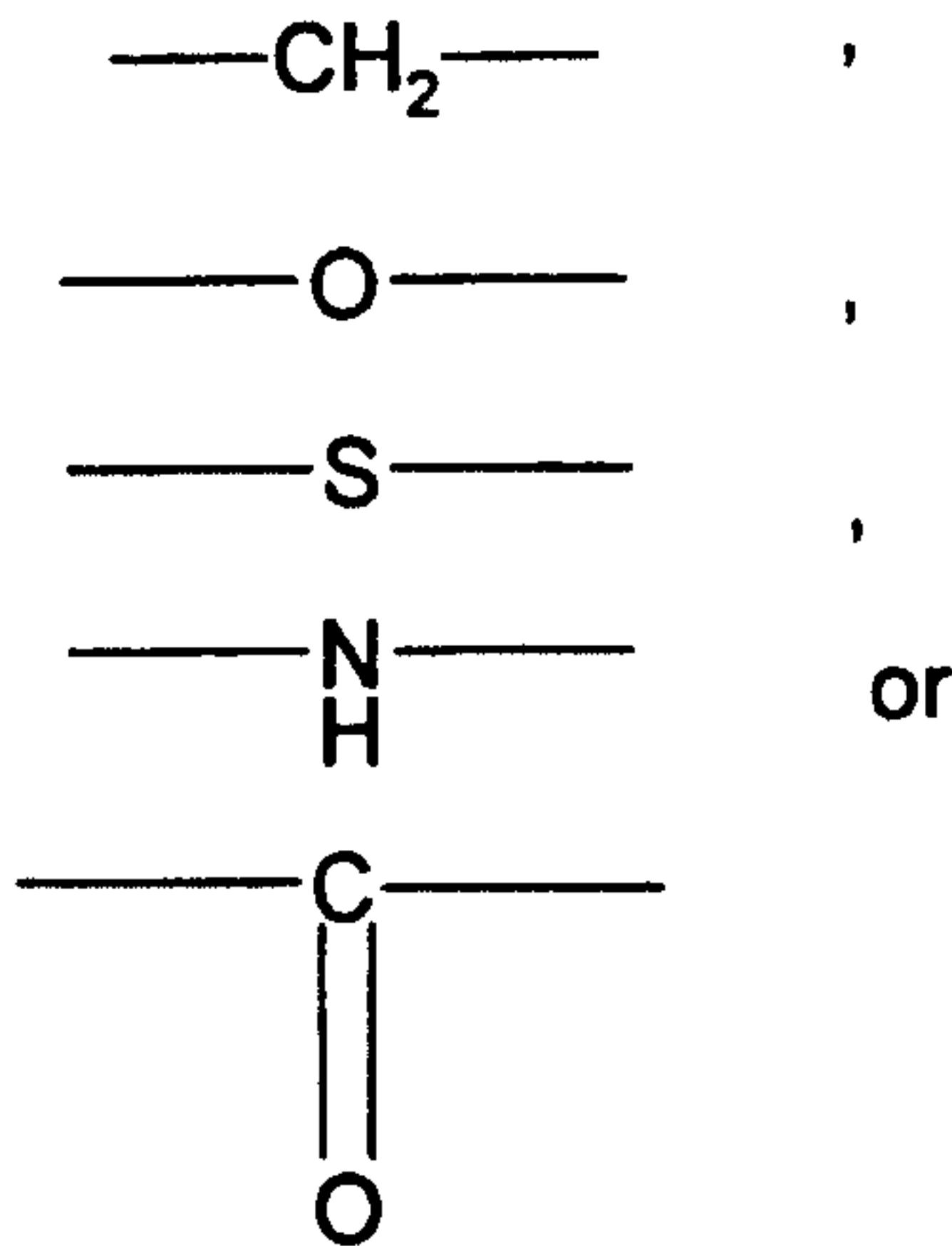
(c) is the group -(L₁)-R₁₁; where, -(L₁)- is a divalent linking group of 1 to 8 atoms and where R₁₁ is a group selected from (a)

15 or (b);

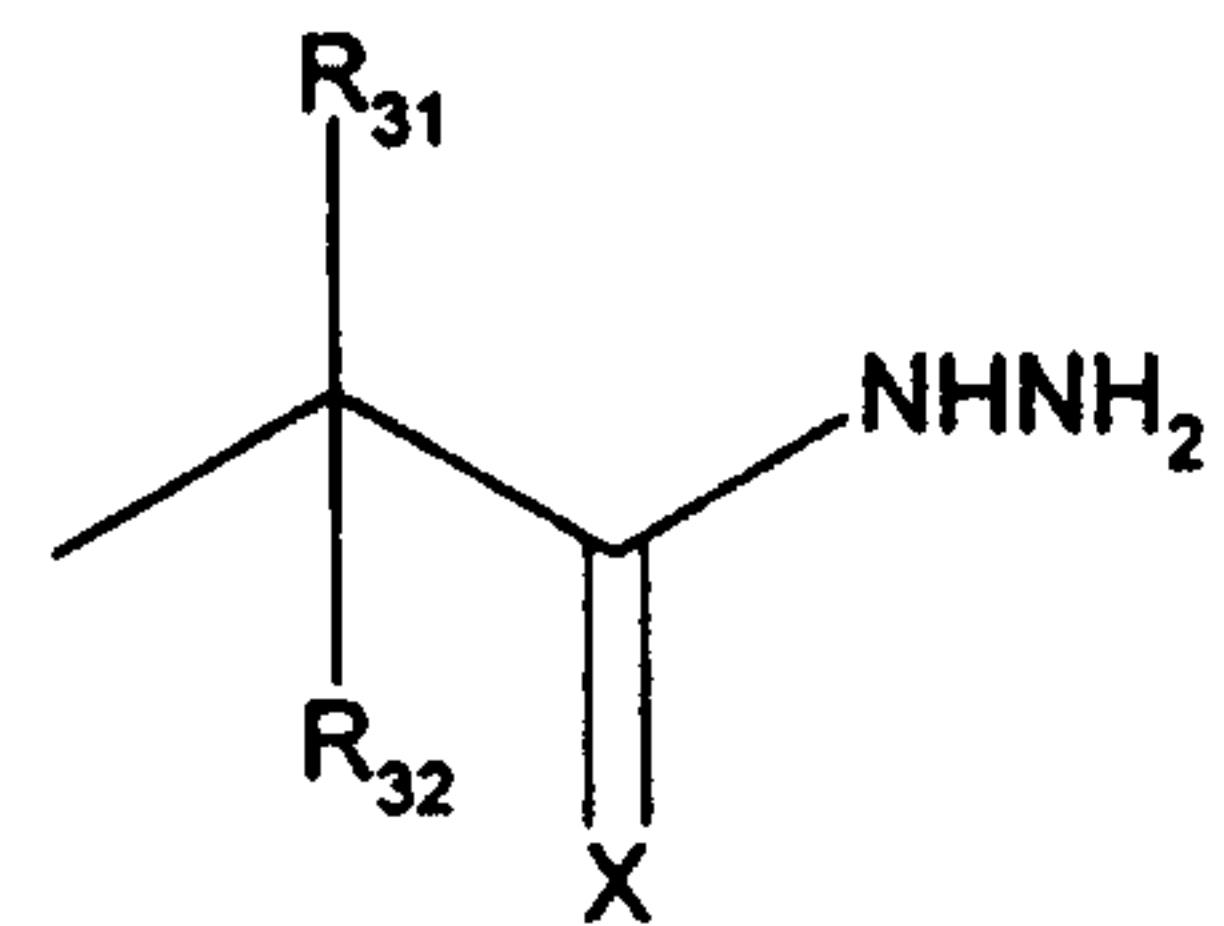
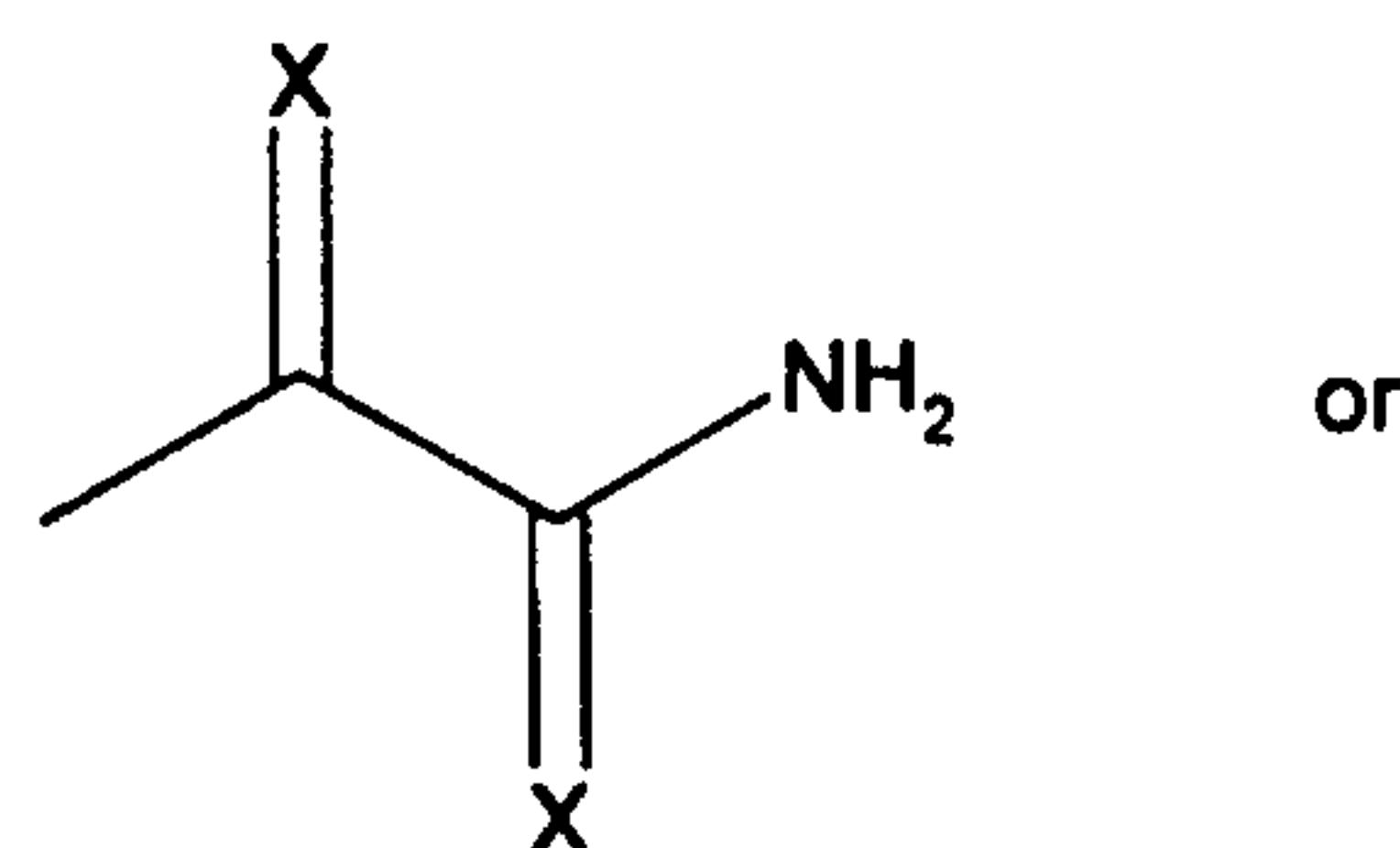
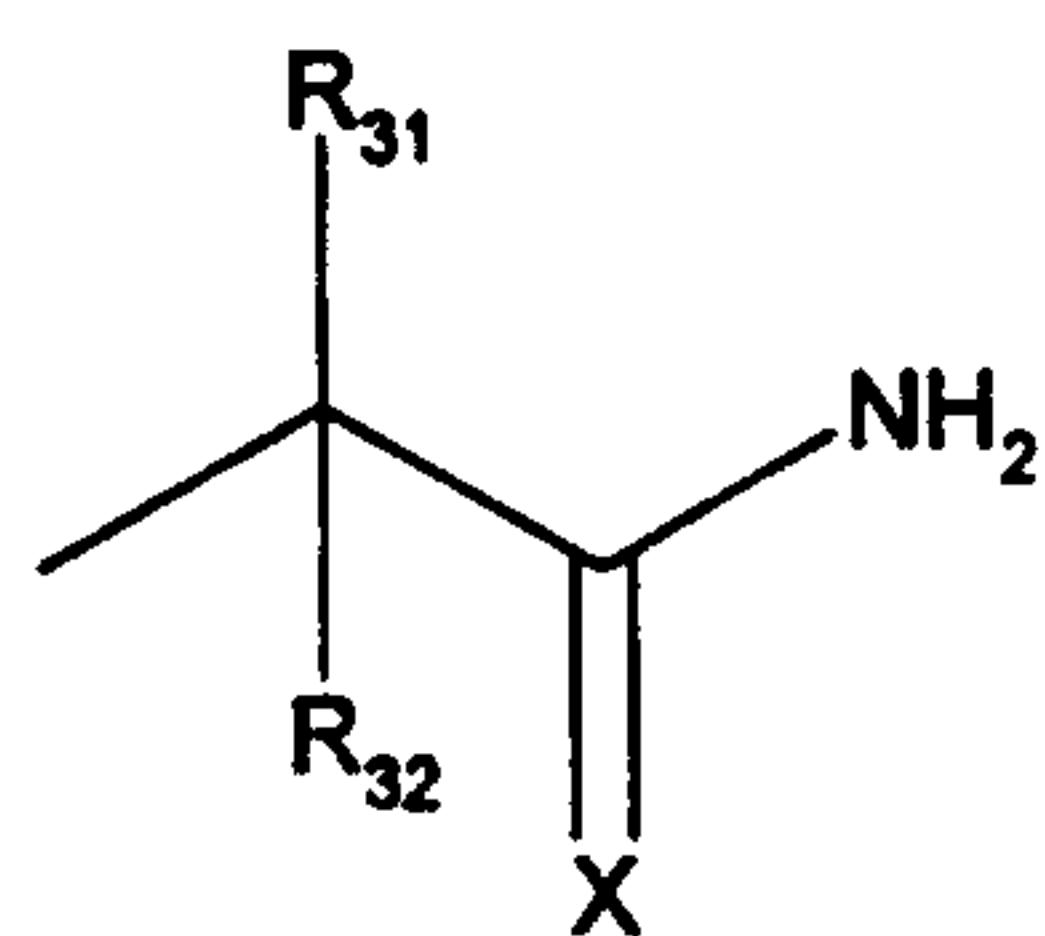
R₂ is hydrogen, or a group containing 1 to 4 non-hydrogen atoms plus any required hydrogen atoms;

20 R₃ is -(L₃)- Z, where -(L₃)- is a divalent linker group selected from a bond or a divalent group selected from:

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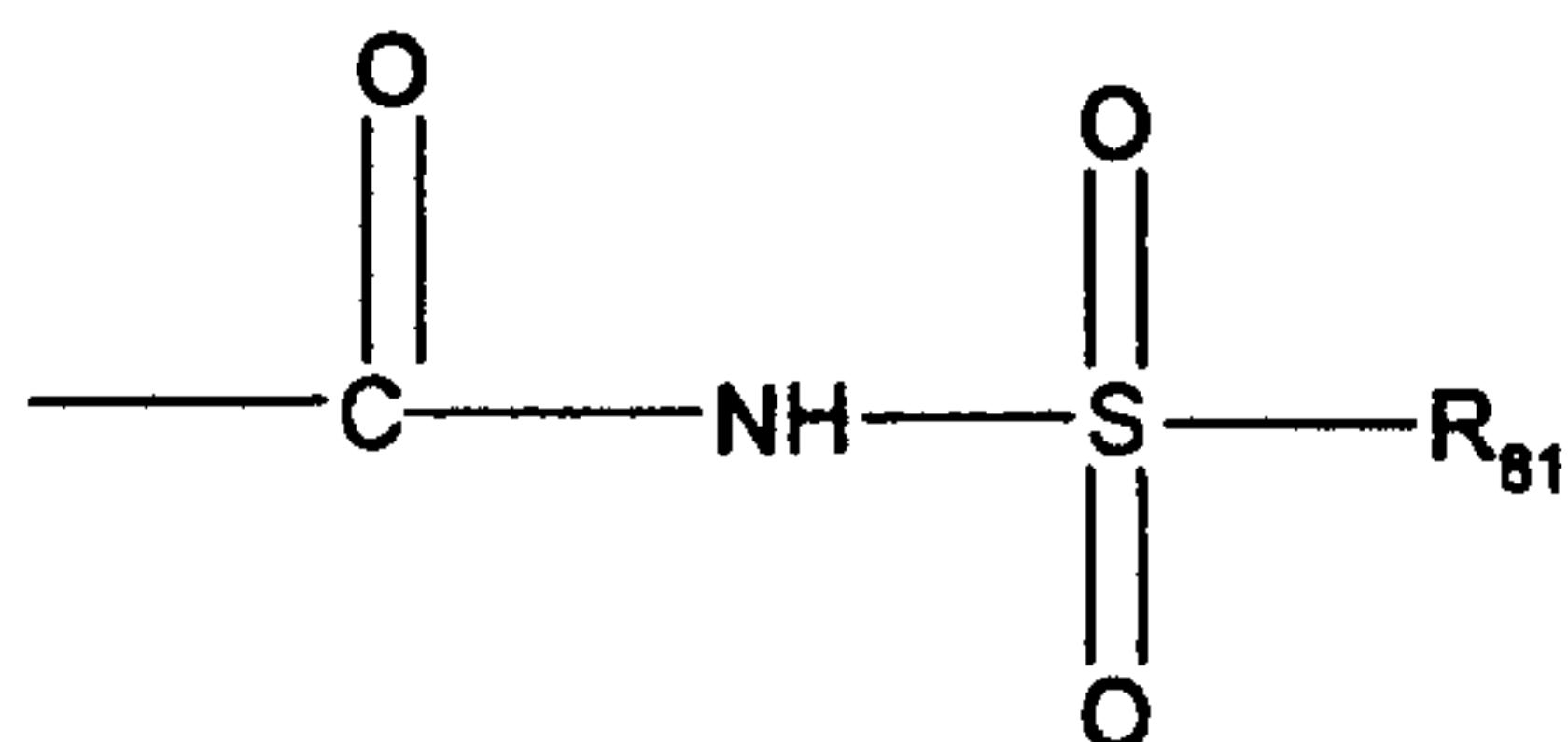
and Z is selected from acetamide, thioacetamide,
glyoxylamide, thioglyoxylamide, hydrazide or
thiohydrazide groups represented by the formulae,



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where R_{31} and R_{32} are independently selected from hydrogen, C_1 - C_8 alkyl, C_1 - C_8 haloalkyl, and C_3 - C_4 cycloalkyl, and X is oxygen or sulfur;

R_4 and R_5 are independently selected from 5 hydrogen, a non-interfering substituent, or the group, $-(L_a)-(acylsulfonamide\ group)$; wherein $-(L_a)-$, is a linker having a linker length of 1 to 8, provided, that at least one of R_4 and R_5 must be the group, $-(L_a)-(acylsulfonamide\ group)$; and the (acylsulfonamide 10 group) is represented by the formula;



where R_{81} is selected from the group consisting of C_1 - C_8 alkyl, C_1 - C_8 alkoxy, C_1 - C_8 alkylthio, C_1 - C_8 alkylamino, C_1 - C_8 haloalkyl, C_1 - C_{14} aralkyl, C_1 - C_{14} alkylaryl, aryl, 15 thioaryl, C_3 - C_{14} carbocyclic radical, C_3 - C_{14} heterocyclic radical.

R_6 and R_7 are selected from hydrogen, non-interfering substituent, carbocyclic radical, carbocyclic radical substituted with non-interfering 20 substituent(s), heterocyclic radical, and heterocyclic radical substituted with non-interfering substituent(s).

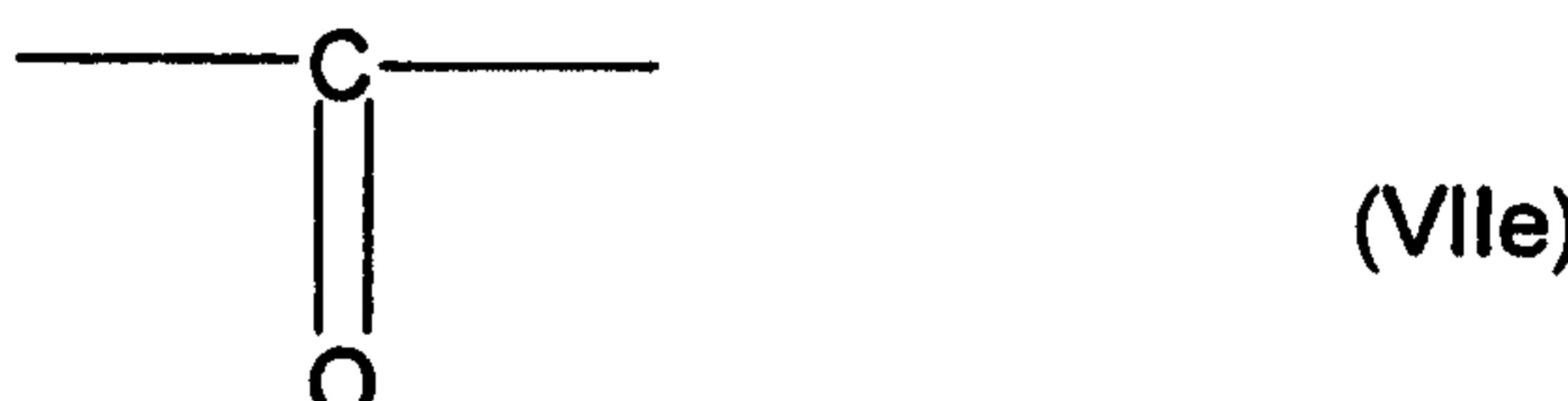
Preferred Subgroups of Compounds of Formula (I):

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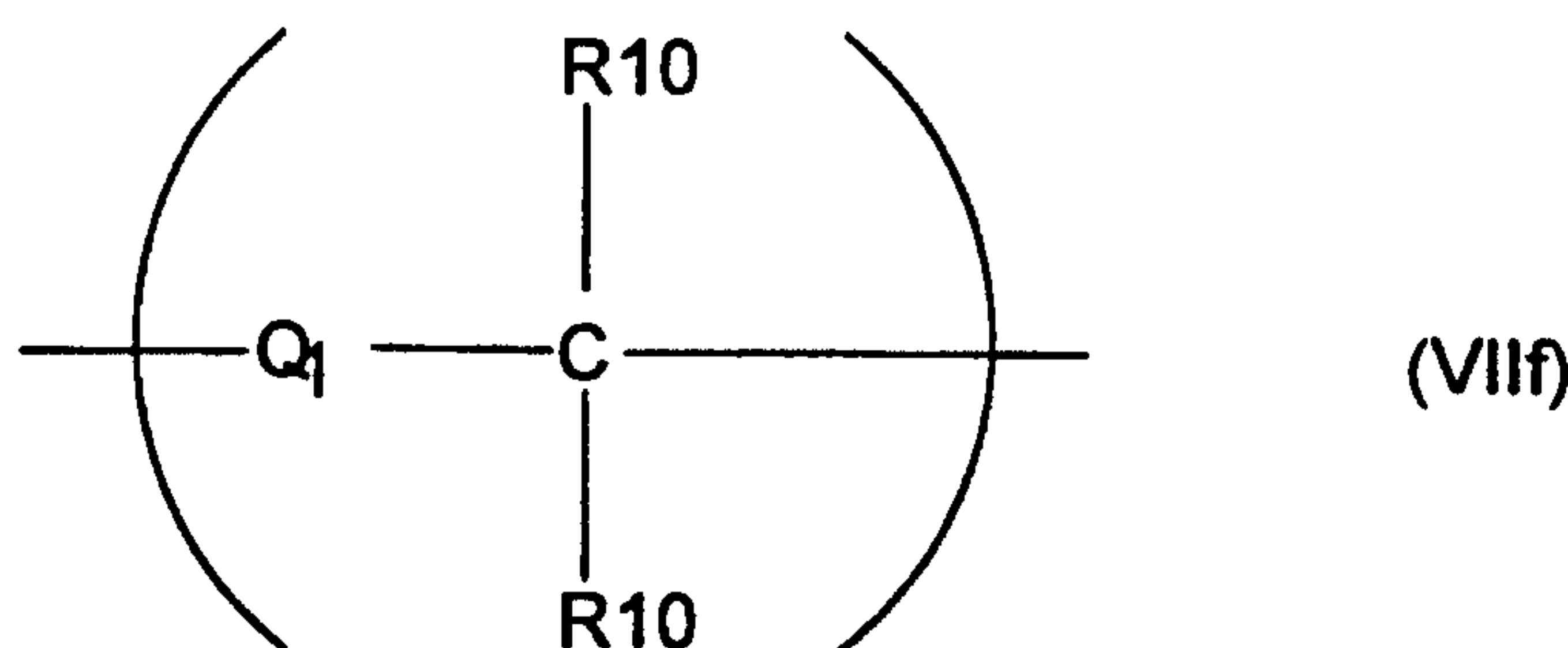
I. Preferred R_1 substituents:

A preferred subclass of compounds of formula (I) wherein for R_1 the divalent linking group $-(L_1)-$ are those corresponding to the formulae (VIIa), (VIIb), 30 (VIIc), (VIId), (VIIe), and (VIIf):

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or



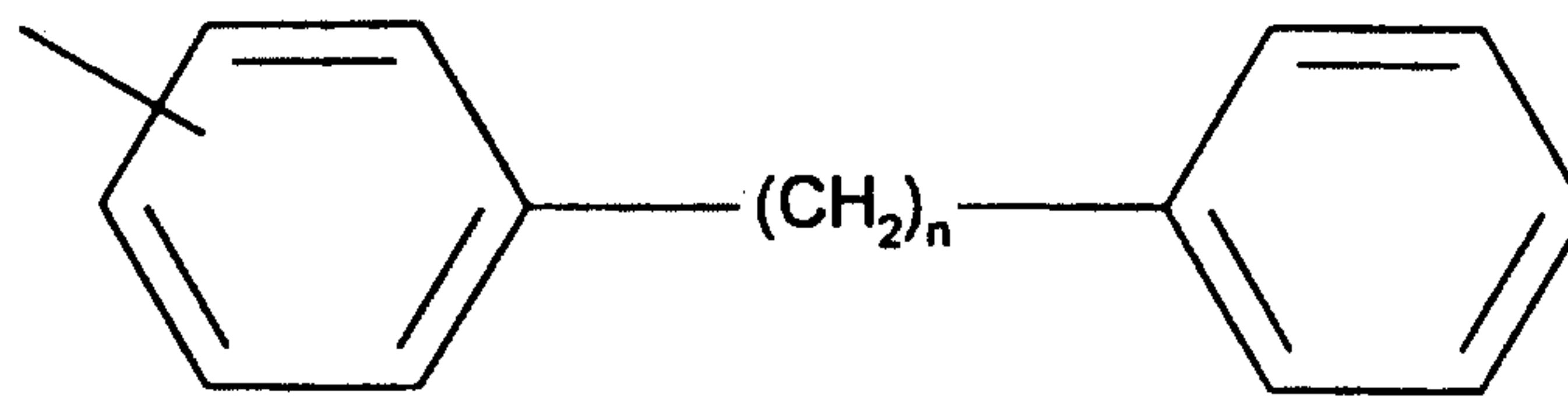
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where Q_1 is a bond or any of the divalent groups (VIIa), (VIIb), (VIIc), (VIId), (VIIe), and (VIIIf) and each R_{10} is independently hydrogen, C₁₋₈ alkyl, C₁₋₈ haloalkyl or C₁₋₈ alkoxy.

10 Particularly preferred as the linking group $-(L_1)-$ of R_1 is an alkylene chain of 1 or 2 carbon atoms, namely, $-(CH_2)-$ or $-(CH_2-CH_2)-$.

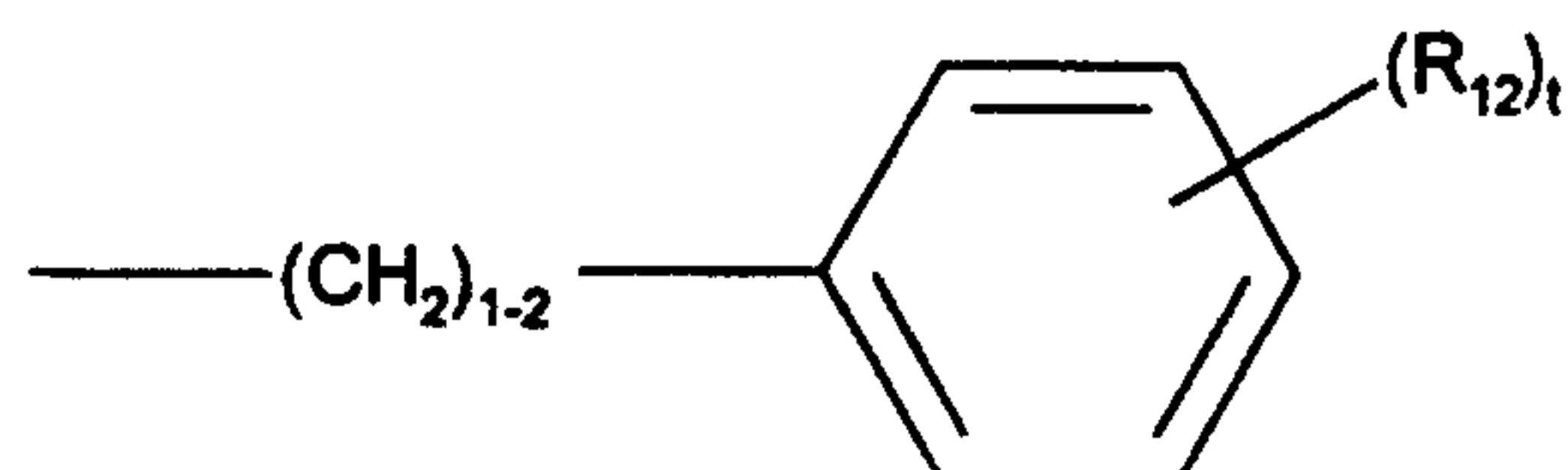
15 The preferred group for R_{11} is a substituted or unsubstituted group selected from the group consisting of C₅-C₁₄ cycloalkyl, C₅-C₁₄ cycloalkenyl, phenyl, naphthyl, norbornanyl, bicycloheptadienyl, tolulyl, xlenyl, indenyl, stilbenyl, terphenylyl, diphenylethylenyl, phenyl-cyclohexenyl, acenaphthylenyl, and anthracenyl, biphenyl, bibenzylyl and related bibenzylyl homologues
20 represented by the formula (a);

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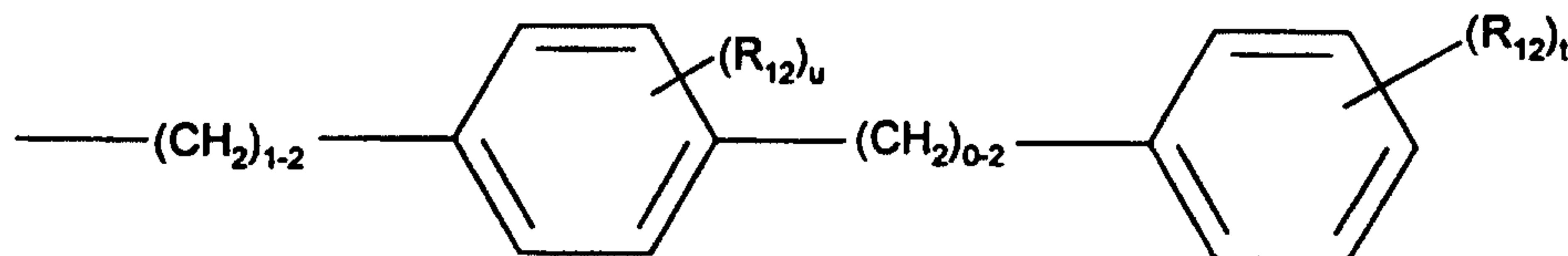


where n is a number from 1 to 8.

Particularly preferred are compounds wherein for R₁ the combined group -(L₁)-R₁₁ is selected from the group 5 consisting of



or



where R₁₂ is a radical independently selected from 10 halo, C₁-C₈ alkyl, C₁-C₈ alkoxy, -S-(C₁-C₈ alkyl), -O-(C₁-C₈ alkyl) and C₁-C₈ haloalkyl where t is a number from 0 to 5 and u is a number from 0 to 4.

15 **II. Preferred R₂ substituents:**

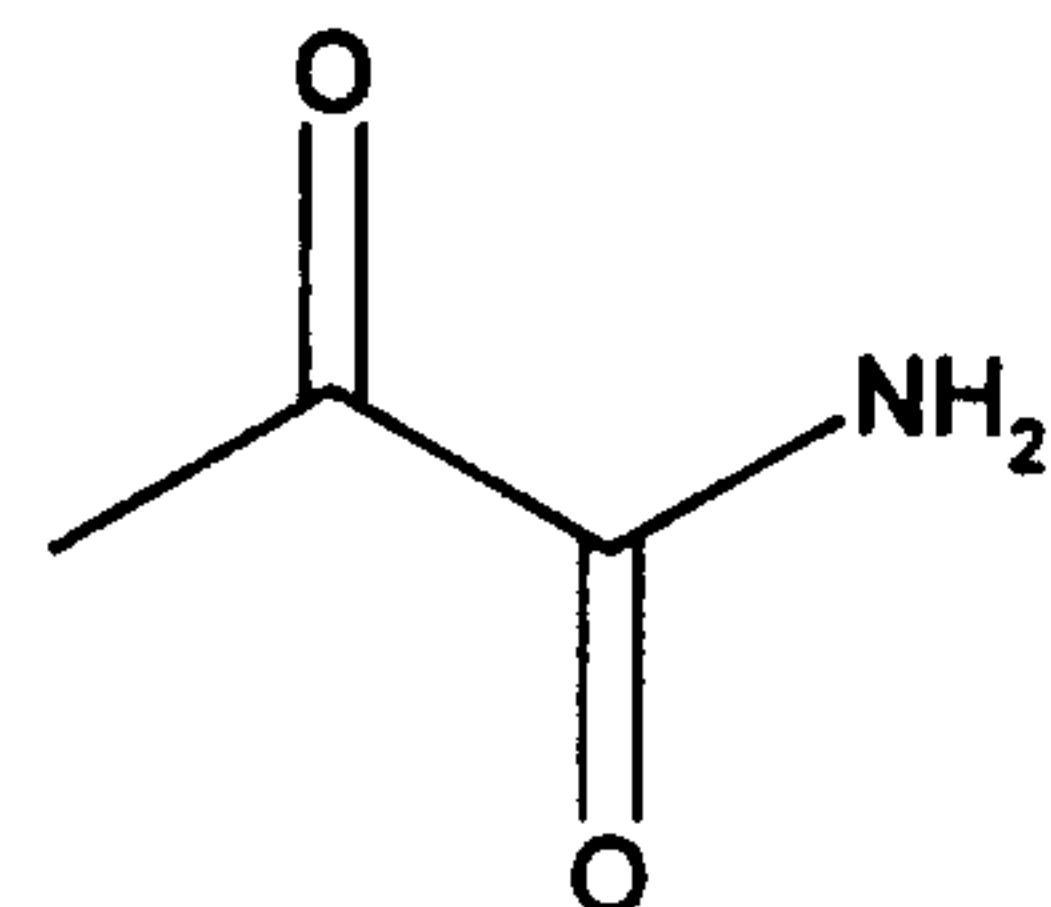
R₂ is preferably selected from the group consisting of hydrogen, C₁-C₄ alkyl, C₂-C₄ alkenyl, -O-(C₁-C₃ alkyl), -S-(C₁-C₃ alkyl), -C₁-C₄ cycloalkyl -CF₃, halo, -NO₂, -CN, -SO₃. Particularly preferred R₂ groups are 20 selected from hydrogen, methyl, ethyl, propyl, isopropyl, cyclopropyl, -F, -CF₃, -Cl, -Br, or -O-CH₃.

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III. Preferred R₃ substituents:

A preferred subclass of compounds of formula (I) are those wherein X is oxygen.

5 Another preferred subclass of compounds of formula (I) are those wherein Z is a glyoxylamide group.

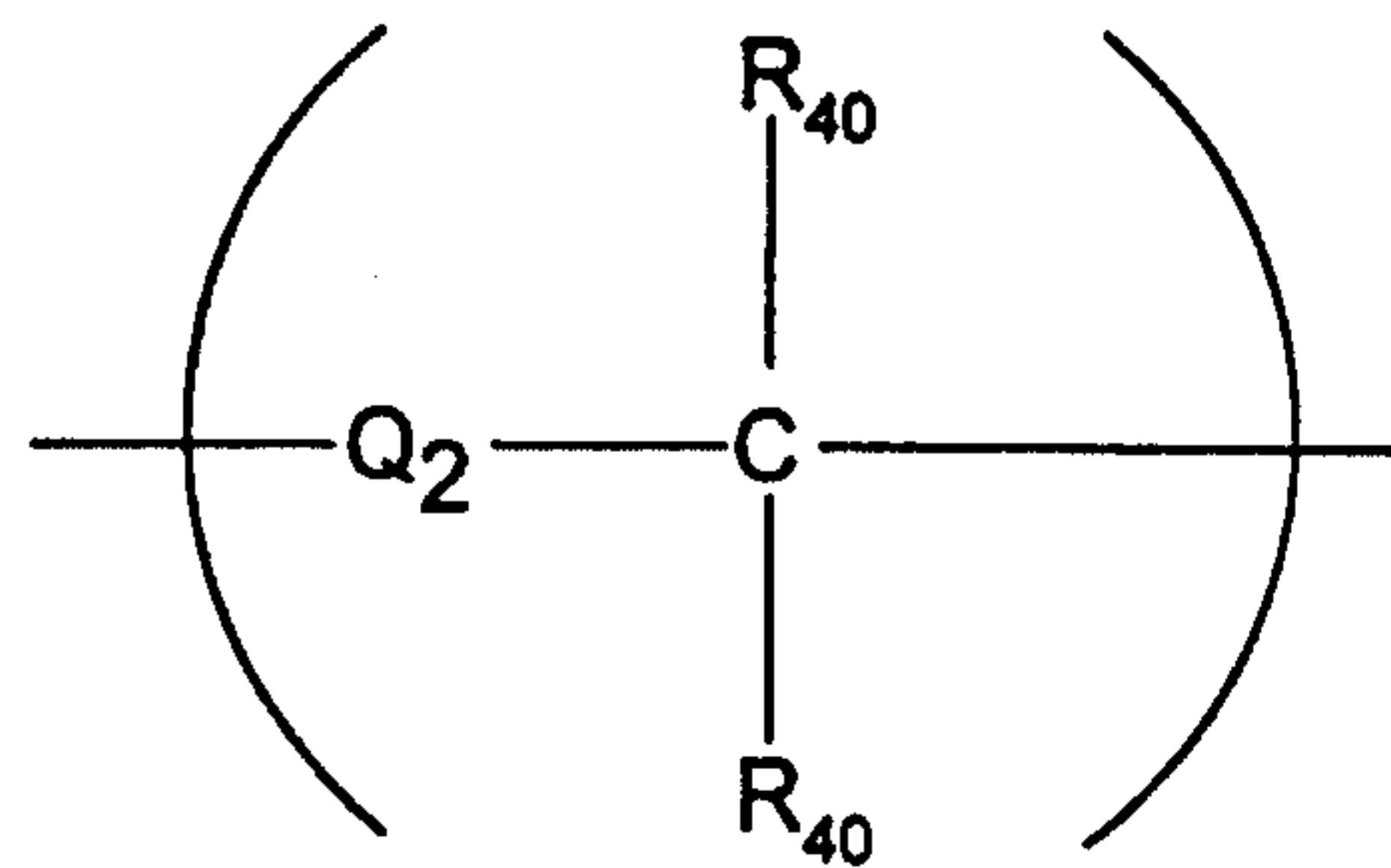


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Most preferred are compounds of formula (I) wherein R₃ is the glyoxamide group. For the group R₃ it is preferred that the linking group -(L₃)- be a bond.

15 IV. Preferred R₄ substituents:

Another preferred subclass of compounds of formula (I) are those wherein R₄ is a substituent having a linker with a linker length of 2 or 3 and the 20 linker group, -(L₄)-, for R₄ is selected from a group represented by the formula;

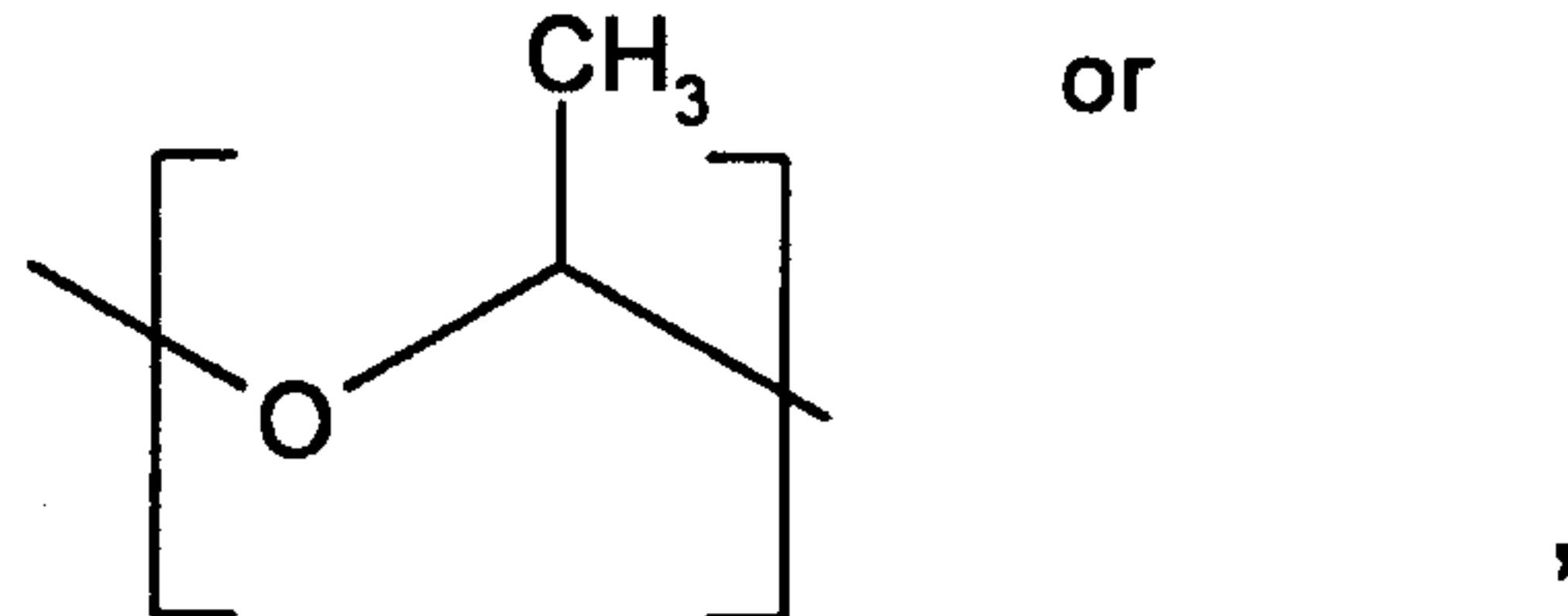
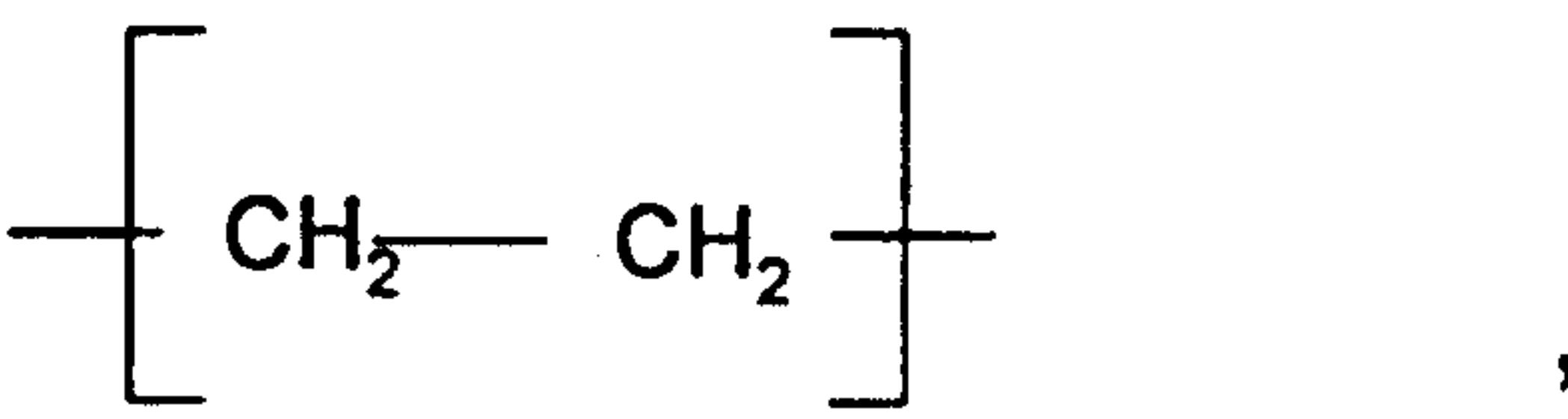
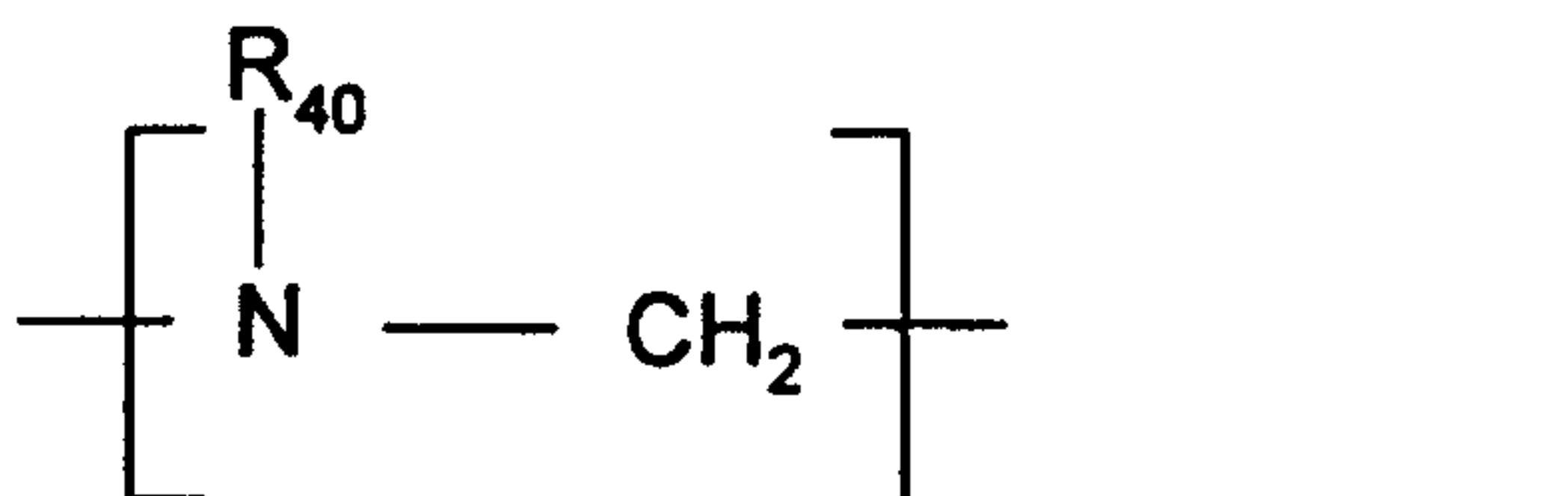
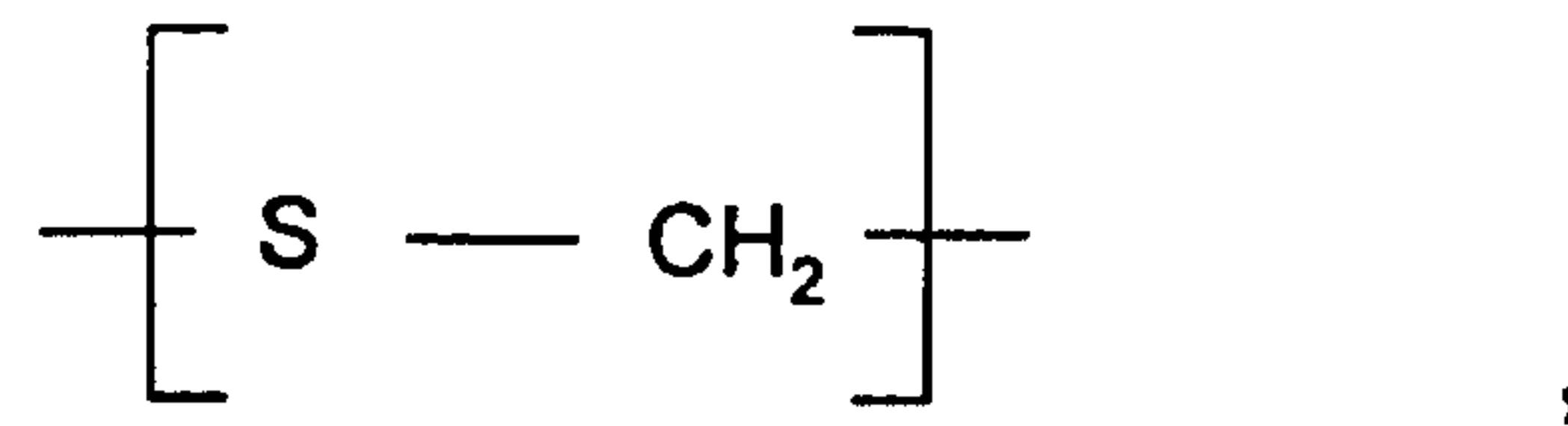
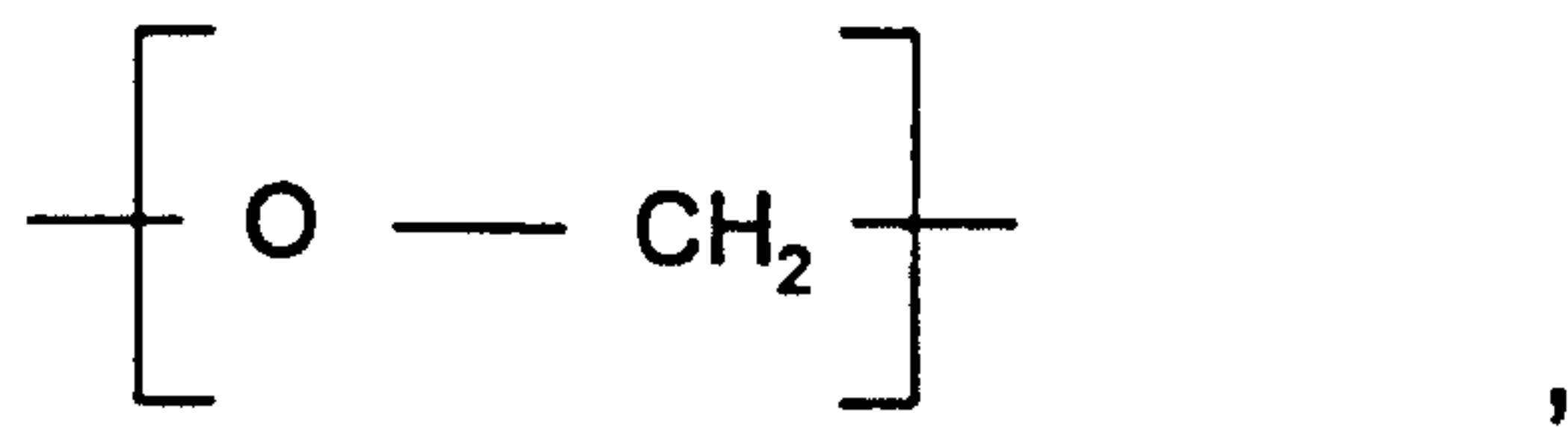


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where Q_2 is selected from the group $-(CH_2)-$, $-O-$, $-NH-$, $-C(O)-$, and $-S-$, and each R_{40} is independently selected from hydrogen, C₁-C₈ alkyl, aryl, C₁-C₈ alkaryl, C₁-C₈ alkoxy, aralkyl, and halo. Most preferred are

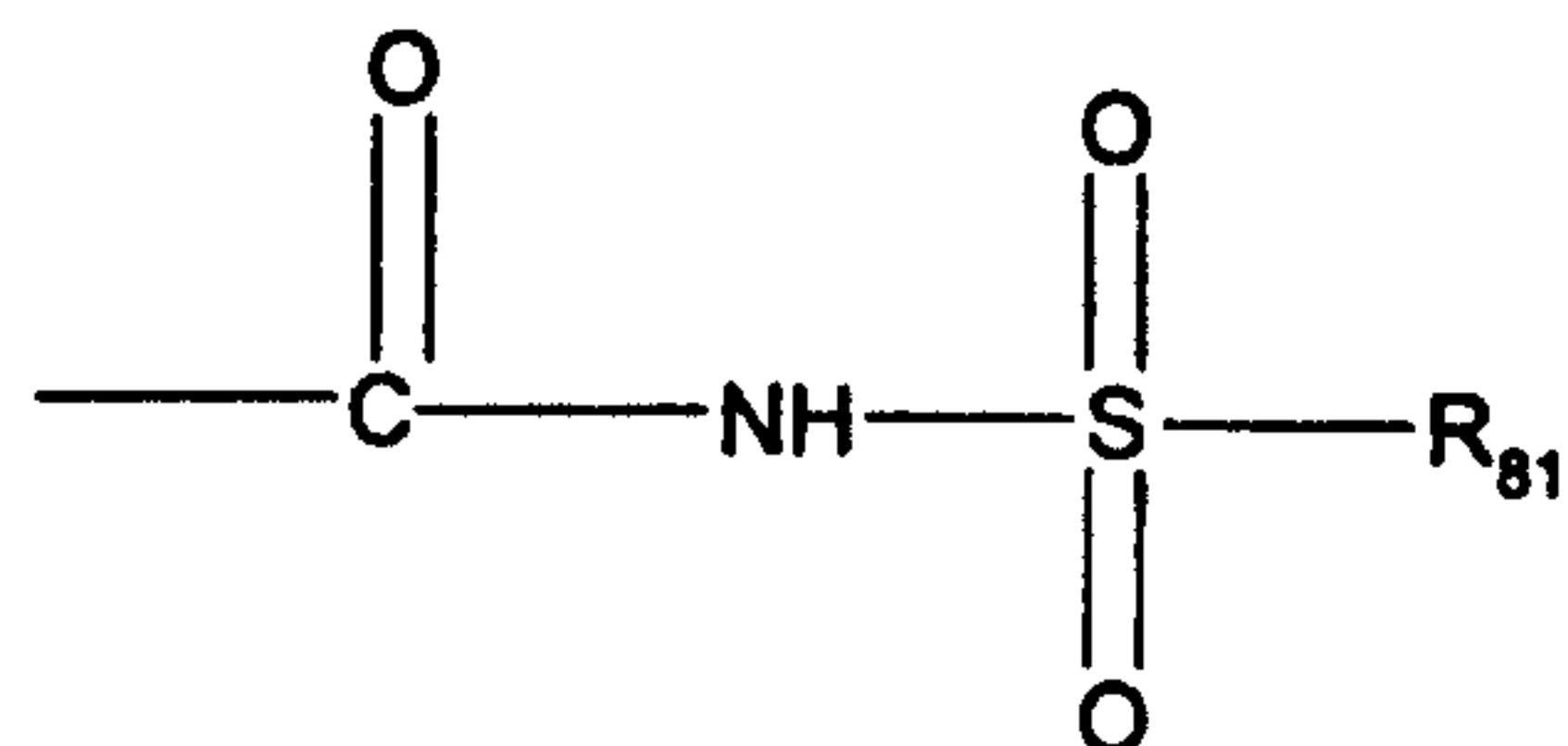
5 compounds where the linker, $-(L_4)-$, for R_4 is selected from the specific groups;



10 where R_{40} is hydrogen or C₁-C₈ alkyl.

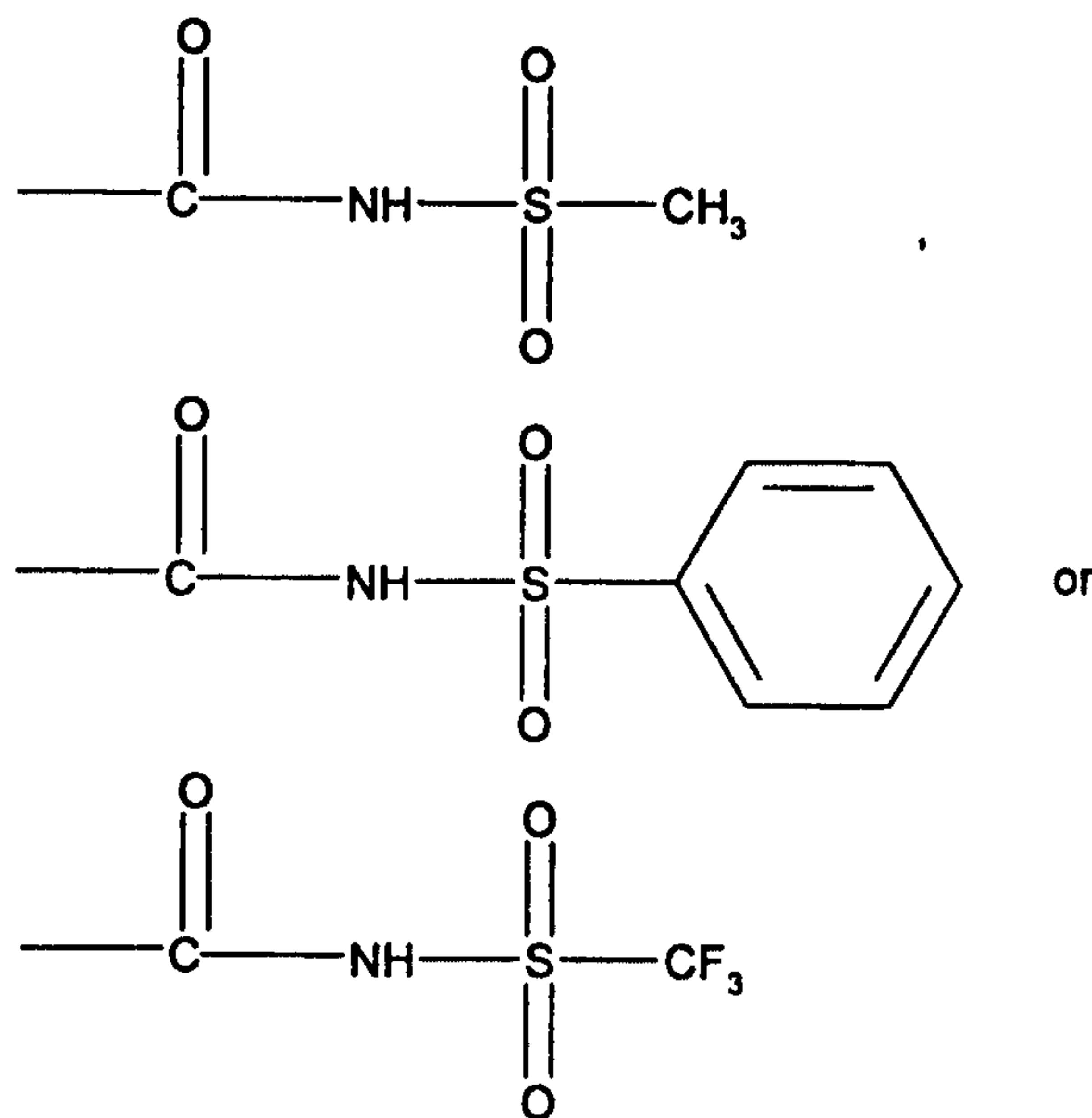
Preferred as the (acylsulfonamide group) in the group R_4 are acylsulfonamide groups selected from:

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where R₈₁ is selected from -CF₃, C₁-C₈ alkyl, C₁-C₈ alkoxy, C₁-C₈ alkylthio, C₁-C₈ alkylamino, C₁-C₈ haloalkyl, C₁-C₁₄ aralkyl, C₁-C₁₄ alkylaryl, aryl, thioaryl, C₃-C₁₄ carbocyclic radical, C₃-C₁₄ heterocyclic radical. A salt or a solvate derivative of the (acylsulfonamide group) is also suitable.

Particularly preferred are acylsulfonamide groups selected from:

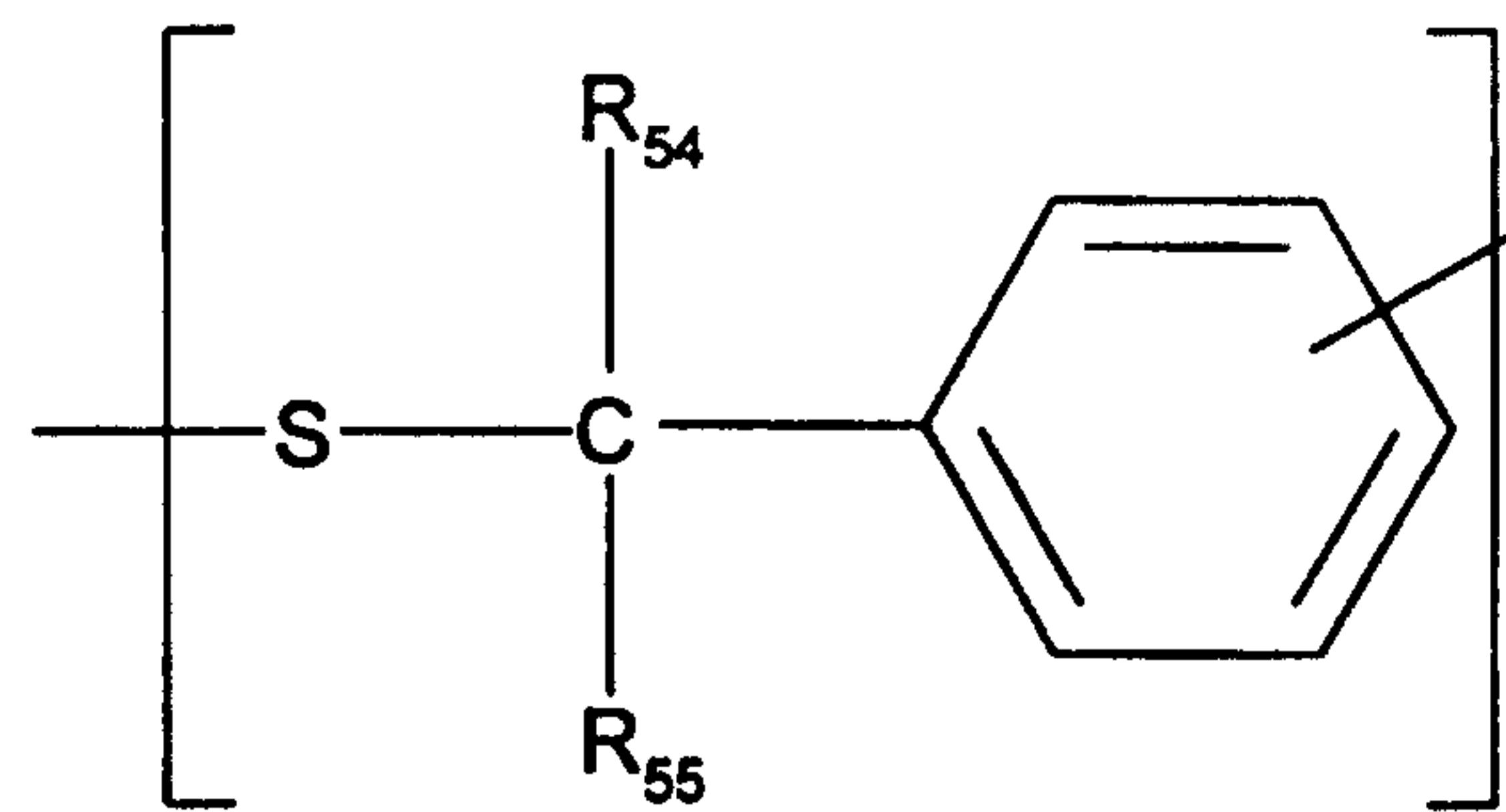
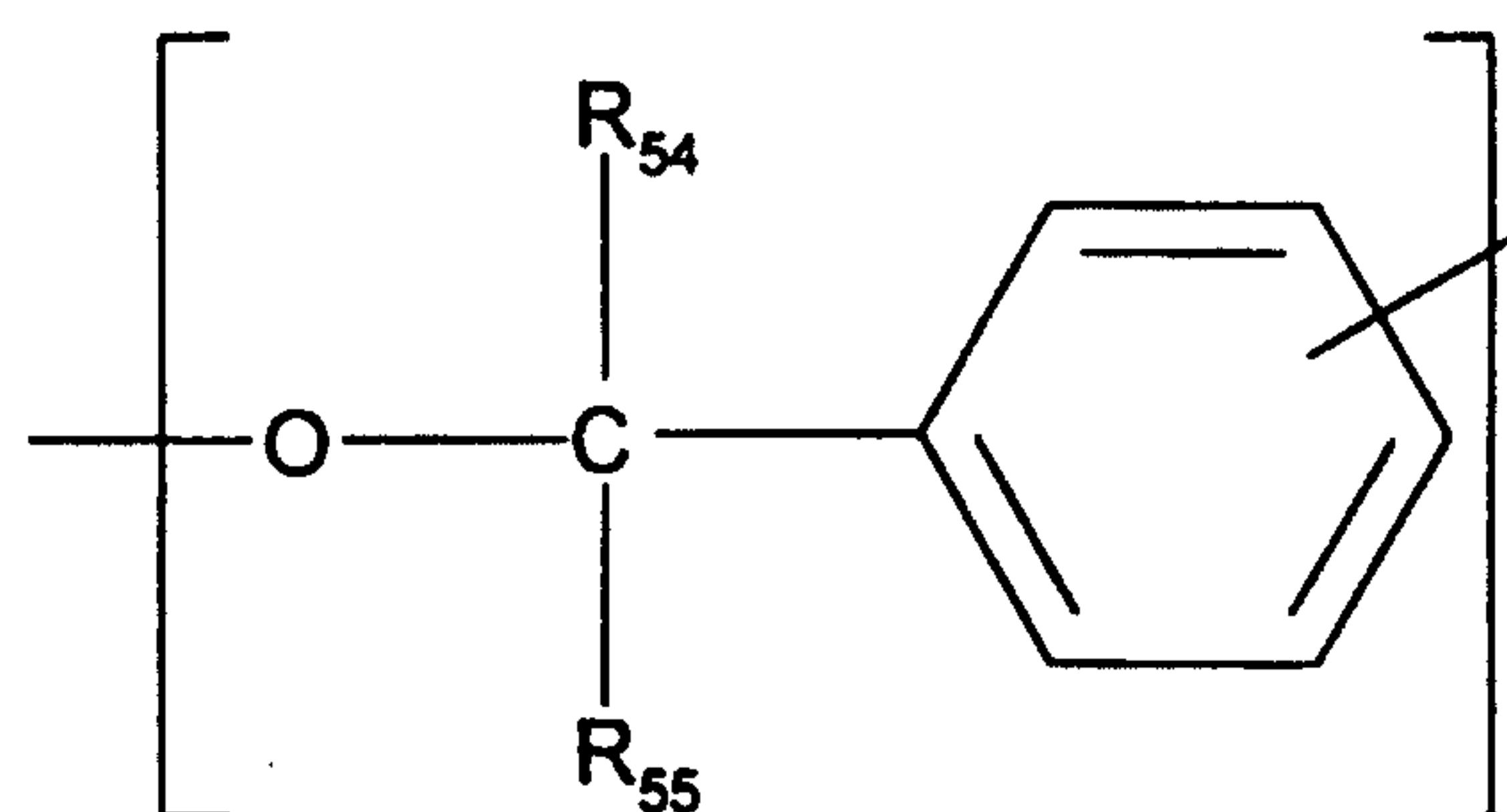


or salts or solvates thereof.

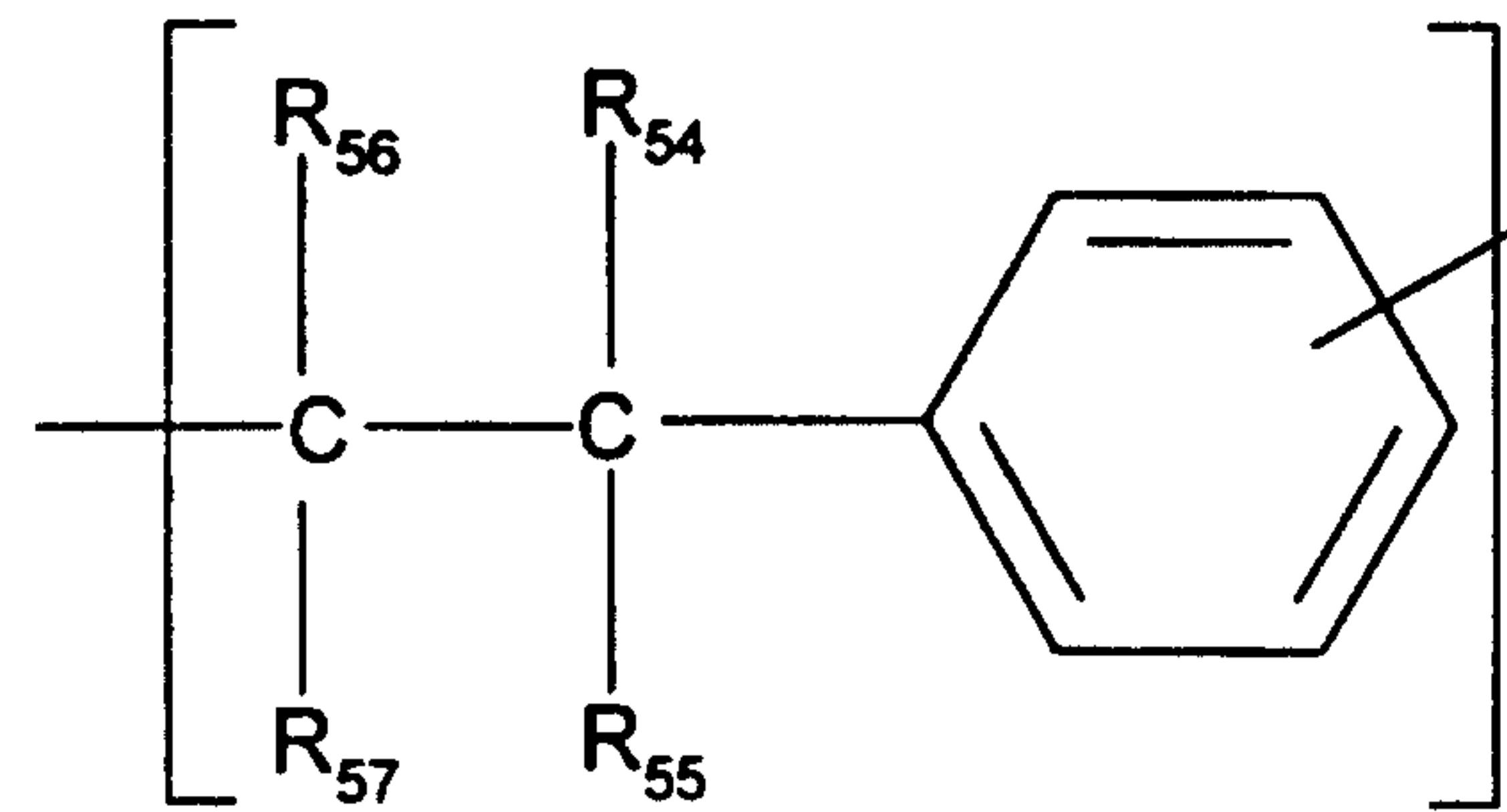
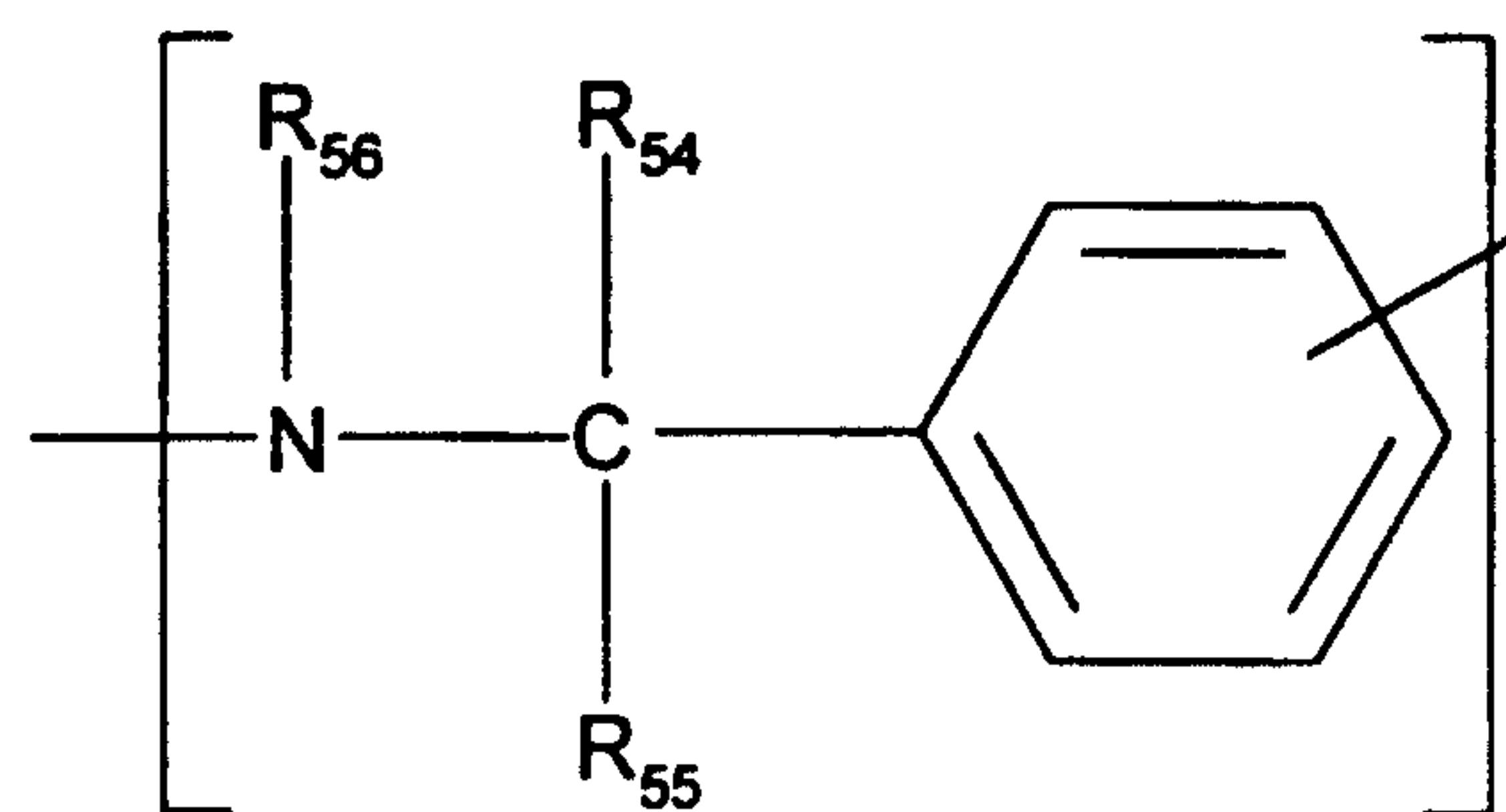
V. Preferred R₅ Substituents:

-18-

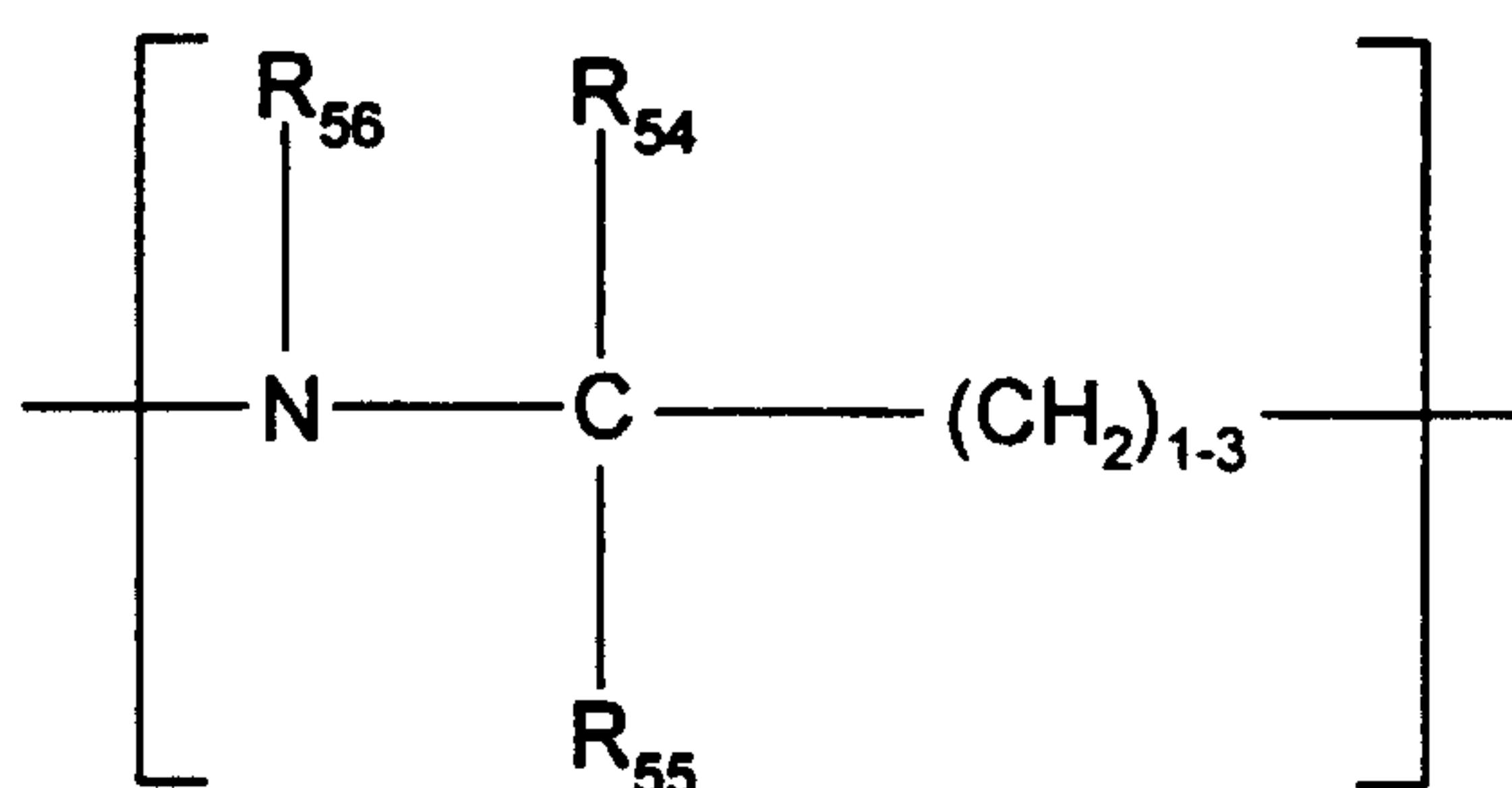
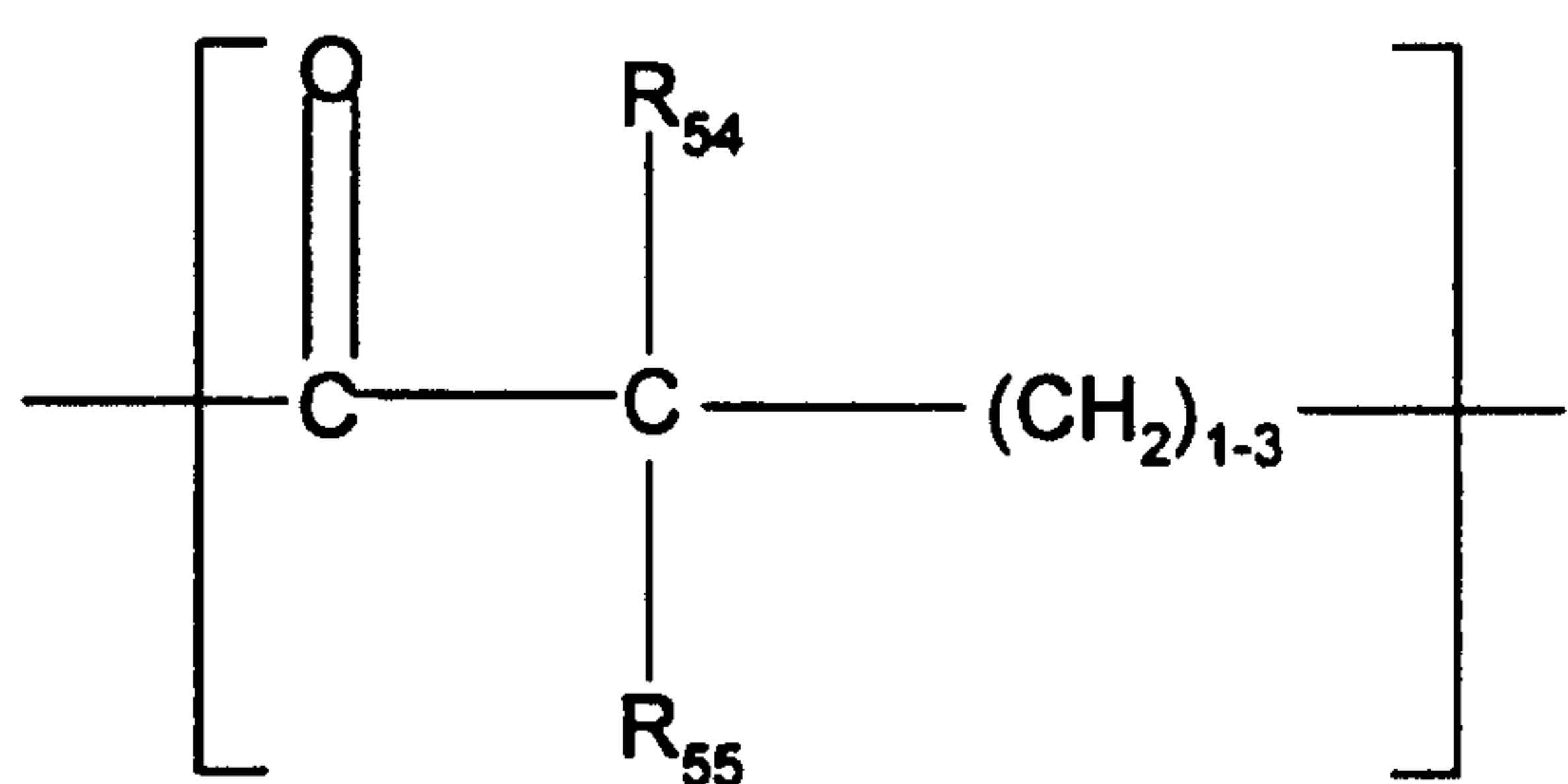
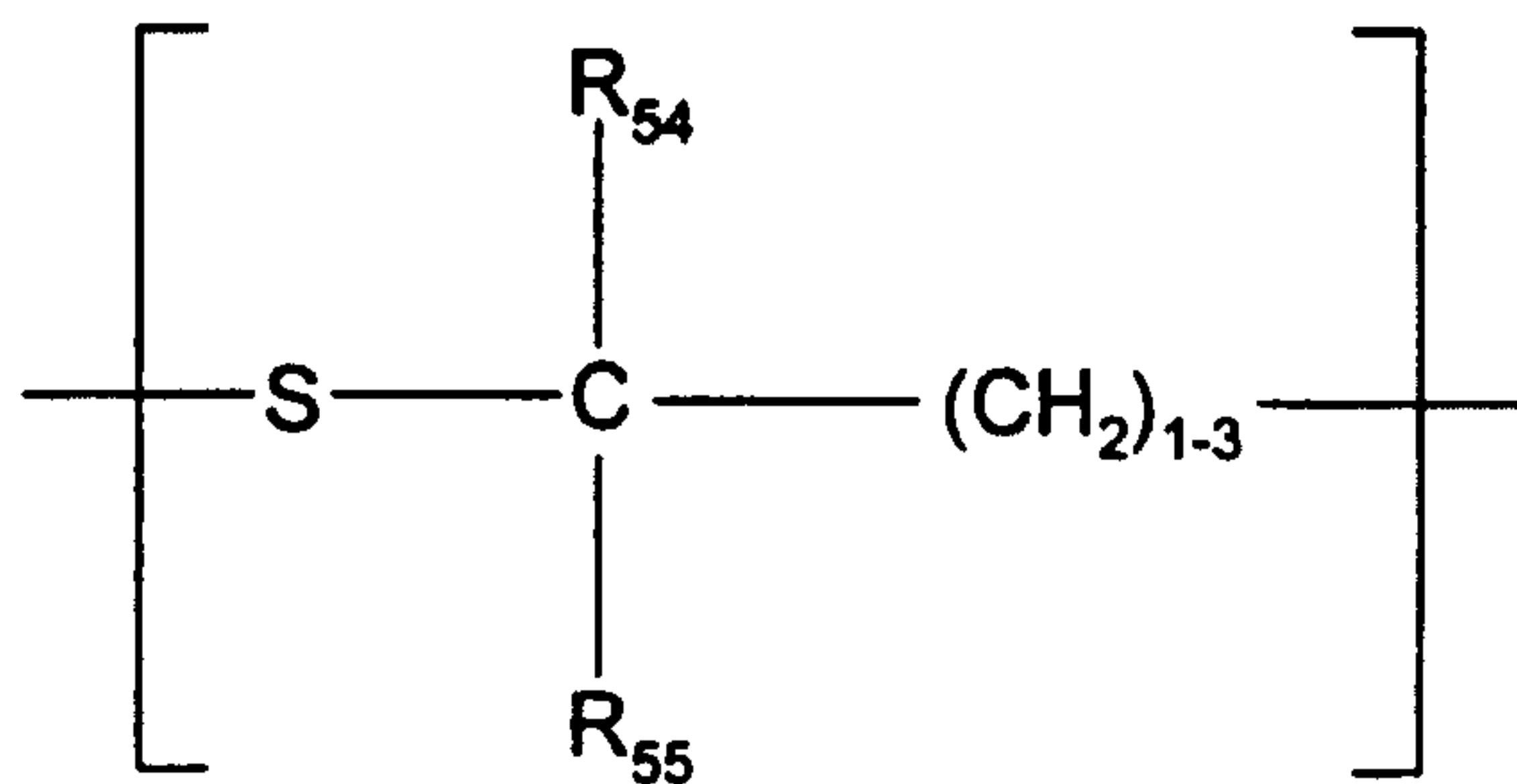
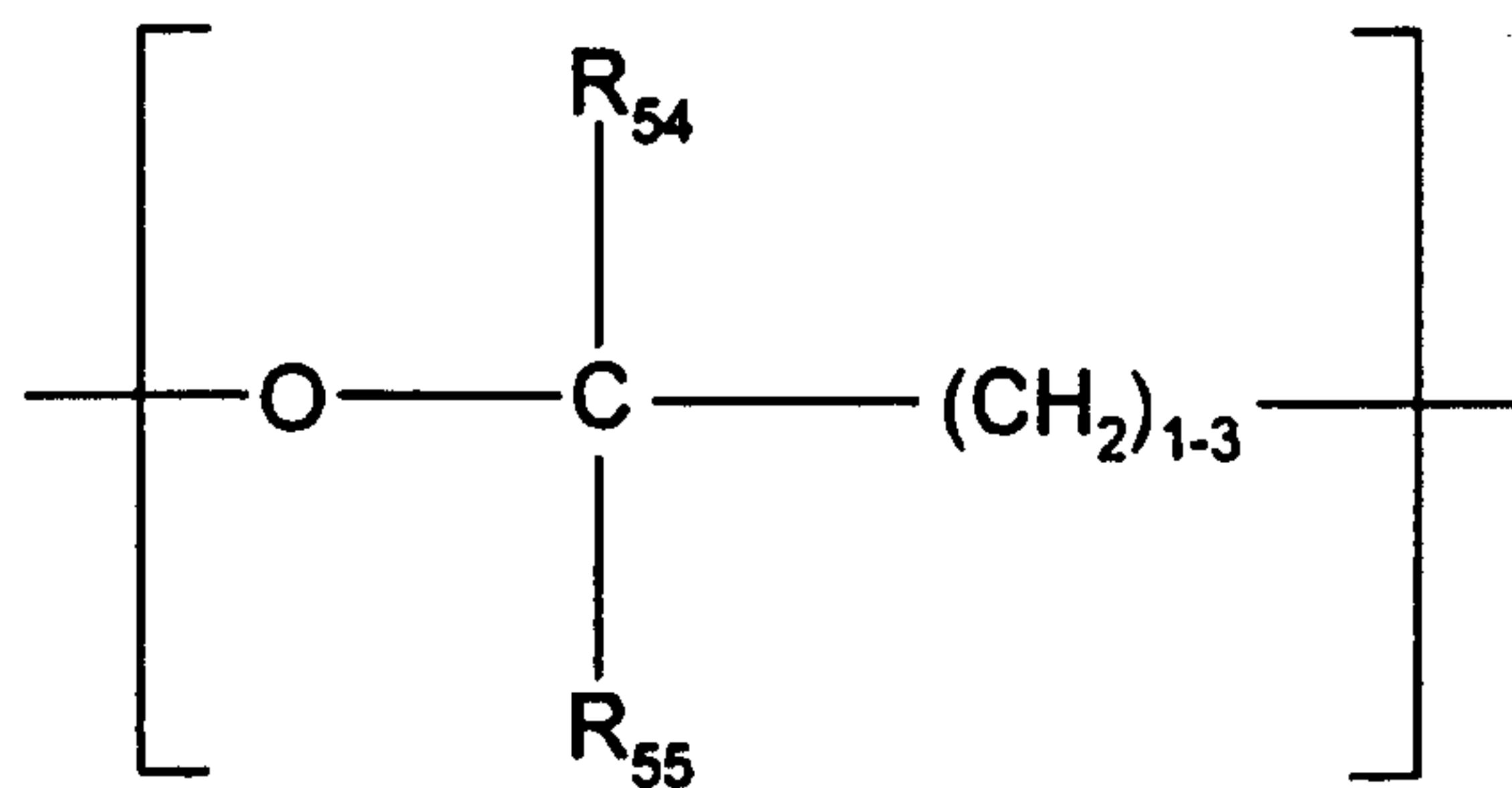
Preferred linker, -(La)-, for R5 is selected from the group consisting of;



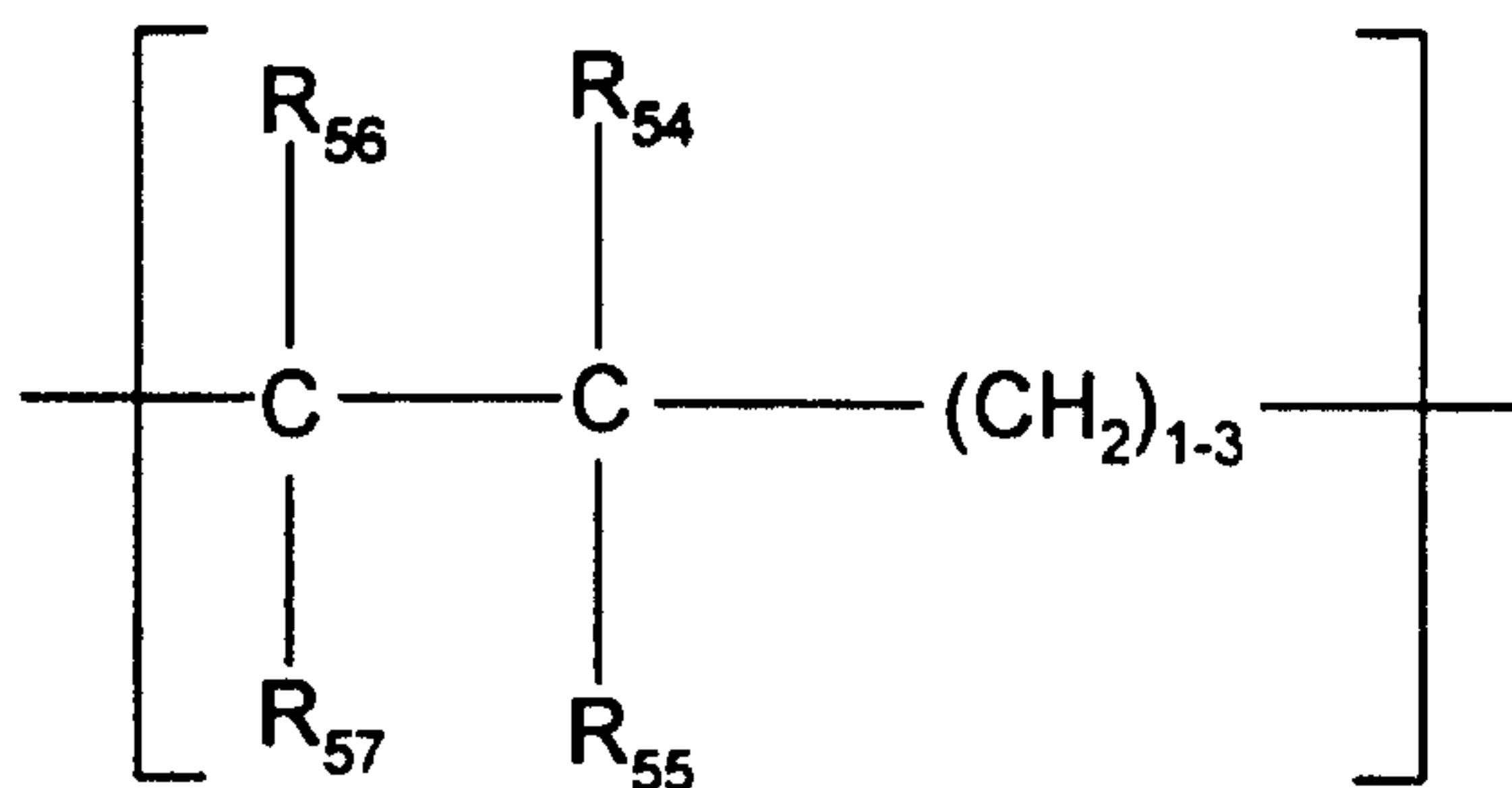
5



-19-



and

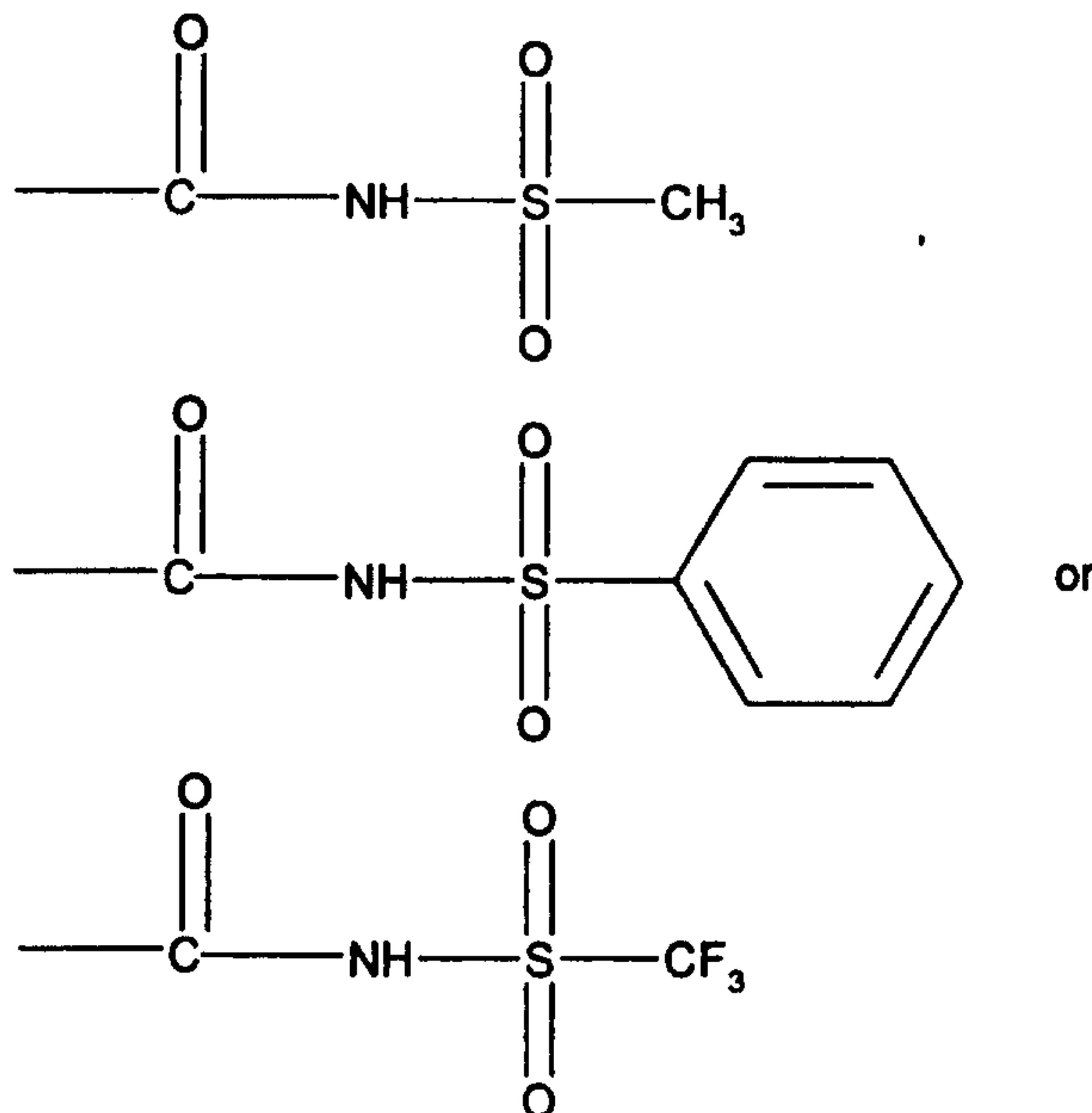


-20-

wherein R₅₄, R₅₅, R₅₆ and R₅₇ are each independently hydrogen, C₁-C₈ alkyl, C₁-C₈ haloalkyl, aryl, C₁-C₈ alkoxy, or halo.

5 VI. Preferred (acylsulfonamide group) for R₄ and/or R₅ substitutions:

At least one of R₄ and R₅ must be the group, -(L_a)-(acylsulfonamide group). The preferred (acylsulfonamide group) on the group -(L_a)-(acylsulfonamide group) of R₄ or R₅ is selected from



In addition, it is preferred that only one R₄ or R₅ substituents be the group, -(L_a)-(acylsulfonamide group).

15 Most preferred is that the R₄ substituent be the group, -(L_a)-(acylsulfonamide group).

V. Preferred R₆ substituents:

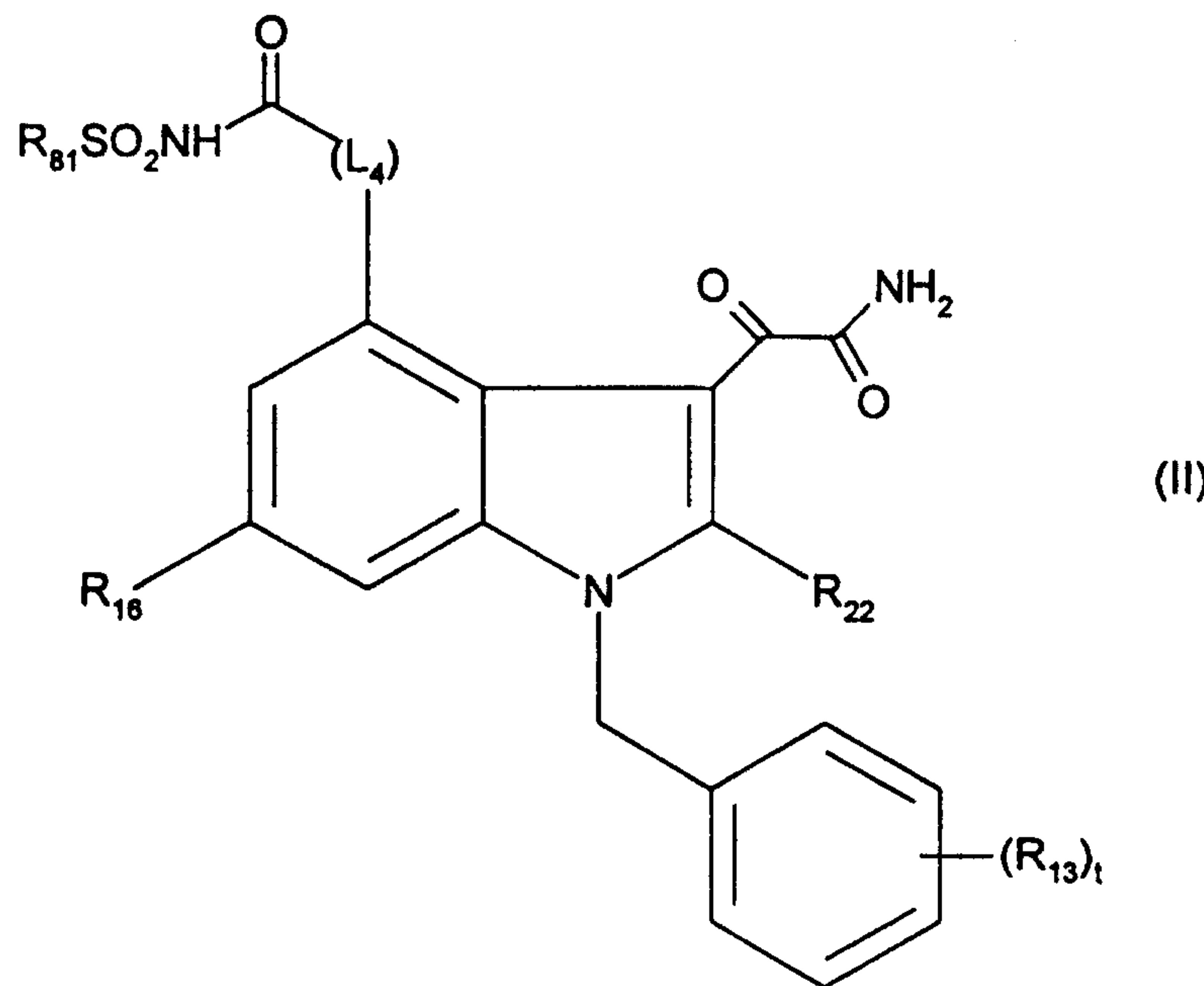
Another preferred subclass of compounds of formula (I) are those wherein for R₆ the non-interfering substituent is methyl, ethyl, propyl, isopropyl, -S-CH₃,

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-O-CH₃, C₄-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₇-C₁₂ aralkyl, C₇-C₁₂ alkaryl, C₃-C₈ cycloalkyl, C₃-C₈ cycloalkenyl, phenyl, toluyl, xlenyl, biphenyl, C₁-C₆ alkoxy, C₂-C₆ alkenyloxy, C₂-C₆ alkynyloxy, C₂-C₁₂ 5 alkoxyalkyl, C₂-C₁₂ alkoxyalkyloxy, C₂-C₁₂ alkylcarbonyl, C₂-C₁₂ alkylcarbonylamino, C₂-C₁₂ alkoxyamino, C₂-C₁₂ alkoxyaminocarbonyl, C₁-C₁₂ alkylamino, C₁-C₆ alkylthio, C₂-C₁₂ alkylthiocarbonyl, C₁-C₆ alkylsulfinyl, C₁-C₆ alkylsulfonyl, C₂-C₆ 10 haloalkoxy, C₁-C₆ haloalkylsulfonyl, C₂-C₆ haloalkyl, C₁-C₆ hydroxyalkyl, -C(O)O(C₁-C₆ alkyl), -(CH₂)_n-O-(C₁-C₆ alkyl), benzyloxy, phenoxy, phenylthio, -(CONHSO₂R), -CHO, amino, amidino, bromo, carbamyl, carboxyl, carbalkoxy, -(CH₂)_n-CO₂H, chloro, cyano, 15 cyanoguanidinyl, fluoro, guanidino, hydrazide, hydrazino, hydrazido, hydroxy, hydroxyamino, iodo, nitro, phosphono, -SO₃H, thioacetal, thiocarbonyl, and C₁-C₆ carbonyl; where R is C₁-C₈ alkyl and n is from 1 to 8.

20 Preferred compounds of the invention are those having the general formula (II), or a pharmaceutically acceptable salt or solvate derivative thereof;

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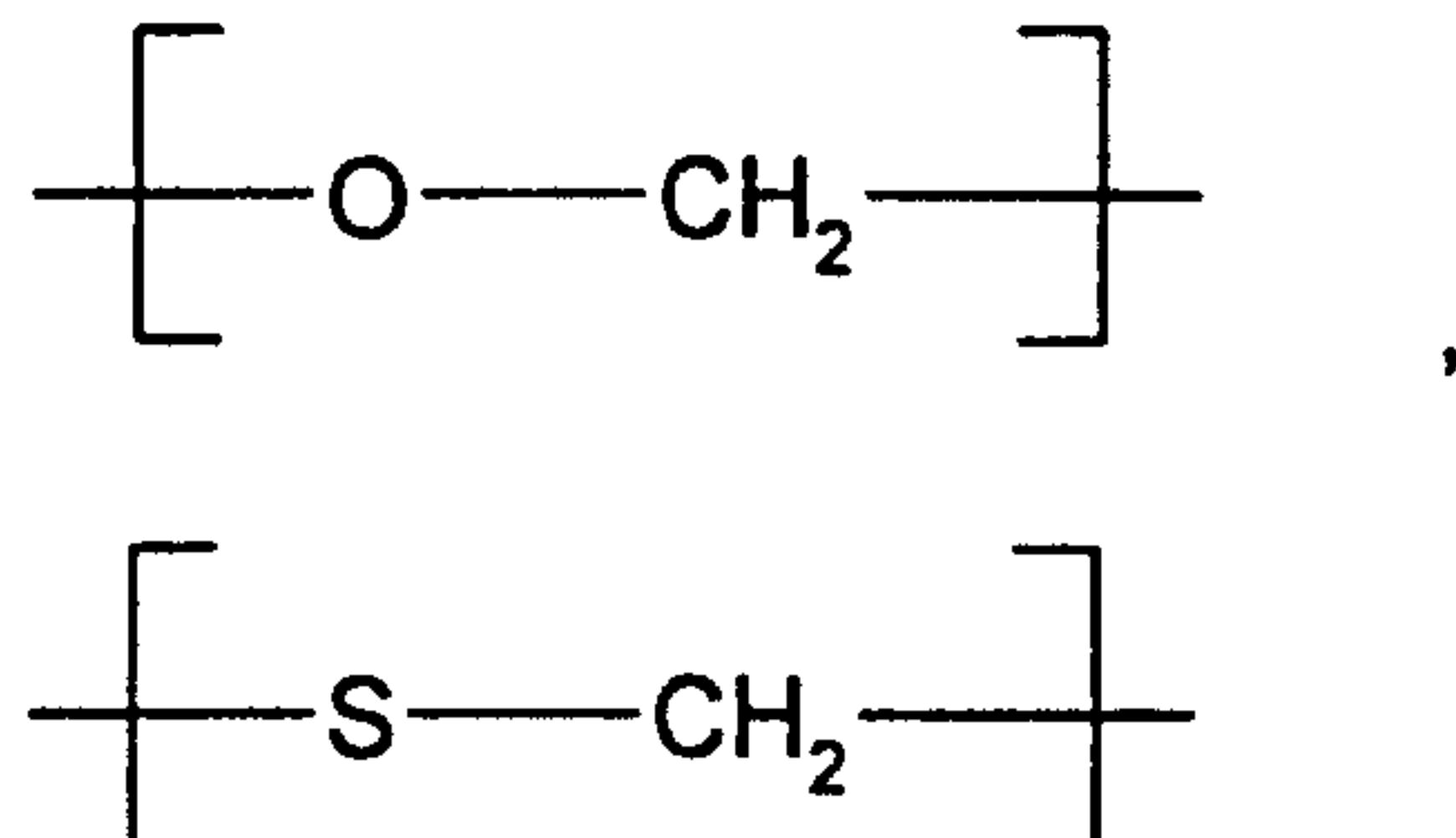


wherein ;

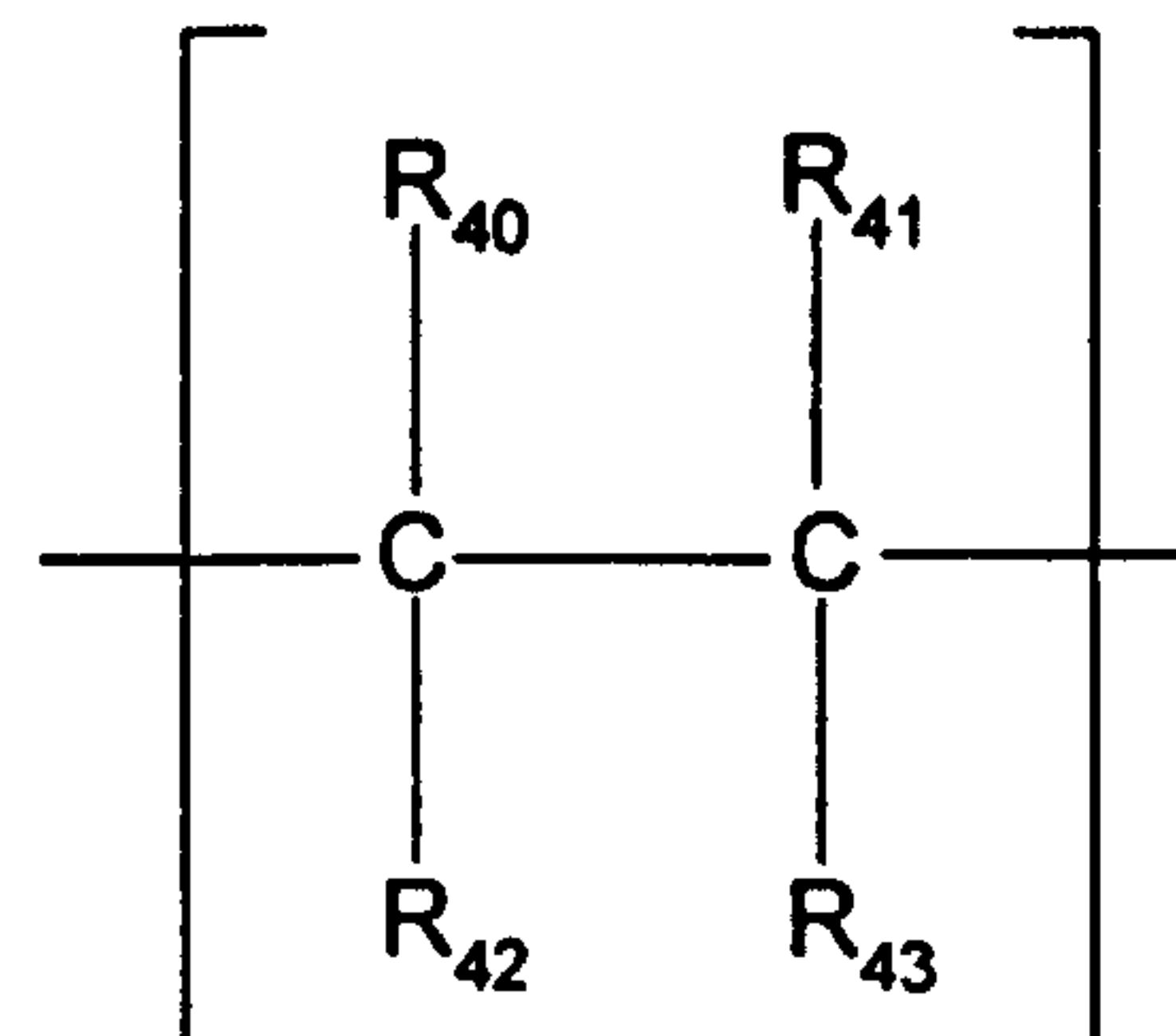
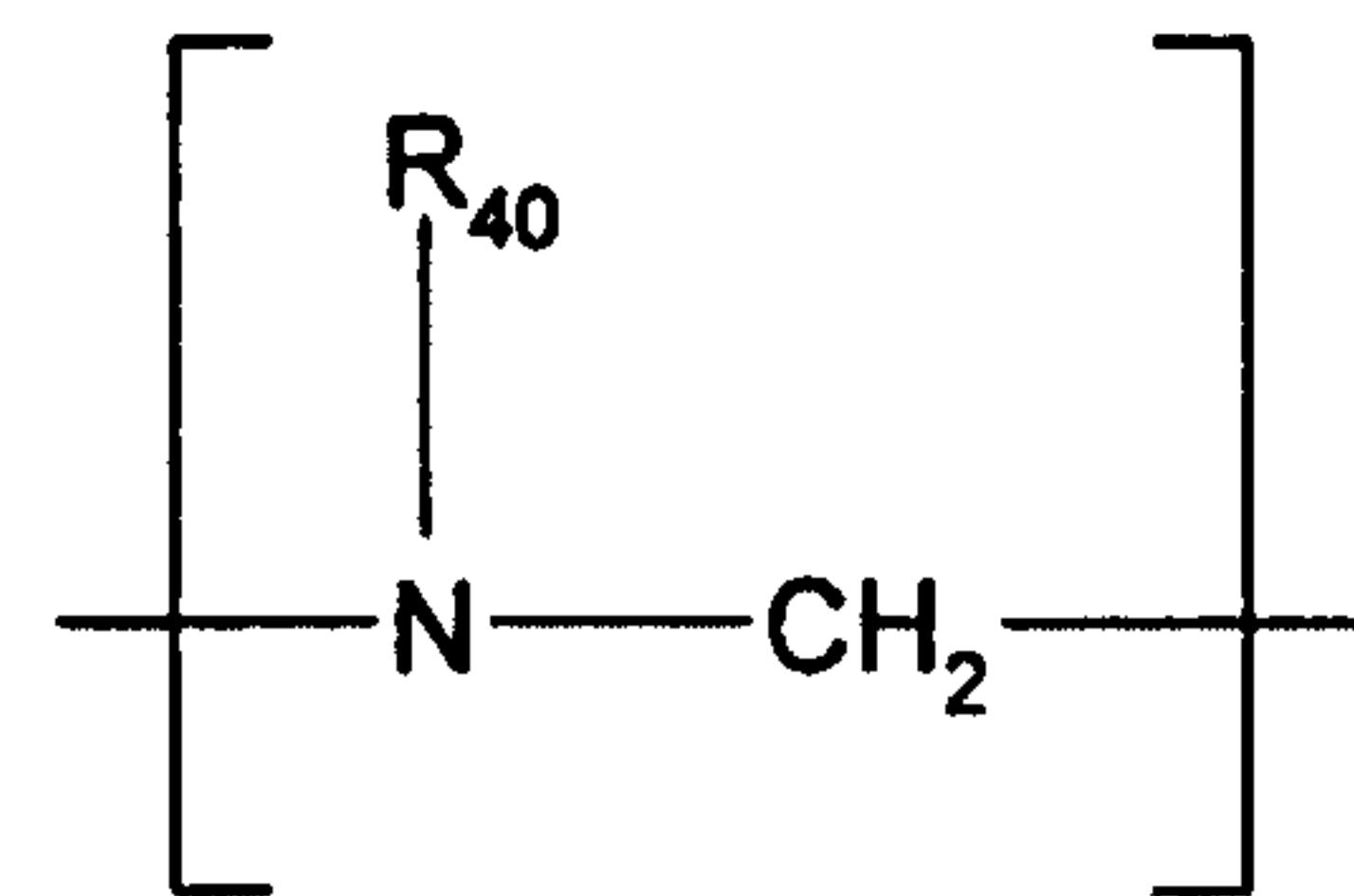
R₈₁ is selected from C₁-C₈ alkyl, C₁-C₈ alkoxy,
 5 C₁-C₈ alkylthio C₁-C₈ haloalkyl, C₁-C₈ alkylamino, C₁-C₁₄ aralkyl, C₁-C₁₄ alkylaryl, aryl, thioaryl, C₃-C₁₄ carbocycle, C₃-C₁₄ heterocycle.

R₂₂ is selected from hydrogen, methyl, ethyl,
 propyl, isopropyl, cyclopropyl, -F, -CF₃, -Cl, -Br, or
 10 -O-CH₃;

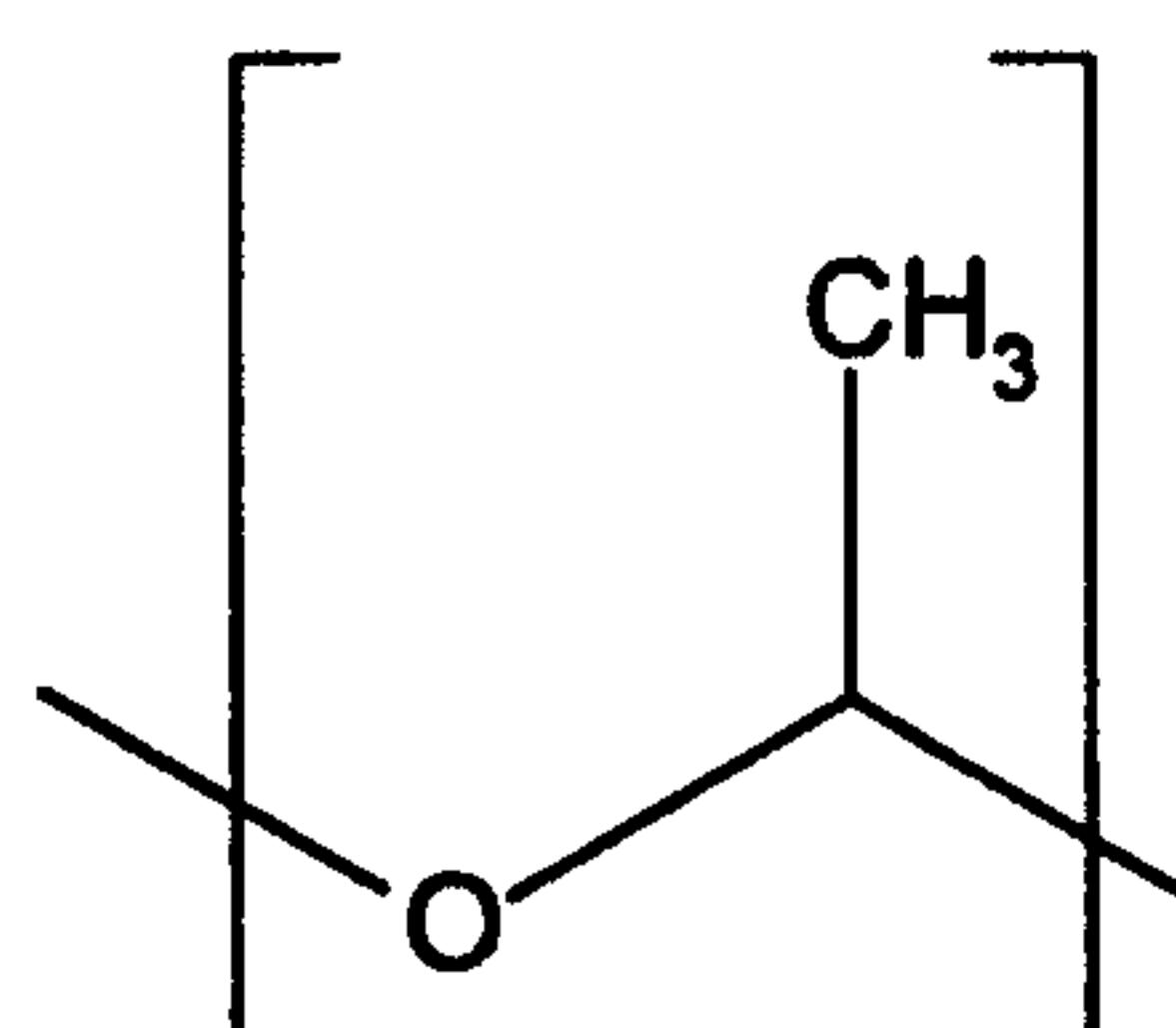
-(L₄)- is a divalent group selected from;



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or



where R₄₀, R₄₁, R₄₂, and R₄₃ are each independently
 5 selected from hydrogen or C₁-C₈ alkyl.

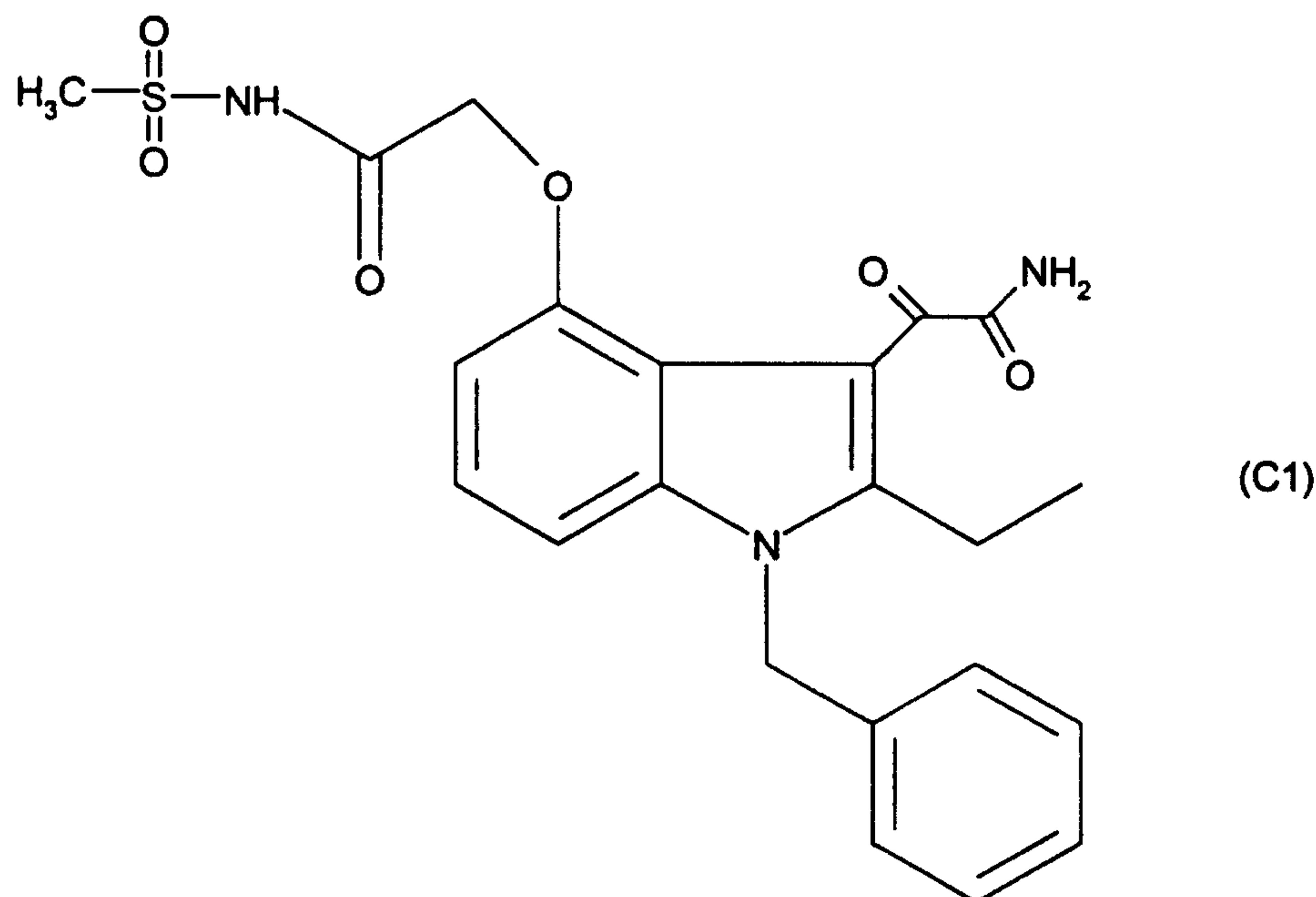
R₁₆ is selected from hydrogen, C₁-C₈ alkyl, C₁-C₈ alkoxy, C₁-C₈ alkylthio, C₁-C₈ haloalkyl, C₁-C₈ hydroxyalkyl, and halo.

R₁₃ is selected from hydrogen and C₁-C₈ alkyl, C₁-C₈ alkoxy, -S-(C₁-C₈ alkyl), C₁-C₈ haloalkyl, C₁-C₈ hydroxyalkyl, and halo, and t is an integer from 0 to 5.

A preferred compound (and all pharmaceutically acceptable salts and solvate derivatives thereof) which is illustrative of the compounds of the invention is as follows:

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Compound C1



The salts of the above indole compounds represented by formulae (I) and (II) are an additional aspect of the invention. In those instances where the compounds of the invention possess acidic or basic functional groups various salts may be formed which are more water soluble and physiologically suitable than the parent compound. Representative pharmaceutically acceptable salts, include but are not limited to, the alkali and alkaline earth salts such as lithium, sodium, potassium, calcium, magnesium, aluminum and the like. Salts are conveniently prepared from the free acid by treating the acylsulfonamide in solution with a base or by exposing the acylsulfonamide to an ion exchange resin. For example, the (acylsulfonamide group) of the substituent R_4 of Formula I may be selected as $-(CO)NHSO_2CH_3$ and salts may be formed by reaction with appropriate bases (e.g., NaOH, KOH) to yield the corresponding sodium and potassium salt.

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Included within the definition of pharmaceutically acceptable salts are the relatively non-toxic, inorganic and organic base addition salts of compounds of the present invention, for example, ammonium, quaternary ammonium, and amine cations, derived from nitrogenous bases of sufficient basicity to form salts with the compounds of this invention (see, for example, S. M. Berge, et al., "Pharmaceutical Salts," J. Phar. Sci., 66: 1-19 (1977)). Moreover, the basic group(s) of the compound of the invention may be reacted with suitable organic or inorganic acids to form salts such as acetate, benzenesulfonate, benzoate, bicarbonate, bisulfate, bitartrate, borate, bromide, camsylate, carbonate, chloride, clavulanate, citrate, chloride, edetate, edisylate, estolate, esylate, fluoride, fumarate, gluceptate, gluconate, glutamate, glycolylarsanilate, hexylresorcinate, bromide, chloride, hydroxynaphthoate, iodide, isothionate, lactate, lactobionate, laurate, malate, malseate, mandelate, mesylate, methylbromide, methylnitrate, methylsulfate, mucate, napsylate, nitrate, oleate, oxalate, palmitate, pantothenate, phosphate, polygalacturonate, salicylate, stearate, subacetate, succinate, tannate, tartrate, tosylate, trifluoroacetate, trifluoromethane sulfonate, and valerate.

Certain compounds of the invention may possess one or more chiral centers and may thus exist in optically active forms. Likewise, when the compounds contain an alkenyl or alkenylene group there exists the possibility of cis- and trans- isomeric forms of the compounds. The R- and S- isomers and mixtures thereof, including racemic mixtures as well as mixtures of cis- and trans- isomers, are contemplated by this invention. Additional asymmetric carbon atoms can be present in a substituent group such as an alkyl group. All such isomers as well as the mixtures thereof are intended to be included in

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the invention. If a particular stereoisomer is desired, it can be prepared by methods well known in the art by using stereospecific reactions with starting materials which contain the asymmetric centers and are already 5 resolved or, alternatively by methods which lead to mixtures of the stereoisomers and subsequent resolution by known methods. For example, a racemic mixture may be reacted with a single enantiomer of some other compound. This changes the racemic form into a mixture of 10 diastereomers and diastereomers, because they have different melting points, different boiling points, and different solubilities can be separated by conventional means, such as crystallization.

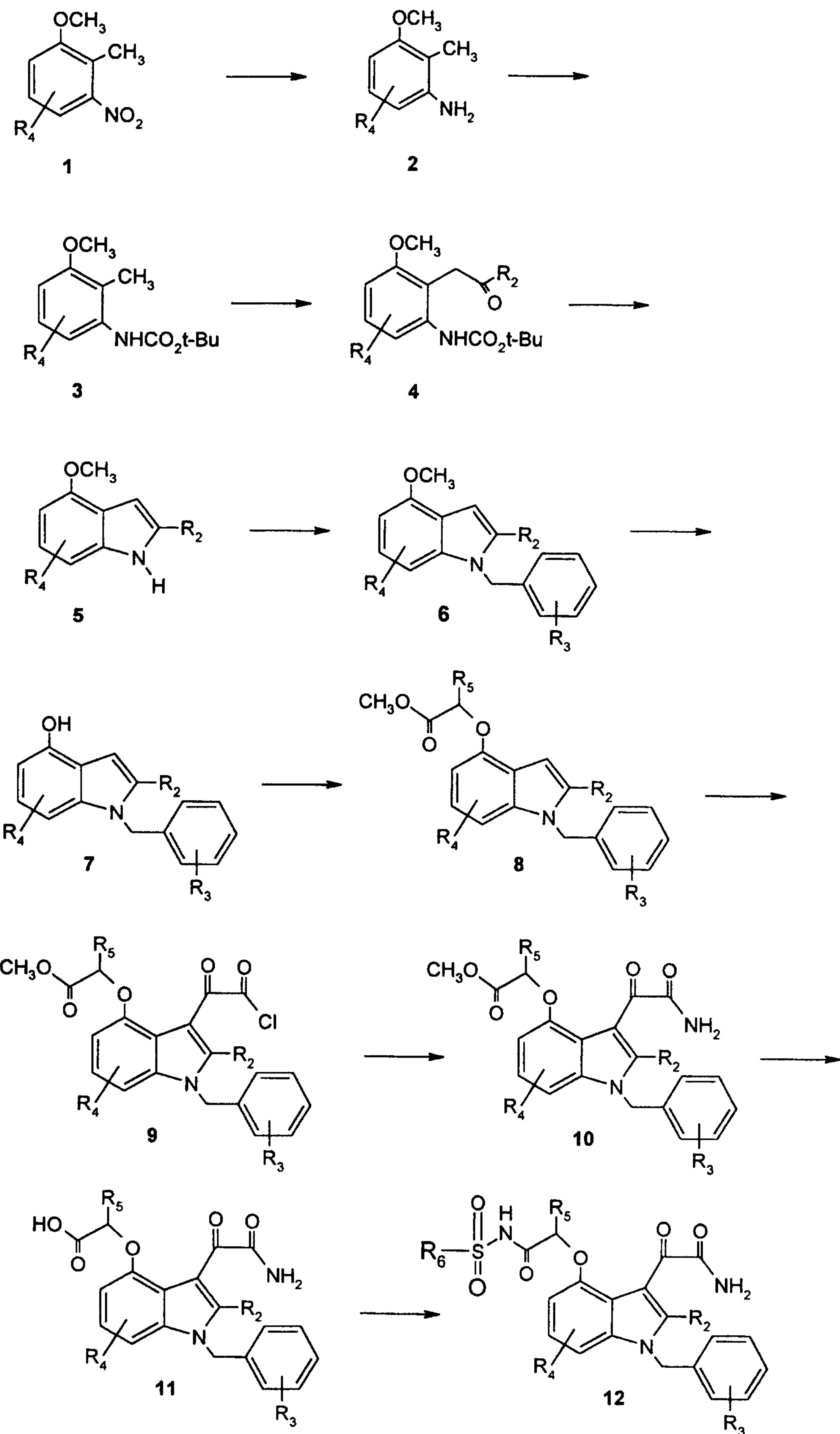
15 Method of Making the Compounds of the Invention:

The synthesis of the indole compound of the invention (viz., Compounds of Formulae I and II) can be accomplished by well known methods as recorded in the chemical literature. In particular, the indole starting 20 materials may be prepared by the synthesis schemes taught in US Patent No. 5,654,326; the disclosure of which is incorporated herein by reference. Procedures useful for the synthesis of the starting material are shown in the Scheme below:

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wherein, for the preceding Scheme, R₆ is an organic substituent or -CF₃, R₄ is equivalent to R₆ or R₇ in Formula I, R₂ is equivalent to R₂ in formula I, R₃ is equivalent to (R₁₂)_t in Formula I and R₅ is -H or C₁-C₈ alkyl.

To obtain the glyoxylamides substituted in the 4-position with an acidic function through an oxygen atom, the reactions outlined in scheme 1 are used (for 10 conversions 1 thru 5, see ref. Robin D. Clark, Joseph M. Muchowski, Lawrence E. Fisher, Lee A. Flippin, David B. Repke, Michel Souchet, Synthesis, 1991, 871-878, the disclosures of which are incorporated herein by reference). The ortho-nitrotoluene, 1, is readily 15 reduced to the 2-methylaniline, 2, using Pd/C as catalyst. The reduction can be carried out in ethanol or tetrahydrofuran (THF) or a combination of both, using a low pressure of hydrogen. The aniline, 2, on heating with di-tert-butyl dicarbonate in THF at 20 reflux temperature is converted to the N-tert-butylcarbonyl derivative, 3, in good yield. The dilithium salt of the dianion of 3 is generated at -40 to -20°C in THF using sec-butyl lithium and reacted 25 with the appropriately substituted N-methoxy-N-methylalkanamide. This product, 4, may be purified by crystallization from hexane, or reacted directly with trifluoroacetic acid in methylene chloride to give the 1,3-unsubstituted indole 5. The 1,3-unsubstituted indole 5 is reacted with sodium hydride in 30 dimethylformamide at room temperature (20-25°C) for 0.5-1.0 hour. The resulting sodium salt of 5 is treated with an equivalent of arylmethyl halide and the mixture stirred at a temperature range of 0-100°C, usually at ambient room temperature, for a period of 4 35 to 36 hours to give the 1-arylmethylindole, 6. This

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indole, 6, is O-demethylated by stirring with boron tribromide in methylene chloride for approximately 5 hours (see ref. Tsung-Ying Shem and Charles A Winter, Adv. Drug Res., 1977, 12, 176, the disclosure of which 5 is incorporated herein by reference). The 4-hydroxyindole, 7, is alkylated with an alpha bromoalkanoic acid ester in dimethylformamide (DMF) using sodium hydride as a base, with reactions conditions similar to that described for the 10 conversion of 5 to 6. The α -[(indol-4-yl)oxy]alkanoic acid ester, 8, is reacted with oxalyl chloride in methylene chloride to give 9, which is not purified but reacted directly with ammonia to give the 15 glyoxamide 10. This product is hydrolyzed using 1N sodium hydroxide in MeOH. The glyoxylamide, 11, is isolated either as the free carboxylic acid. Sulfonamide formation is accomplished by reaction of the appropriate sulfonamide with the indole acid (glyoxylamide) 11, in the presence of a suitable 20 coupling agent such as EDCI (1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride) and dimethylaminopyridine as a base to afford the indole acylsulfonamide, 12. The formation 25 of the sulfonamide, 12, can be accomplished by other procedures known in the art.

An alternative method of making starting materials substituted in the 4-position is described in provisional patent application number 60/082110 filed 04/17/98 and entitled "PROCESS FOR PREPARING 4-30 SUBSTITUTED-1H-INDOLE-3-GLYOXYLAMIDES." The esters described therein may be hydrolyzed to the acid form suitable for a starting material for preparing compounds of the invention.

35 Methods of Using the Compounds of the Invention:

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The method of the invention for inhibiting sPLA₂ mediated release of fatty acids comprises contacting mammalian sPLA₂ with an therapeutically effective amount of indole compounds corresponding to Formulae 5 (I) or (II) as described herein including salt or a prodrug derivative thereof.

Another aspect of this invention is a method for treating Inflammatory Diseases such as inflammatory bowel disease, septic shock, adult respiratory distress 10 syndrome, pancreatitis, trauma, bronchial asthma, allergic rhinitis, rheumatoid arthritis, osteoarthritis, and related diseases which comprises administering to a mammal (including a human) a therapeutically effective dose of the indole compound 15 of the invention (see, formula I and II).

As previously noted the compounds of this invention are useful for inhibiting sPLA₂ mediated release of fatty acids such as arachidonic acid. By the term, "inhibiting" is meant the prevention or 20 therapeutically significant reduction in release of sPLA₂ initiated fatty acids by the compounds of the invention. By "pharmaceutically acceptable" it is meant the carrier, diluent or excipient must be compatible with the other ingredients of the 25 formulation and not deleterious to the recipient thereof.

The specific dose of a compound administered according to this invention to obtain therapeutic or prophylactic effects will, of course, be determined by 30 the particular circumstances surrounding the case, including, for example, the compound administered, the route of administration and the condition being treated. Typical daily doses will contain a non-toxic dosage level of from about 0.01 mg/kg to about 50 mg/kg of body weight 35 of an active compound of this invention.

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Preferably compounds of the invention (per Formulae I or II) or pharmaceutical formulations containing these compounds are in unit dosage form for administration to a mammal. The unit dosage form can be 5 a capsule or tablet itself, or the appropriate number of any of these. The quantity of Active ingredient in a unit dose of composition may be varied or adjusted from about 0.1 to about 1000 milligrams or more according to the particular treatment involved. It may be appreciated 10 that it may be necessary to make routine variations to the dosage depending on the age and condition of the patient. The dosage will also depend on the route of administration.

The compound can be administered by a variety of 15 routes including oral, aerosol, rectal, transdermal, subcutaneous, intravenous, intramuscular, and intranasal.

Pharmaceutical formulations of the invention are prepared by combining (e.g., mixing) a therapeutically 20 effective amount of the indole compound of the invention together with a pharmaceutically acceptable carrier or diluent therefor. The present pharmaceutical formulations are prepared by known 25 procedures using well known and readily available ingredients.

In making the compositions of the present invention, the Active ingredient will usually be admixed with a carrier, or diluted by a carrier, or enclosed within a carrier which may be in the form of a 30 capsule, sachet, paper or other container. When the carrier serves as a diluent, it may be a solid, semi-solid or liquid material which acts as a vehicle, or can be in the form of tablets, pills, powders, 35 lozenges, elixirs, suspensions, emulsions, solutions, syrups, aerosols (as a solid or in a liquid medium), or

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ointment, containing, for example, up to 10% by weight of the active compound. The compounds of the present invention are preferably formulated prior to administration.

5 For the pharmaceutical formulations any suitable carrier known in the art can be used. In such a formulation, the carrier may be a solid, liquid, or mixture of a solid and a liquid. For example, for intravenous injection the compounds of the invention may
10 be dissolved in at a concentration of 2 mg/ml in a 4% dextrose/0.5% Na citrate aqueous solution. Solid form formulations include powders, tablets and capsules. A solid carrier can be one or more substances which may also act as flavoring agents, lubricants, solubilisers,
15 suspending agents, binders, tablet disintegrating agents and encapsulating material.

Tablets for oral administration may contain suitable excipients such as calcium carbonate, sodium carbonate, lactose, calcium phosphate, together with
20 disintegrating agents, such as maize, starch, or alginic acid, and/or binding agents, for example, gelatin or acacia, and lubricating agents such as magnesium stearate, stearic acid, or talc.

In powders the carrier is a finely divided solid
25 which is in admixture with the finely divided Active ingredient. In tablets the Active ingredient is mixed with a carrier having the necessary binding properties in suitable proportions and compacted in the shape and size desired. The powders and tablets preferably contain from
30 about 1 to about 99 weight percent of the Active ingredient which is the novel compound of this invention. Suitable solid carriers are magnesium carbonate, magnesium stearate, talc, sugar lactose, pectin, dextrin, starch, gelatin, tragacanth, methyl cellulose, sodium

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carboxymethyl cellulose, low melting waxes, and cocoa butter.

Sterile liquid form formulations include suspensions, emulsions, syrups and elixirs.

5 The Active ingredient can be dissolved or suspended
in a pharmaceutically acceptable carrier, such as sterile
water, sterile organic solvent or a mixture of both. The
Active ingredient can often be dissolved in a suitable
organic solvent, for instance aqueous propylene glycol.
10 Other compositions can be made by dispersing the finely
divided Active ingredient in aqueous starch or sodium
carboxymethyl cellulose solution or in a suitable oil.

The following pharmaceutical formulations 1 thru 8 are illustrative only and are not intended to limit the scope of the invention in any way. "Active ingredient", refers to a compound according to Formula (I) or (II) or a pharmaceutically acceptable salt, solvate, or prodrug thereof.

20 Formulation 1

Hard gelatin capsules are prepared using the following ingredients:

	Quantity <u>(mg/capsule)</u>
Active ingredient	250
Starch, dried	200
Magnesium stearate	<u>10</u>
Total	460 mg

25 Formulation 2

A tablet is prepared using the ingredients below:

**Quantity
(mg/tablet)**

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Active ingredient	250
Cellulose, microcrystalline	400
Silicon dioxide, fumed	10
Stearic acid	5
Total	665 mg

The components are blended and compressed to form tablets each weighing 665 mg

5

Formulation 3

An aerosol solution is prepared containing the following components:

	<u>Weight</u>
Active ingredient	0.25
Ethanol	25.75
Propellant 22 (Chlorodifluoromethane)	<u>74.00</u>
Total	100.00

10 The active compound is mixed with ethanol and the mixture added to a portion of the propellant 22, cooled to -30°C and transferred to a filling device. The required amount is then fed to a stainless steel container and diluted with the remainder of the propellant. The valve units are then fitted to the container.

Formulation 4

20 Tablets, each containing 60 mg of Active ingredient, are made as follows:

Active ingredient	60 mg
Starch	45 mg
Microcrystalline cellulose	35 mg

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Polyvinylpyrrolidone (as 10% solution in water)	4 mg
Sodium carboxymethyl starch	4.5 mg
Magnesium stearate	0.5 mg
Talc	<u>1 mg</u>
Total	150 mg

The Active ingredient, starch and cellulose are passed through a No. 45 mesh U.S. sieve and mixed thoroughly. The aqueous solution containing 5 polyvinylpyrrolidone is mixed with the resultant powder, and the mixture then is passed through a No. 14 mesh U.S. sieve. The granules so produced are dried at 50°C and passed through a No. 18 mesh U.S. sieve. The sodium carboxymethyl starch, magnesium stearate and talc, 10 previously passed through a No. 60 mesh U.S. sieve, are then added to the granules which, after mixing, are compressed on a tablet machine to yield tablets each weighing 150 mg.

15

Formulation 5

Capsules, each containing 80 mg of Active ingredient, are made as follows:

Active ingredient	80 mg
Starch	59 mg
Microcrystalline cellulose	59 mg
Magnesium stearate	<u>2 mg</u>
Total	200 mg

20

The Active ingredient, cellulose, starch, and magnesium stearate are blended, passed through a No. 45 mesh U.S. sieve, and filled into hard gelatin capsules in 200 mg quantities.

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Formulation 6

Suppositories, each containing 225 mg of Active ingredient, are made as follows:

Active ingredient	225 mg
Saturated fatty acid glycerides	<u>2,000 mg</u>
Total	2,225 mg

5

The Active ingredient is passed through a No. 60 mesh U.S. sieve and suspended in the saturated fatty acid glycerides previously melted using the minimum heat necessary. The mixture is then poured into a suppository mold of nominal 2 g capacity and allowed to cool.

Formulation 7

Suspensions, each containing 50 mg of Active ingredient per 5 ml dose, are made as follows:

15

Active ingredient	50 mg
Sodium carboxymethyl cellulose	50 mg
Syrup	1.25 ml
Benzoic acid solution	0.10 ml
Flavor	q.v.
Color	q.v.
Purified water to total	5 ml

The Active ingredient is passed through a No. 45 mesh U.S. sieve and mixed with the sodium carboxymethyl cellulose and syrup to form a smooth paste. The benzoic acid solution, flavor and color are diluted with a portion of the water and added, with stirring. Sufficient water is then added to produce the required volume.

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Formulation 8

An intravenous formulation may be prepared as follows:

Active ingredient	100 mg
Isotonic saline	1,000 ml

5

The solution of the above ingredients generally is administered intravenously to a subject at a rate of 1 ml per minute.

10 The compounds of the invention are prepared by the general procedure of reacting indole compound starting materials having carboxyl functionality at the 4- or 5-position with an R₈₁-sulfonamide, where R₈₁ is as described, supra.

15 All of the products of the Examples described below as well as intermediates used in the following procedures showed satisfactory nmr and ir spectra. They also had the correct elemental analyses values.

20

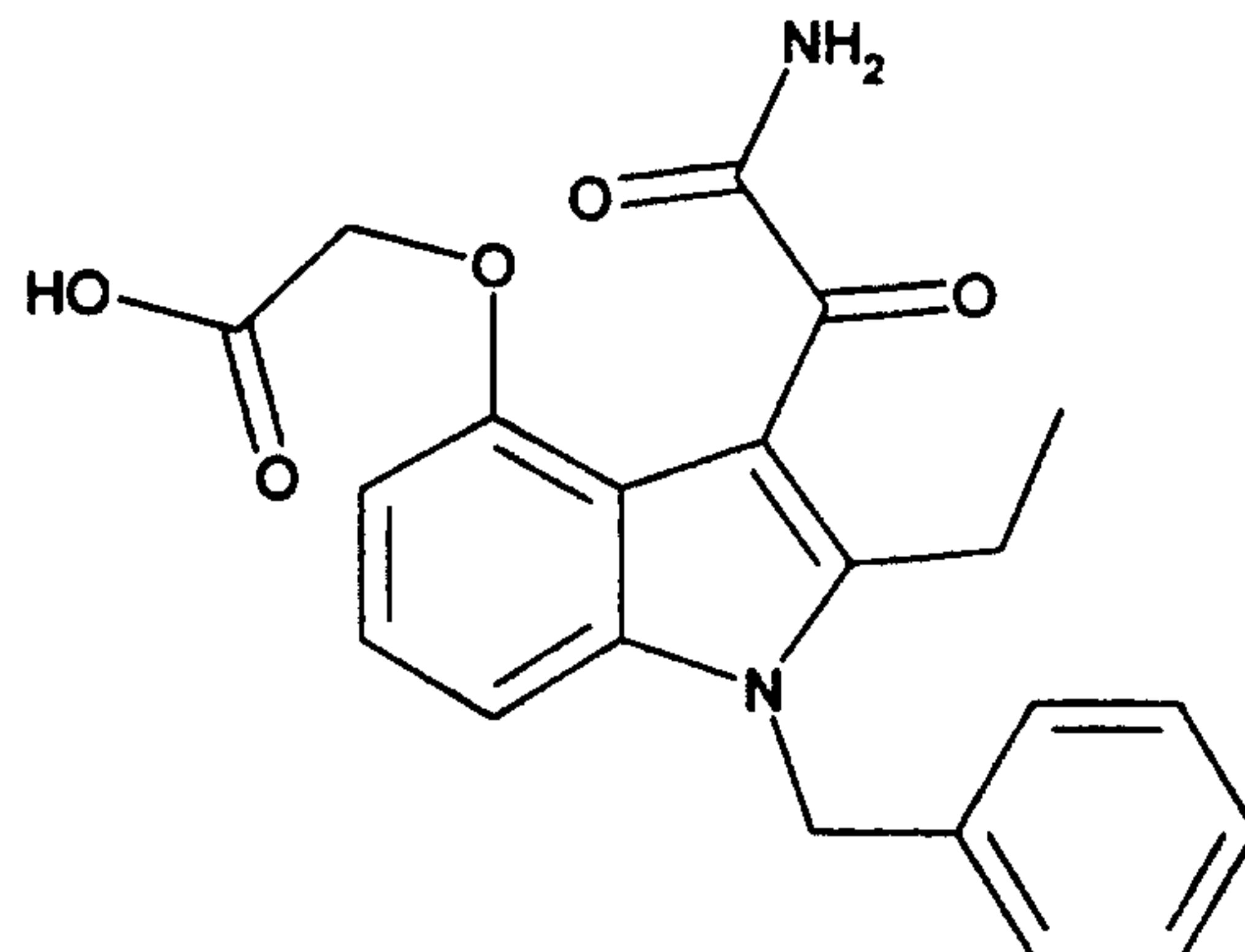
Example A

This Example illustrates the preparation of a starting material for preparing the acylsulfonamide functional indole compounds of the invention (viz., formulae I and II).

25

Preparation of [[3-(2-amino-1,2-dioxoethyl)-2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid, a compound represented by the formula:

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Part A. Preparation of 2-Ethyl-4-methoxy-1H-indole.

A solution of 140 mL (0.18 mol) of 1.3M sec-butyl lithium in cyclohexane is added slowly to N-tert-butoxycarbonyl-3-methoxy-2-methylaniline (21.3g, 0.09 mol) in 250 mL of THF keeping the temperature below -40°C with a dry ice-ethanol bath. The bath is removed and the temperature allowed to rise to 0°C and then the bath replaced. After the temperature is cooled to -60°C, 18.5g (0.18 mol) of N-methoxy-N-methylpropanamide in an equal volume of THF is added dropwise. The reaction mixture is stirred 5 minutes, the cooling bath removed and stirred an additional 18 hours. It is then poured into a mixture of 300 mL of ether and 400 mL of 0.5N HCl. The organic layer is separated, washed with water, brine, dried over MgSO₄, and concentrated at reduced pressure to give 25.5g of a crude of 1-[2-(tert-butoxycarbonylamino)-6-methoxyphenyl]-2-butanone. This material is dissolved in 250 mL of methylene chloride and 50 mL of trifluoroacetic acid and stirred for a total of 17 hours. The mixture is concentrated at reduced pressure and ethyl acetate and water added to the remaining oil. The ethyl acetate is separated, washed with brine, dried (MgSO₄) and concentrated. The residue is chromatographed three times on silica eluting with 20% EtOAc/hexane to give 13.9g of 2-ethyl-4-methoxy-1H-indole.

Analyses for C₁₁H₁₃NO:

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Calculated: C, 75.40; H, 7.48; N, 7.99;
 Found: C, 74.41; H, 7.64; N, 7.97.

Part B. Preparation of 2-Ethyl-4-methoxy-1-(phenylmethyl)-1H-indole.

2-Ethyl-4-methoxy-1H-indole (4.2g, 24 mmol) is dissolved in 30 mL of DMF and 960mg (24 mmol) of 60% NaH/minerial oil is added. After 1.5 hours, 2.9 mL(24 mmol) of benzyl bromide is added. After 4 hours, the mixture is diluted with water and extracted twice with ethyl acetate. The combined ethyl acetate is washed with brine, dried ($MgSO_4$) and concentrated at reduced pressure. The residue is chromatographed on silica gel and eluted with 20% EtOAc/hexane to give 3.1g (49% yield) of 2-ethyl-4-methoxy-1-(phenylmethyl)-1H-indole.

Part C. Preparation of 2-Ethyl-4-hydroxy-1-(phenylmethyl)-1H-indole.

3.1g (11.7 mmol) of 2-ethyl-4-methoxy-1-(phenylmethyl)-1H-indole is O-demethylated by treating it with 48.6 mL of 1M BBr_3/CH_2Cl_2 , then stirred at room temperature for 5 hours and concentrated at reduced pressure. The residue is dissolved in ethyl acetate, then washed with brine and dried. The reaction product is then chromatographed on silica gel (eluted with 20% EtOAc/hexane) to give 1.58g (54% yield) of 2-ethyl-4-hydroxy-1-(phenylmethyl)-1H-indole, mp, 86-90°C.

Analyses for $C_{17}H_{17}NO$:

Calculated: C, 81.24; H, 6.82; N, 5.57;
 Found: C, 81.08; H, 6.92; N, 5.41.

Part D. Preparation of [[2-Ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid methyl ester.

2-ethyl-4-hydroxy-1-(phenylmethyl)-1H-indole (1.56g, 6.2 mmol) is treated with 248mg (6.2 mmol) of 60%

-40-

NaH/mineral oil in dimethylformamide and the mixture stirred for 0.67 hours. 0.6 mL(6.2 mmol) of methyl bromoacetate is added and the mixture stirred for 17 hours. The reaction mixture is diluted with water and 5 then extracted with ethyl acetate. The ethyl acetate solution is washed with brine, dried, and concentrated at reduced pressure. The product is purified by chromatography over silica gel eluting with 20% EtOAc/hexane, to give 1.37g (69% yield) of [[2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid methyl ester, 89-92°C.

Analyses for $C_{20}H_{21}NO_3$:

Calculated: C, 74.28; H, 6.55; N, 4.33;

Found: C, 74.03; H, 6.49; N, 4.60.

15

Part E. Preparation of [[3-(2-Amino-1,2-dioxoethyl)-2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid methyl ester.

1.36g (4.2 mmol) of [[2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid methyl ester is reacted first with 0.4 mL (4.2 mmol) of oxalyl chloride in methylene chloride and stirred for 1.5 hours. Anhydrous ammonia (in excess) is bubbled into the reaction mixture and the mixture is stirred for 1.5 hours and evaporated at 20 reduced pressure to give a white solid. This is stirred with ethyl acetate and the insoluble material separated and dried to give 1.37g of a mixture of [[3-(2-amino-1,2-dioxoethyl)-2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid methyl ester and ammonium chloride.

25

25 This mixture melted at 172-187°C.

30 Part F. Preparation of [[3-(2-Amino-1,2-dioxoethyl)-2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid.

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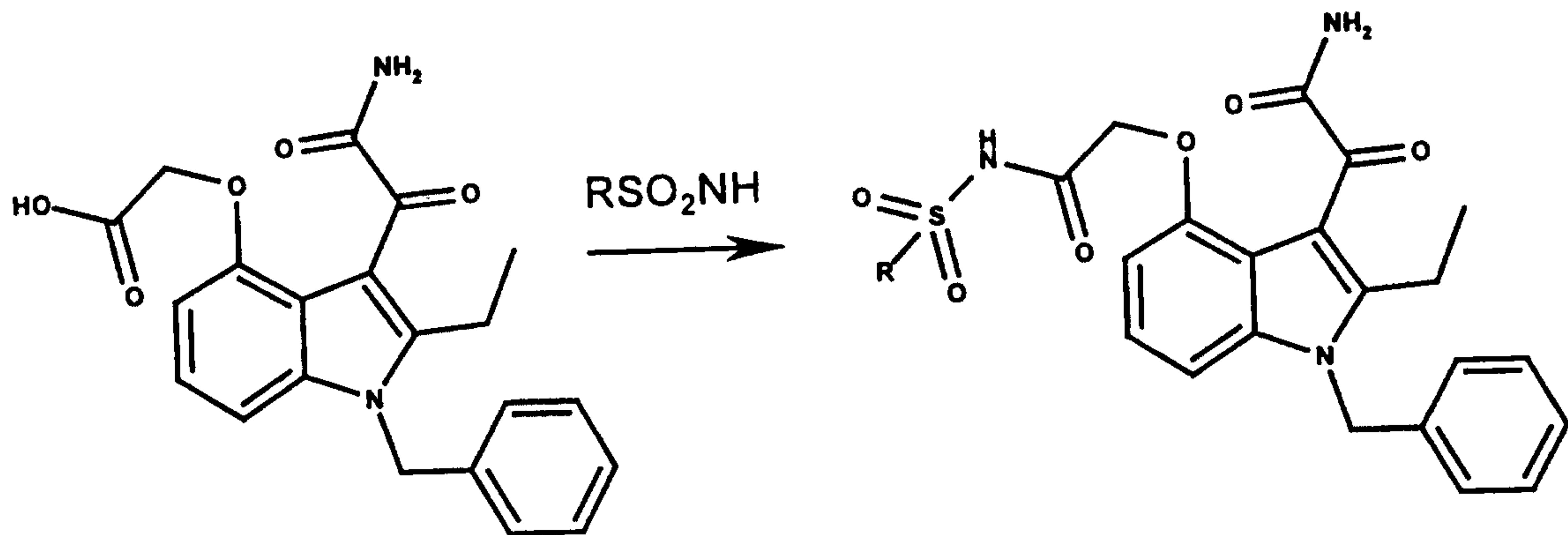
-41-

A mixture of 788mg (2 mmol) of [3-(2-amino-1,2-dioxoethyl)-2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid methyl ester, 10 mL of 1N NaOH and 30 mL of MeOH is heated to maintain reflux for 0.5 hour, 5 stirred at room temperature for 0.5 hour and concentrated at reduced pressure. The residue is taken up in ethyl acetate and water, the aqueous layer separated and made acidic to pH 2-3 with 1N HCl. The precipitate is filtered and washed with ethyl acetate to give 559mg (74% 10 yield) of [(3-(2-amino-1,2-dioxoethyl)-2-ethyl-1-(phenylmethyl)-1H-indol-4-yl]oxy]acetic acid, mp, 230-234°C.

Analyses for $C_{21}H_{20}N_2O_5$:
 Calculated: C, 65.96; H, 5.80; N, 7.33;
 15 Found: C, 66.95; H, 5.55; N, 6.99.

General Reaction Scheme used in Examples 1 to 5:

20

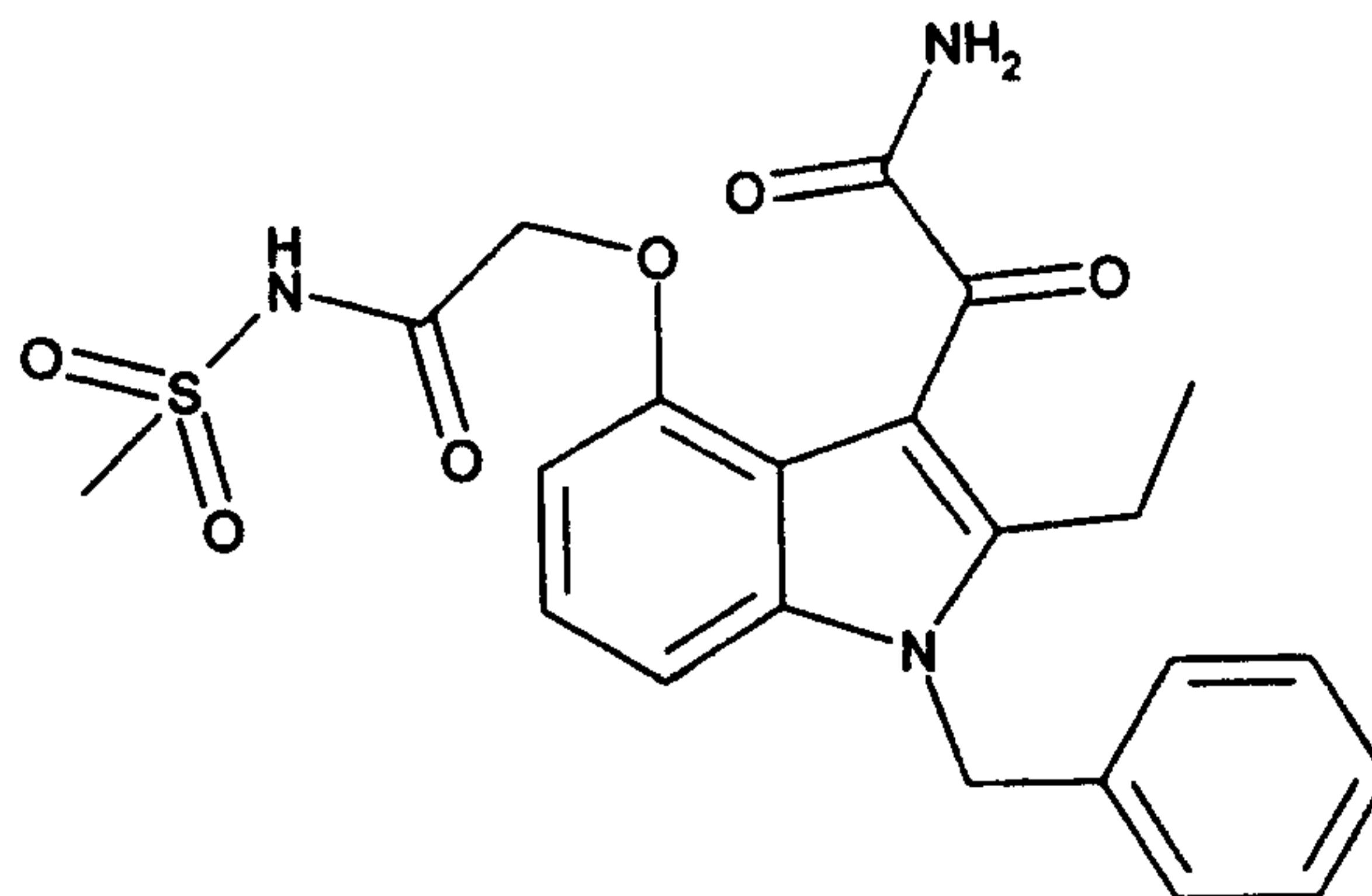


WO 00/07591

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Example 1

Preparation of 1-benzyl-2-ethyl-4-methanesulfonamidoymethoxy-indole-3-glyoxylamide



5

To 100mg (0.26mmol) of 1-benzyl-2-ethyl-4-carboxymethoxy-indole-3-glyoxylamide suspended in 3.7ml CH₂Cl₂ was added 4-dimethylaminopyridine (48mg, 0.39mmol), 10 methanesulfonamide (50mg, 0.52mmol), and 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (50mg, 0.26mmol), respectively. After 23 h, the reaction was diluted with CH₂Cl₂ and extracted with 1 N HCl, then brine. The organic layer was dried with sodium sulfate 15 and evaporated *in vacuo*. The residue was chromatographed on silica gel eluting with a CH₂Cl₂/MeOH gradient to give the titled product (22.2mg, 19%).

MS (ES+) 458, 413

Elemental Analyses for C₂₂H₂₃N₃O₆S:

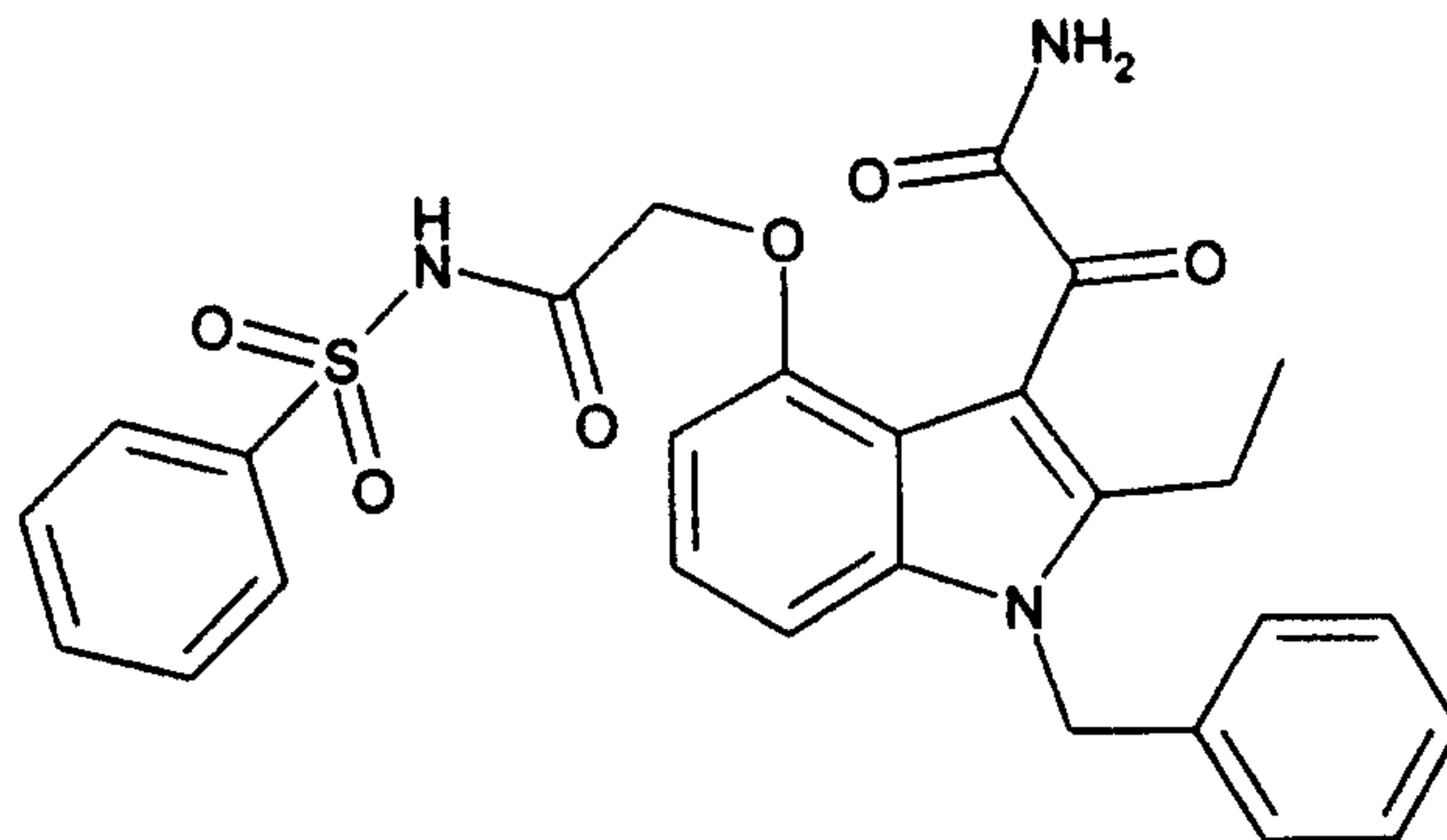
20	Calculated:	C 57.76; H 5.07; N 9.18
	Found:	C 57.66; H 5.27; N 8.92

25

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Example 2

Preparation of 1-benzyl-2-ethyl-4-benzenesulfonamidoymethoxy-indole-3-glyoxylamide



5

To 200mg (0.53mmol) of 1-benzyl-2-ethyl-4-carboxymethoxy-indole-3-glyoxylamide suspended in 5.3ml CH₂Cl₂ was added 4-dimethylaminopyridine (96mg, 0.79mmol), benzenesulfonamide (165mg, 1.05mmol), and 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (101mg, 0.53mmol), respectively. After 19 h, the reaction was diluted with CH₂Cl₂ and extracted with 1 N HCl, then brine. The organic layer was dried with sodium sulfate and evaporated *in vacuo*. The residue was chromatographed on silica gel eluting with a CH₂Cl₂/MeOH gradient to give impure product. Recrystallization from acetone/hexane provided the titled product (62mg, 23%).

MS (ES+) 520, 475

Elemental Analyses for C₂₇H₂₅N₃O₆S:

20	Calculated:	C 62.42; H 4.85; N 8.09
	Found:	C 62.64; H 4.97; N 8.31

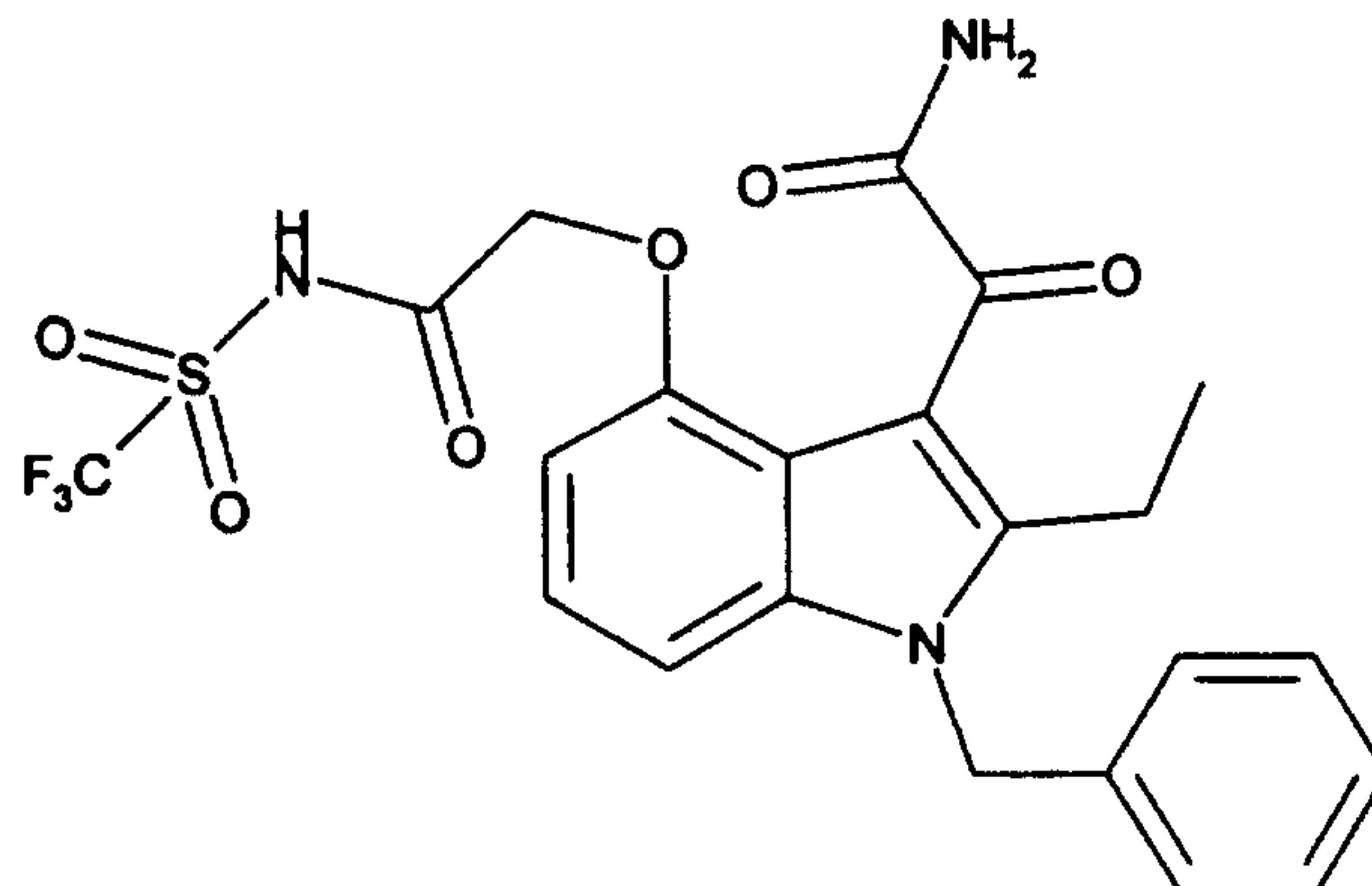
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Example 3

Preparation of 1-benzyl-2-ethyl-4-trifluoromethanesulfonamidoymethoxy-indole-3-glyoxylamide

5



To 200mg (0.53mmol) of 1-benzyl-2-ethyl-4-carboxymethoxy-indole-3-glyoxylamide suspended in 5.3ml CH₂Cl₂ was added 4-dimethylaminopyridine (96mg, 0.79mmol), trifluoromethanesulfonamide (157mg, 1.05mmol), and 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (101mg, 0.53mmol), respectively. After 24 h, the reaction was diluted with CH₂Cl₂ and extracted with 1 N HCl, then brine. The organic layer was dried with sodium sulfate and evaporated *in vacuo*. The residue was chromatographed on silica gel eluting with a CH₂Cl₂/MeOH gradient to give impure product. Recrystallisation from acetone/hexane provided the titled product (89mg, 33%).

10
15
20
25

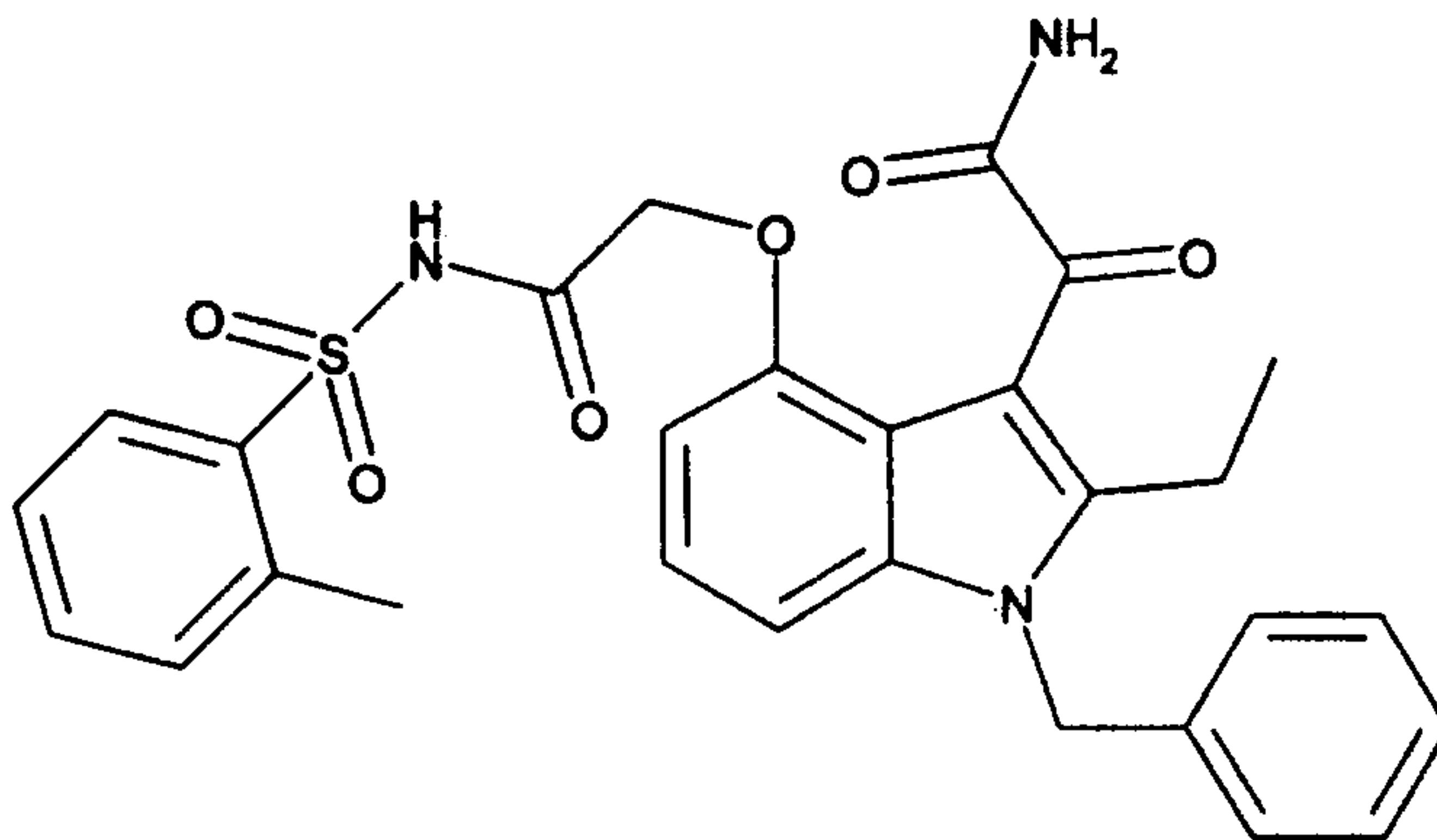
MS (ES+) 512, 467
MS (Exact)
Calculated: 512.1103
Found: 512.1108

Elemental Analyses for C₂₂H₂₀F₃N₃O₆S:
Calculated: C 51.66; H 3.94; N 8.22
Found: C 49.68; H 3.78; N 7.86

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Example 4

Preparation of 1-benzyl-2-ethyl-4-(2-methylbenzenesulfonamidoymethoxy)-indole-3-glyoxylamide



To 200mg (0.53mmol) of 1-benzyl-2-ethyl-4-carboxymethoxy-indole-3-glyoxylamide suspended in 5.3ml CH₂Cl₂ was added 4-dimethylaminopyridine (96mg, 0.79mmol), 2-methylbenzenesulfonamide (180mg, 1.05mmol), and 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (101mg, 0.53mmol), respectively. After 23 h, the reaction was diluted with CH₂Cl₂ and extracted with 1 N HCl, then brine. The organic layer was dried with sodium sulfate and evaporated *in vacuo*. The residue was chromatographed on silica gel eluting with a CH₂Cl₂/MeOH gradient to give impure product. Recrystallization from acetone/hexane provided the titled product (102mg, 36%).

MS (ES+) 534, 489

MS (Exact)

Calculated: 534.1699

Found: 534.1696

Elemental Analyses for C₂₈H₂₇N₃O₆S:

Calculated: C 63.03; H 5.10; N 7.87

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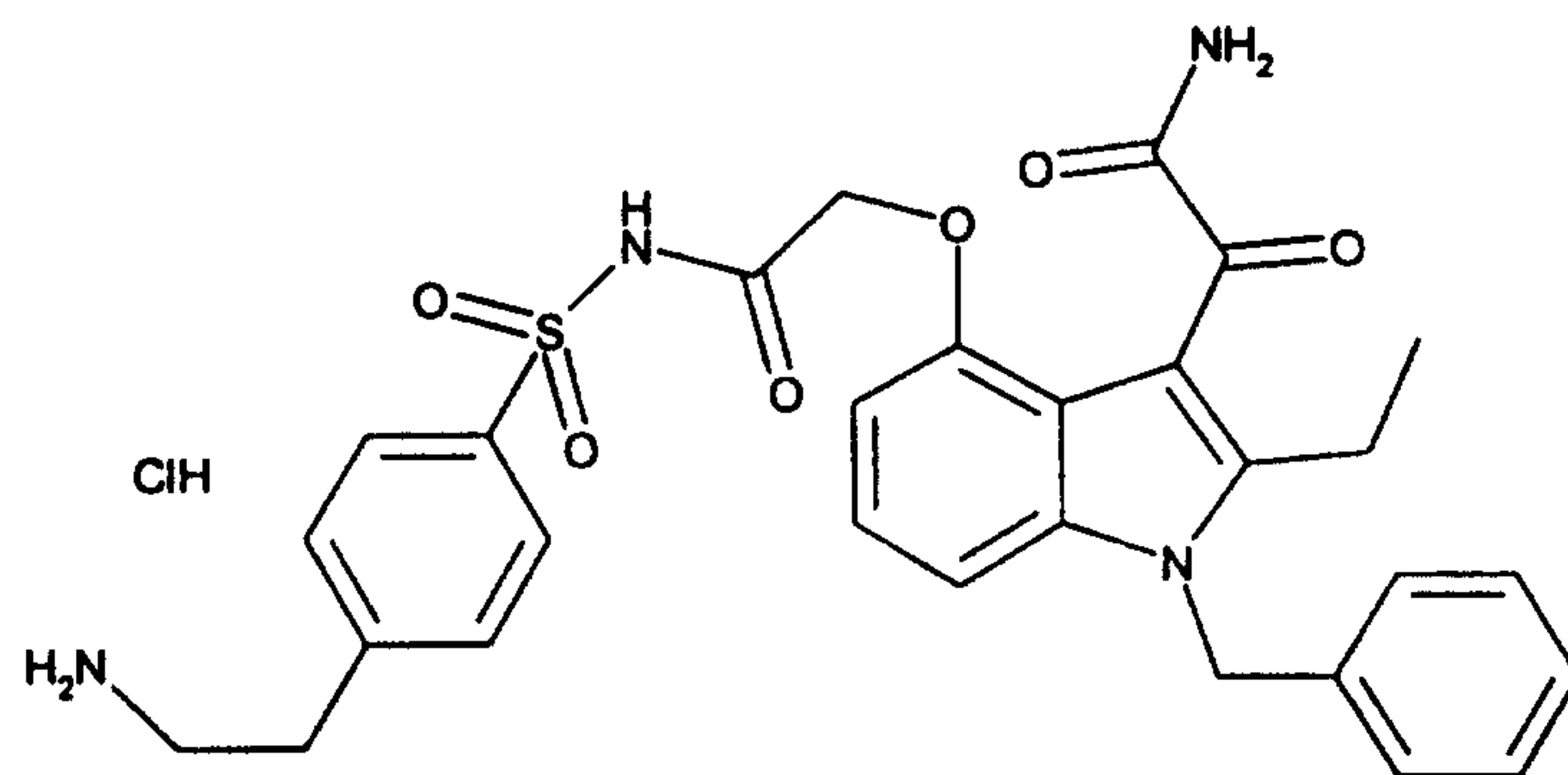
Found: C 63.30; H 5.87; N 7.70

Example 5

Preparation of 1-benzyl-2-ethyl-4-(4-(2-

5 aminoethyl)benzenesulfonamidoymethoxy)-indole-3-

glyoxylamide, hydrochloride salt



10 Part A. 4-(2-t-

Butoxycarbonylamino)ethylbenzenesulfonamide

To 2.00g (10.0mmol) of 4-(2-

aminoethyl)benzenesulfonamide suspended in a mixture of

10ml THF, 10ml CH_2Cl_2 , and 3ml DMF was added di-t-

15 butyldicarbonate (2.20g, 10.0 mmol) After 19 h, the

reaction was diluted with EtOAc and extracted with 1 N

HCl, then with brine. The organic layer was dried with

sodium sulfate and evaporated *in vacuo*. The residue was

triturated with hexanes and filtered to give the

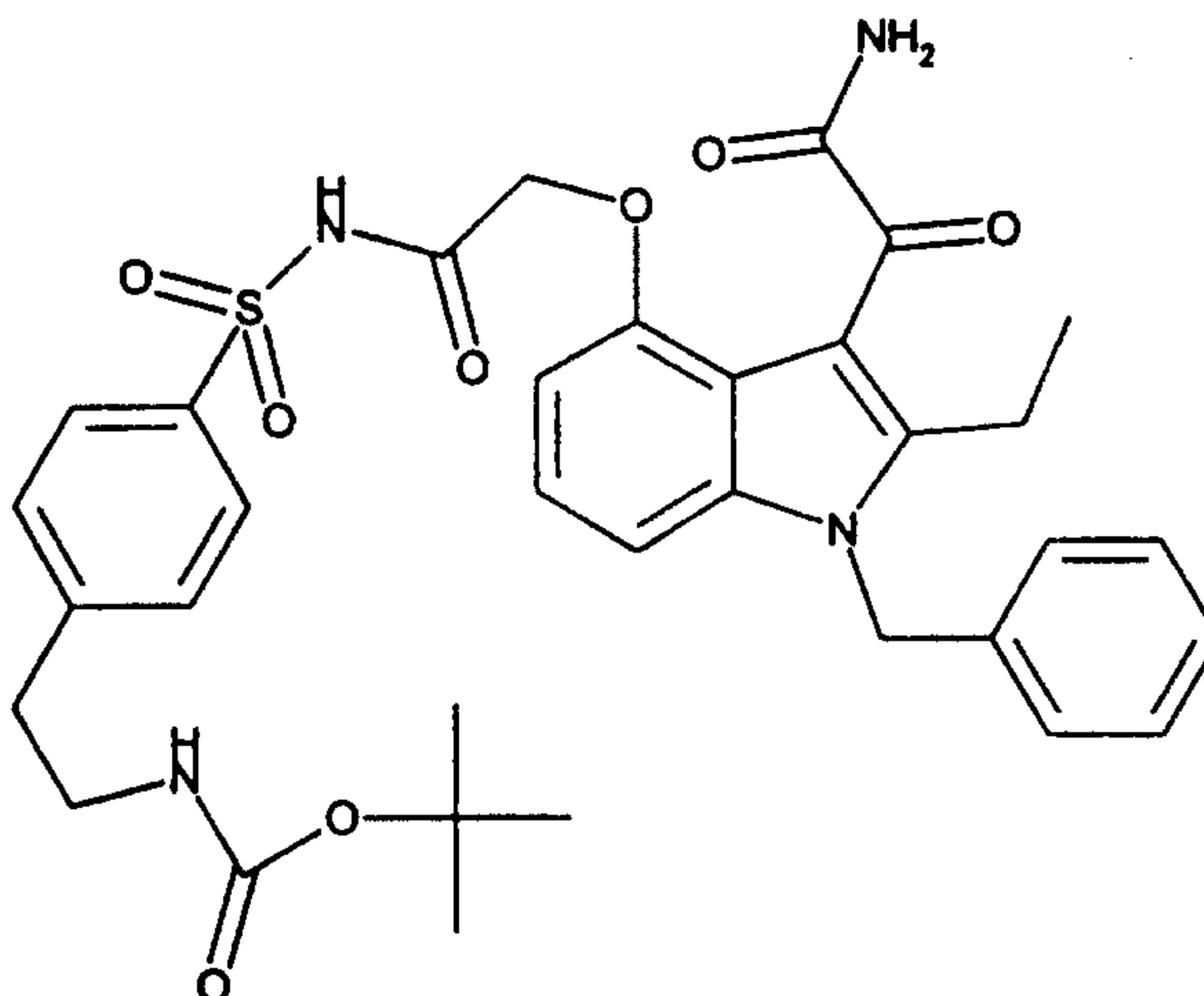
20 subtitled product (1.85g, 62%).

Part B. 1-benzyl-2-ethyl-4-(4-(2-t-

butoxycarbonylaminoethyl)benzenesulfonamidoymethoxy)-

indole-3-glyoxylamide

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To 275mg (0.72mmol) of 1-benzyl-2-ethyl-4-carboxymethoxy-indole-3-glyoxylamide and 0.38ml (2.17mmol) N-diisopropyl,N-ethylamine suspended in 4.8ml CH₂Cl₂ was added 4-dimethylaminopyridine (59mg, 0.48mmol), 4-(2-t-butoxycarbonyl)ethylbenzenesulfonamide (145mg, 0.48mmol), and 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (0.21g, 1.09mmol), respectively. After 24 h, the reaction was diluted with CH₂Cl₂ and extracted with 1 N HCl, then with brine. The organic layer was dried with sodium sulfate and evaporated *in vacuo*. The residue was chromatographed on silica gel eluting with a hexane/acetone gradient, then with 10:1 CH₂Cl₂/MeOH to give the subtitled product (248mg, 78%).

MS (ES+) 563, (ES-) 661

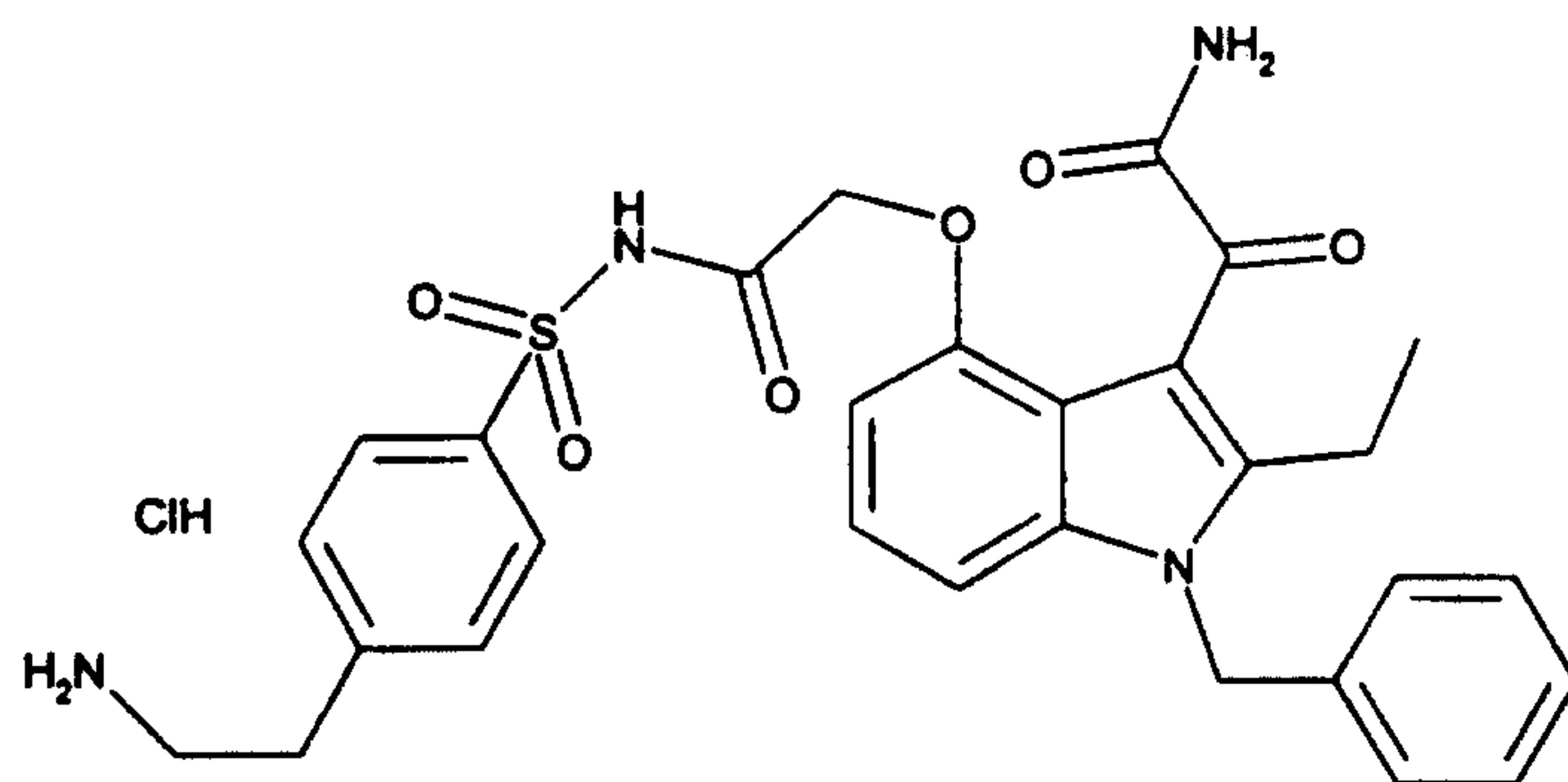
Elemental Analyses for C₃₄H₃₈N₄O₈S:

Calculated: C 61.62; H 5.78; N 8.45

20 Found: C 59.42; H 5.91; N 7.10

Part C. 1-benzyl-2-ethyl-4-(4-(2-aminoethyl)benzenesulfonamidoethylmethoxy)-indole-3-glyoxylamide, hydrochloride salt

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To 115mg (0.17mmol) of 1-benzyl-2-ethyl-4-(4-(2-t-butoxycarbonylaminoethyl)benzenesulfonamidoethyl)methoxy-5-indole-3-glyoxylamide suspended in 8.7ml CH₂Cl₂ was added trifluoroacetic acid (4.32ml, 56mmol). After 2 h, the reaction was evaporated *in vacuo*. The residue was triturated with 5:1 CH₂Cl₂/EtOAc, filtered, and chromatographed on reverse phase silica gel eluting with an acetonitrile/water/HCl gradient to give the titled product (56mg, 54%).

MS (ES+) 563, (ES-) 561

Elemental Analyses for C₂₉H₃₁ClN₄O₆S:

Calculated: C 58.14; H 5.22; N 9.35

15 Found: C 57.07; H 5.02; N 9.12

Assay

The following chromogenic assay procedure was used to identify and evaluate inhibitors of recombinant 20 human secreted phospholipase A₂. The assay described herein has been adapted for high volume screening using 96 well microtiter plates. A general description of this assay method is found in the article, "Analysis of Human Synovial Fluid Phospholipase A₂ on Short Chain 25 Phosphatidylcholine-Mixed Micelles: Development of a Spectrophotometric Assay Suitable for a Microtiterplate Reader", by Laure J. Reynolds, Lori L. Hughes, and

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Edward A Dennis, Analytical Biochemistry, 204, pp. 190-197, 1992 (the disclosure of which is incorporated herein by reference):

Reagents:

5 REACTION BUFFER -

CaCl₂.2H₂O (1.47 g/L)

KCl (7.455 g/L)

Bovine Serum Albumin (fatty acid free) (1g/L)
(Sigma A-7030, product of Sigma

10 Chemical Co., St. Louis MO, USA)

TRIS HCl (3.94 g/L)

pH 7.5 (adjust with NaOH)

ENZYME BUFFER -

0.05 NaOAc.3H₂O, pH 4.5

15 0.2 NaCl

Adjust pH to 4.5 with acetic acid

DTNB - 5,5'-dithiobis-2-nitrobenzoic acid

RACEMIC DIHEPTANOYL THIO - PC

racemic 1,2-bis(heptanoylthio)-1,2-dideoxy-*sn*-
20 glycero-3-phosphorylcholine

TRITON X-100TM prepare at 6.249 mg/ml in
reaction buffer to equal 10uM.

REACTION MIXTURE -

25 A measured volume of racemic dipheptanoyl thio PC supplied in chloroform at a concentration of 100 mg/ml is taken to dryness and redissolved in 10 millimolar TRITON X-100TM nonionic detergent aqueous solution. Reaction Buffer is added to the solution, then DTNB to give the Reaction Mixture.

30 The reaction mixture thus obtained contains 1mM diheptanoyl thio-PC substrate, 0.29 mm Triton X-100TM detergent, and 0.12 mm DTMB in a buffered aqueous solution at pH 7.5.

Assay Procedure:

35 1. Add 0.2 ml reaction mixture to all wells;

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2. Add 10 ul test compound (or solvent blank) to appropriate wells, mix 20 seconds;
3. Add 50 nanograms of sPLA₂ (10 microliters) to appropriate wells;
- 5 4. Incubate plate at 40°C for 30 minutes;
5. Read absorbance of wells at 405 nanometers with an automatic plate reader.

All compounds were tested in triplicate.

Typically, compounds were tested at a final 10 concentration of 5 ug/ml. Compounds were considered active when they exhibited 40% inhibition or greater compared to uninhibited control reactions when measured at 405 nanometers. Lack of color development at 405 nanometers evidenced inhibition. Compounds initially 15 found to be active were reassayed to confirm their activity and, if sufficiently active, IC₅₀ values were determined. Typically, the IC₅₀ values (see, Table I, below) were determined by diluting test compound serially two-fold such that the final concentration in 20 the reaction ranged from 45 ug/mL to 0.35 ug/ml. More potent inhibitors required significantly greater dilution. In all cases, % inhibition measured at 405 nanometers generated by enzyme reactions containing 25 inhibitors relative to the uninhibited control reactions was determined. Each sample was titrated in triplicate and result values were averaged for plotting and calculation of IC₅₀ values. IC₅₀ were determined by plotting log concentration versus inhibition values in the range from 10-90% inhibition.

30

35

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Results of Human Secreted Phospholipase A2
Inhibition Tests

Table

5

Compound of Example No.	Inhibition of human secreted PLA ₂ IC ₅₀ ± mean deviation
1	12nM
2	7nM
3	17nM
4	9nM
5	16nM

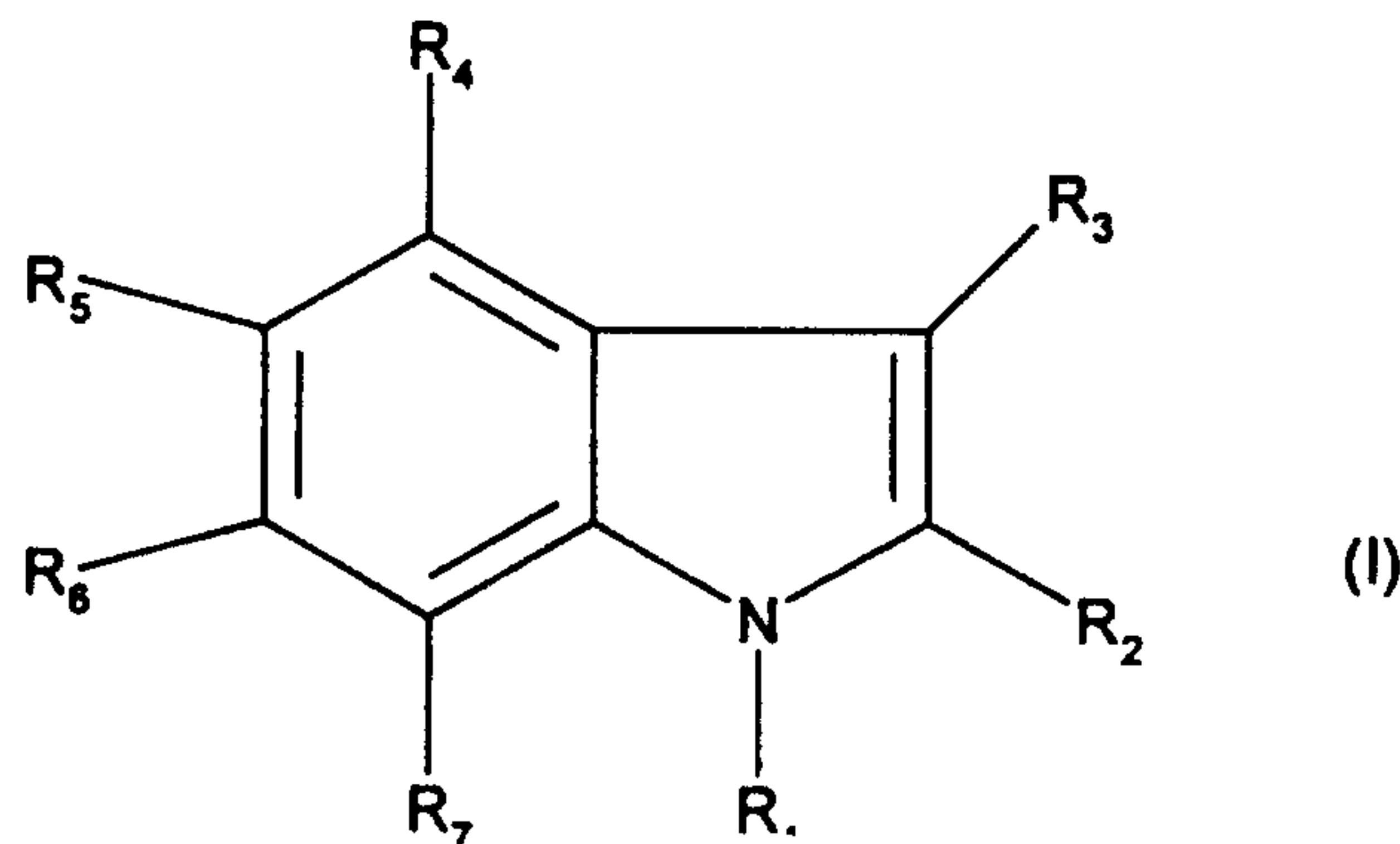
The compounds of Example 1 to 5 are useful in inhibiting
10 sPLA₂.

While the present invention has been illustrated above by certain specific embodiments, it is not intended that these specific examples should limit the scope of the invention as described in the appended claims.

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WE CLAIM:

1. An indole compound represented by the formula (I), or a pharmaceutically acceptable salt, or solvate derivative thereof;



wherein ;

10 R₁ is selected from groups (a), (b) and (c)
wherein;

(a) is C₇-C₂₀ alkyl, C₇-C₂₀ haloalkyl, C₇-C₂₀ alkenyl, C₇-C₂₀ alkynyl, carbocyclic radical, or heterocyclic radical, or

15 (b) is a member of (a) substituted with one or more independently selected non-interfering substituents; or

20 (c) is the group -(L₁)-R₁₁; where, -(L₁)- is a divalent linking group of 1 to 8 atoms and R₁₁ is a group selected from (a) or (b);

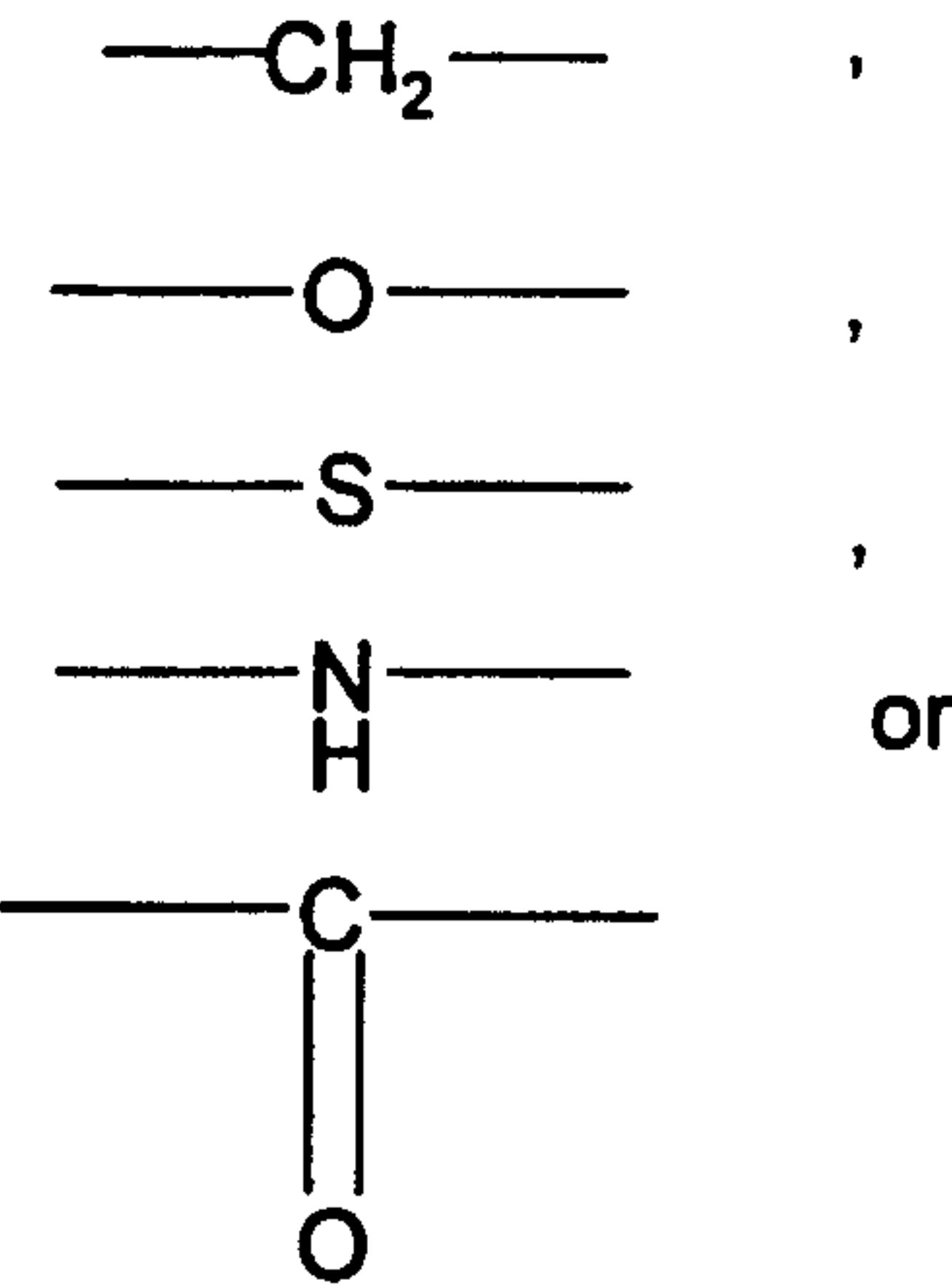
 R₂ is hydrogen, or a group containing 1 to 4 non-hydrogen atoms;

 R₃ is -(L₃)- Z, where -(L₃)- is a divalent linker group selected from a bond or a divalent group selected from:

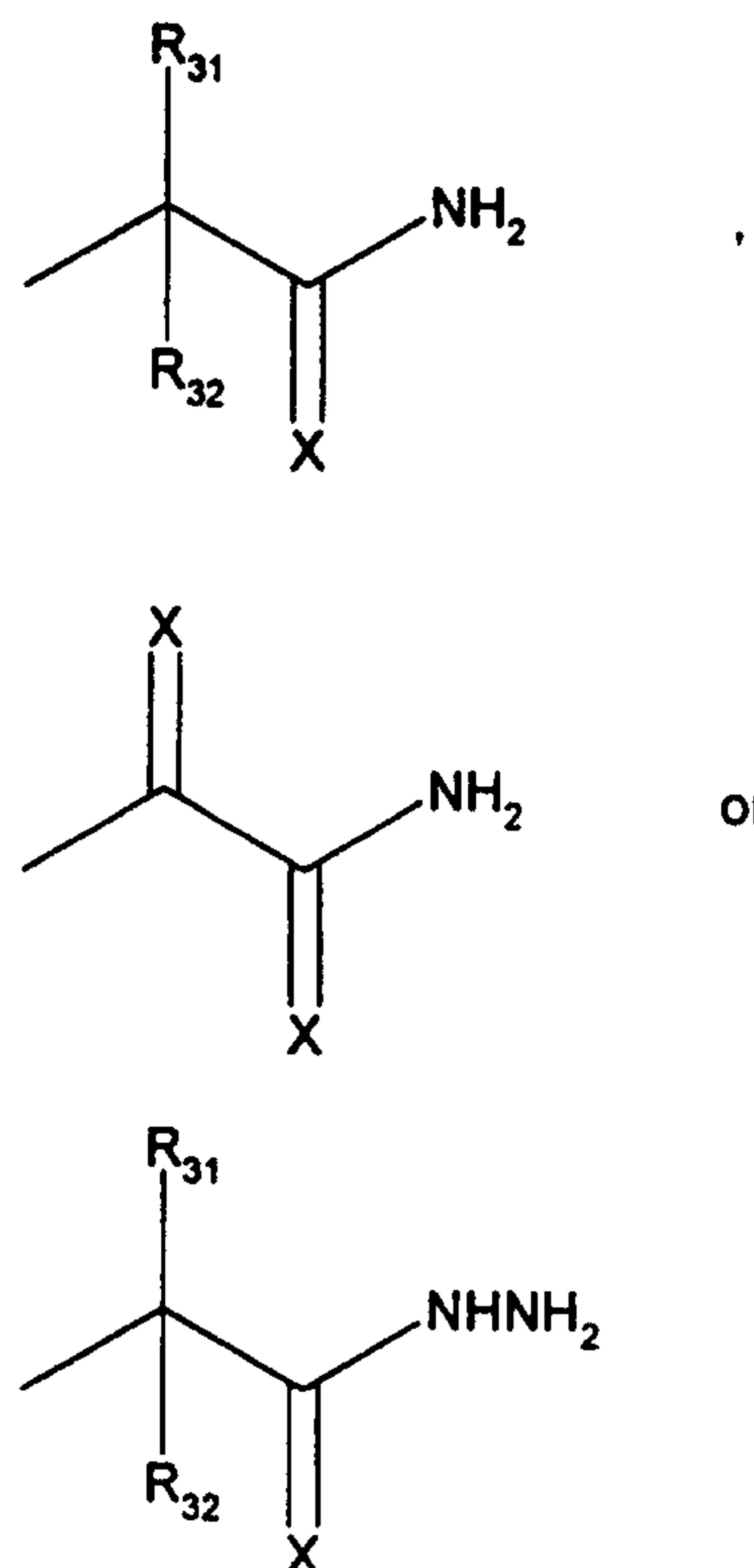
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and Z is selected from acetamide, thioacetamide, glyoxylamide, thioglyoxylamide, hydrazide or 5 thiohydrazide groups represented by the formulae,



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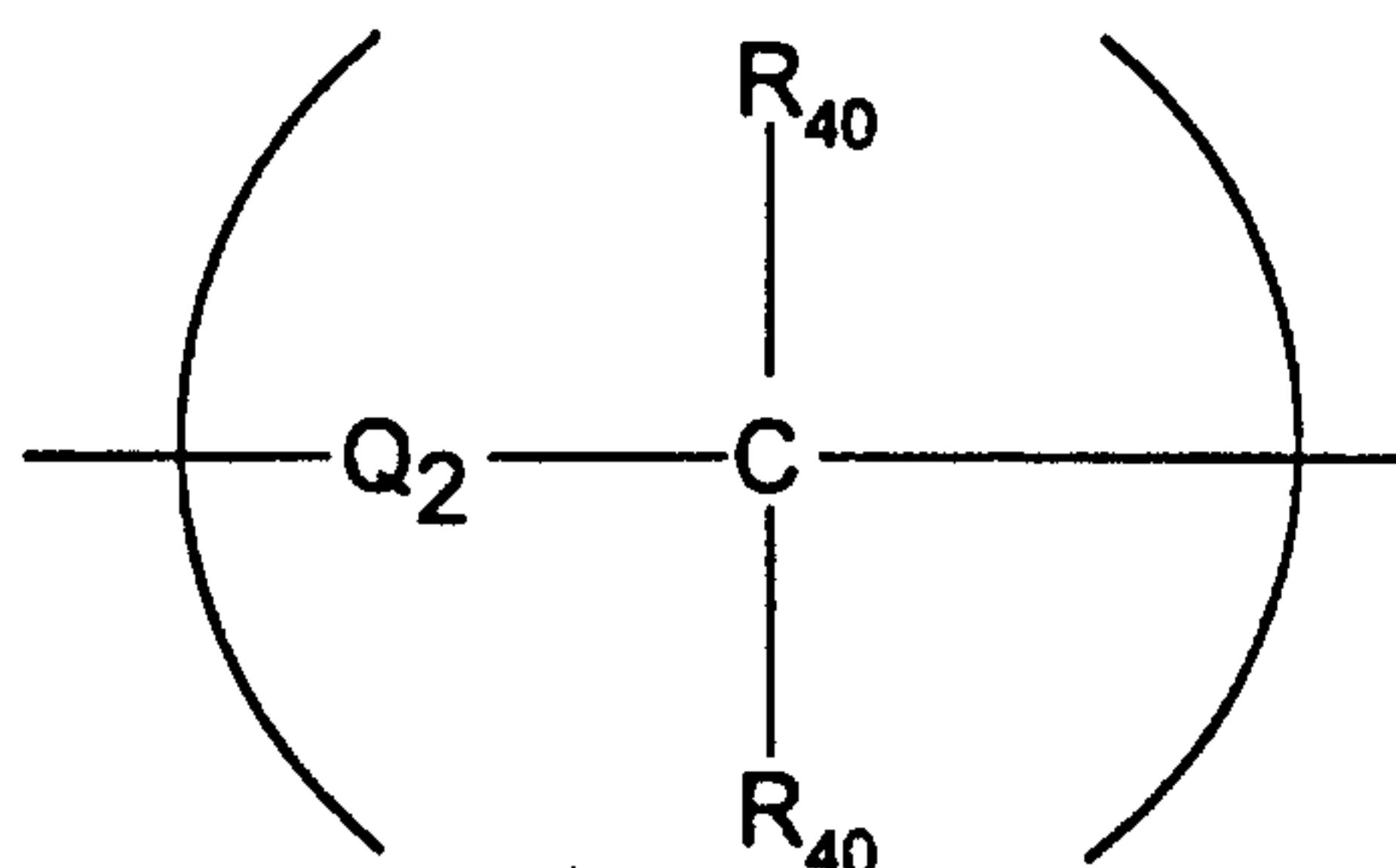
where R_{31} and R_{32} are independently selected from hydrogen, C_1 - C_8 alkyl, C_1 - C_8 haloalkyl, and C_3 - C_4 cycloalkyl, and X is oxygen or sulfur;

5 R_4 and R_5 each independently selected from hydrogen, a non-interfering substituent, or the group, $-(L_a)-(acylsulfonamide\ group)$, where $-(L_a)-$, is a divalent linker having a linker length of 1 to 8; provided that at least one of R_4 and R_5 must be the
10 group, $-(L_a)-(acylsulfonamide\ group)$; and

R_6 and R_7 are each independently selected from hydrogen, non-interfering substituent, carbocyclic radical, carbocyclic radical substituted with non-interfering substituent, heterocyclic radical, and
15 heterocyclic radical substituted with non-interfering substituent.

2. The compound of claim 1 wherein R_2 is hydrogen, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, $-O-(C_1-C_3\ alkyl)$,
20 $-S-(C_1-C_3\ alkyl)$, $-C_1-C_4$ cycloalkyl $-CF_3$, halo, $-NO_2$, $-CN$, or $-SO_3$.

3. The compound of Claim 1 wherein the linker group, $-(L_a)-$, for R_4 is selected from a group
25 represented by the formula;

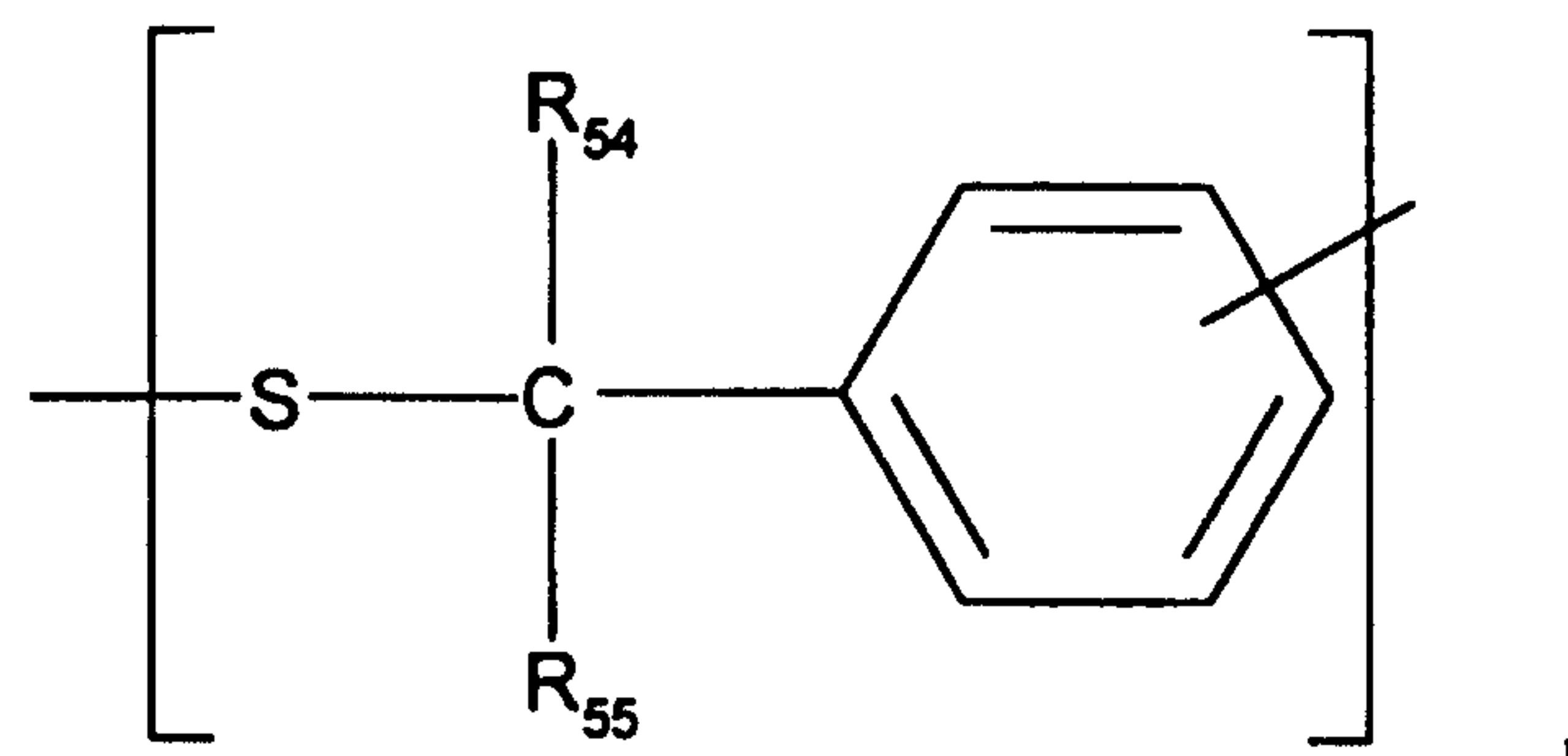
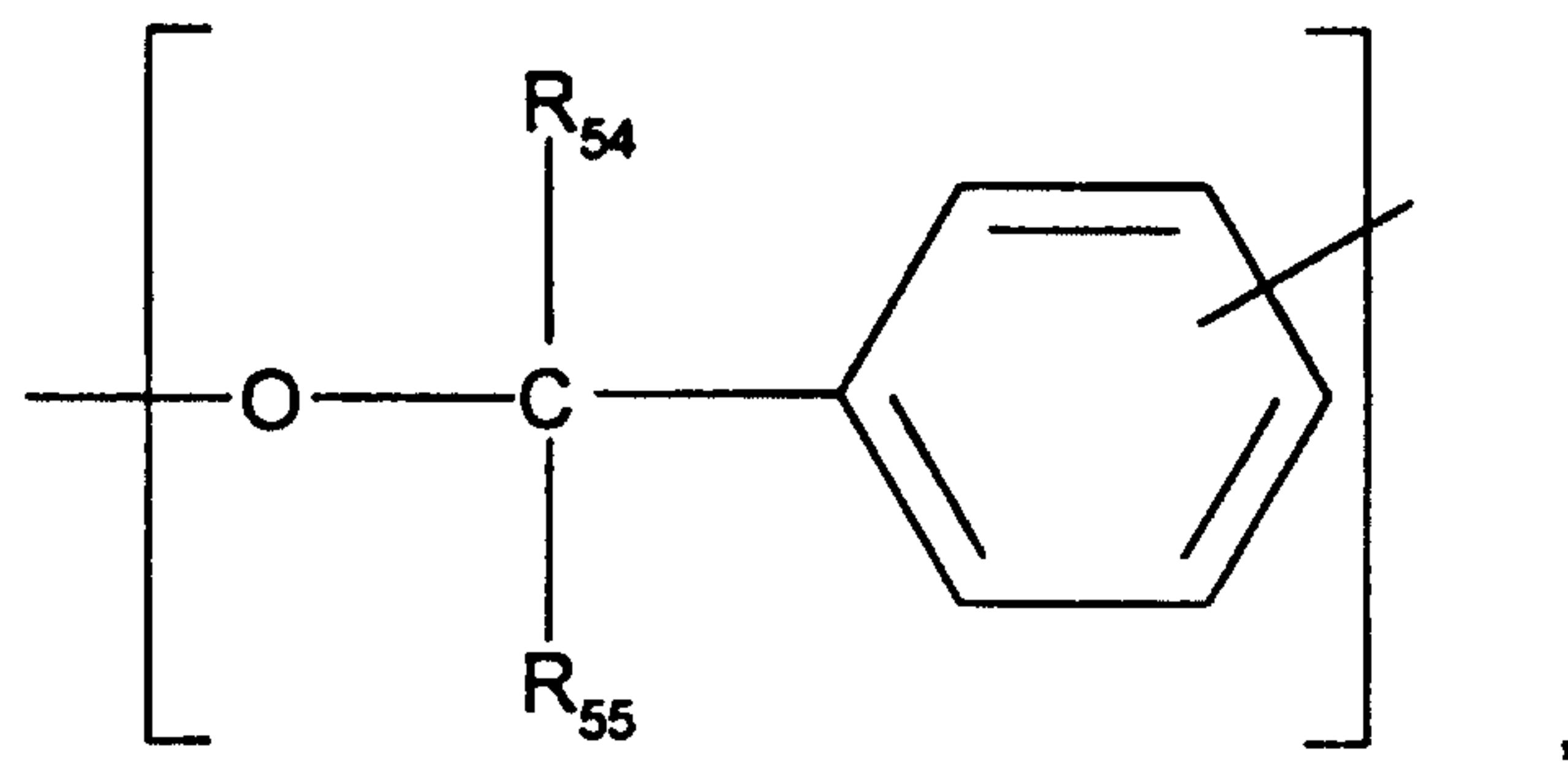


where Q_2 is selected from the group $-(CH_2)-$, $-O-$, $-NH-$,

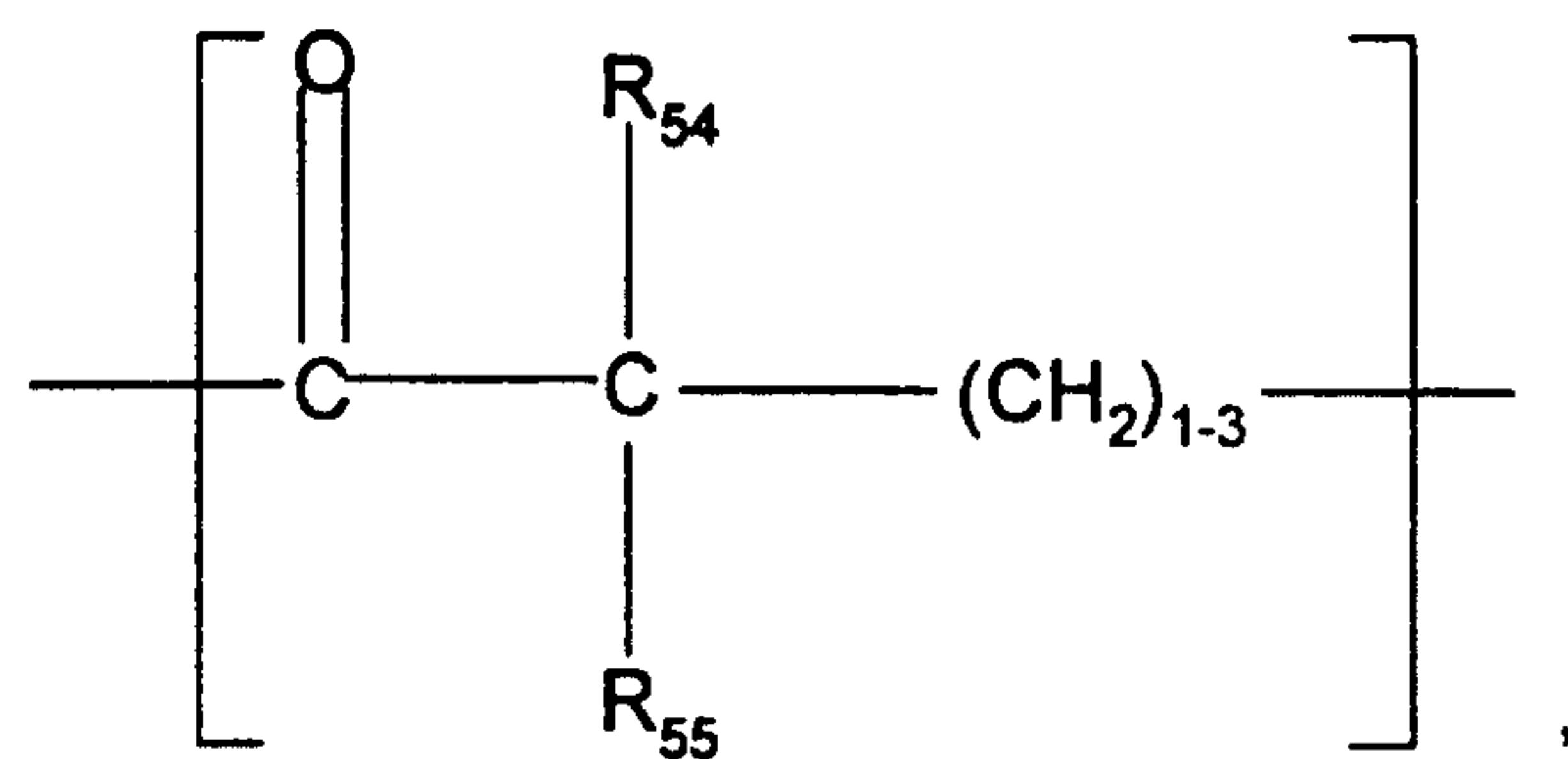
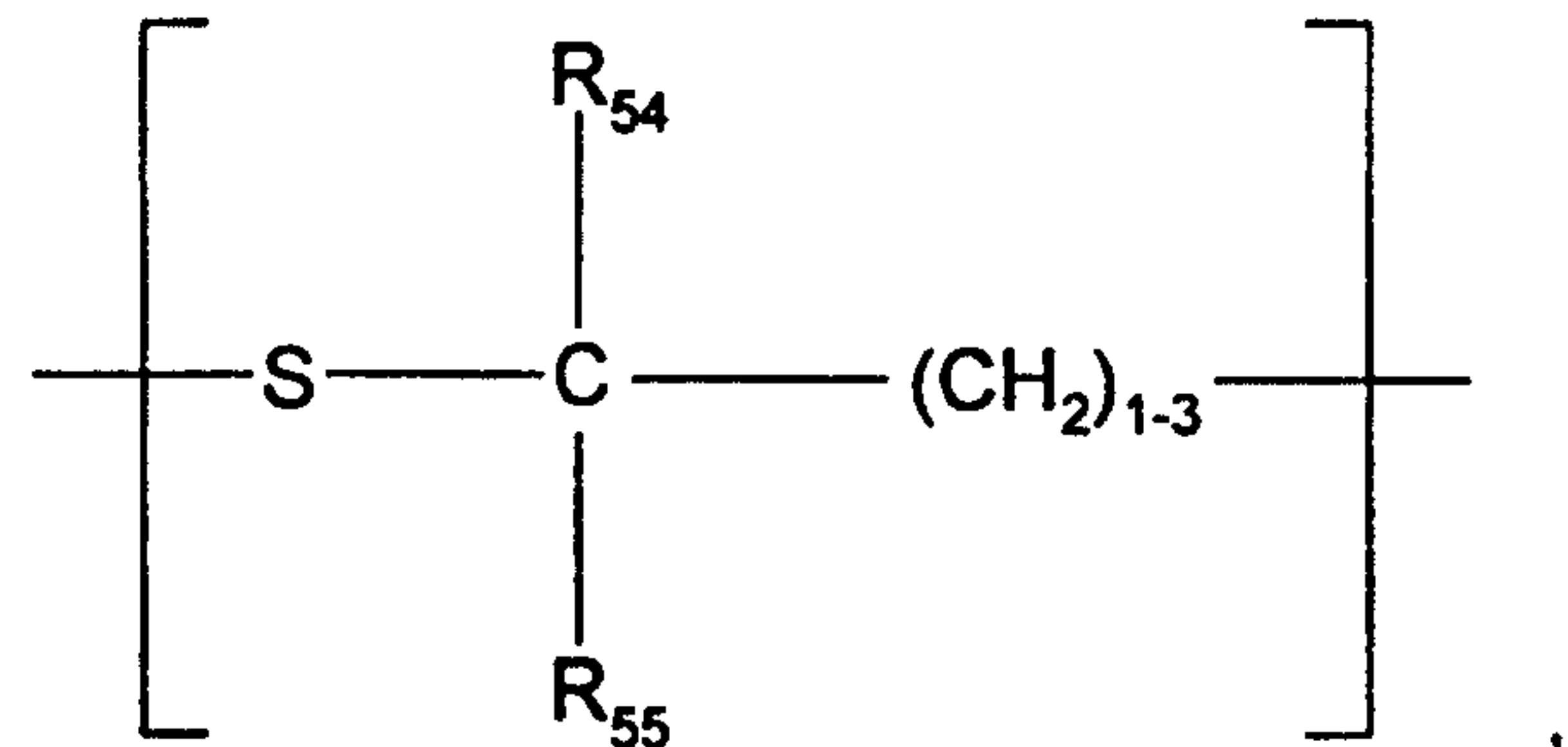
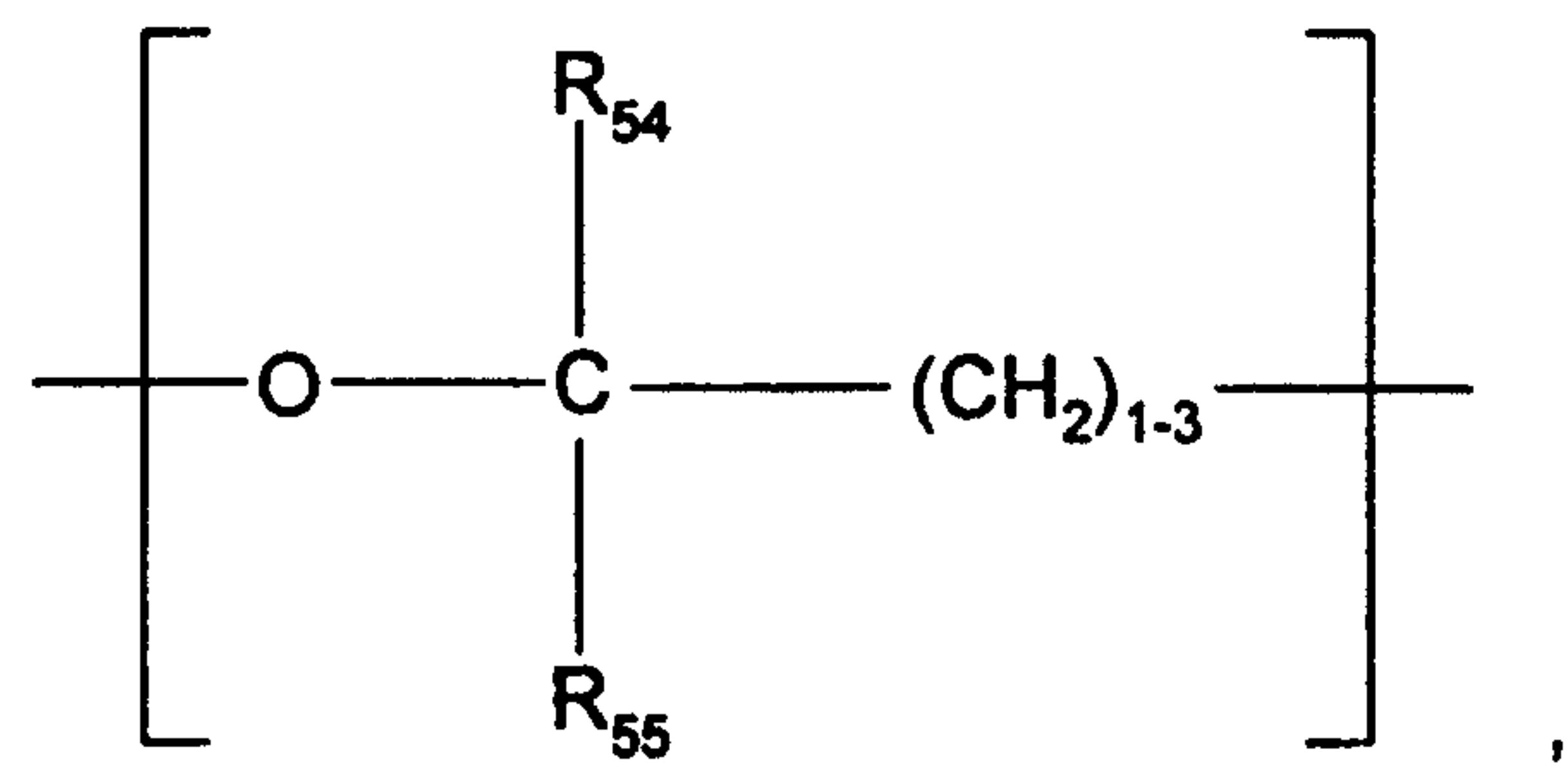
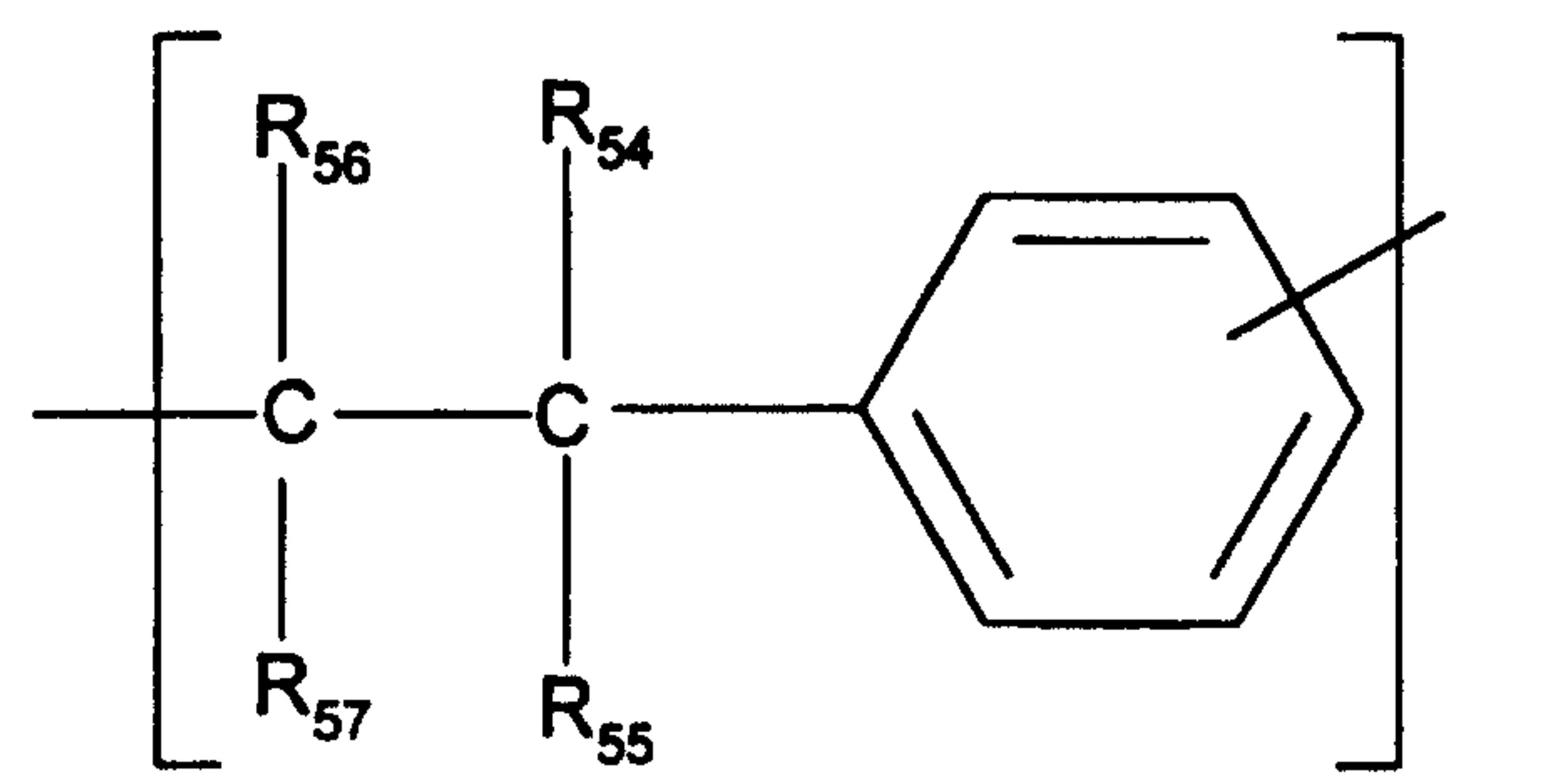
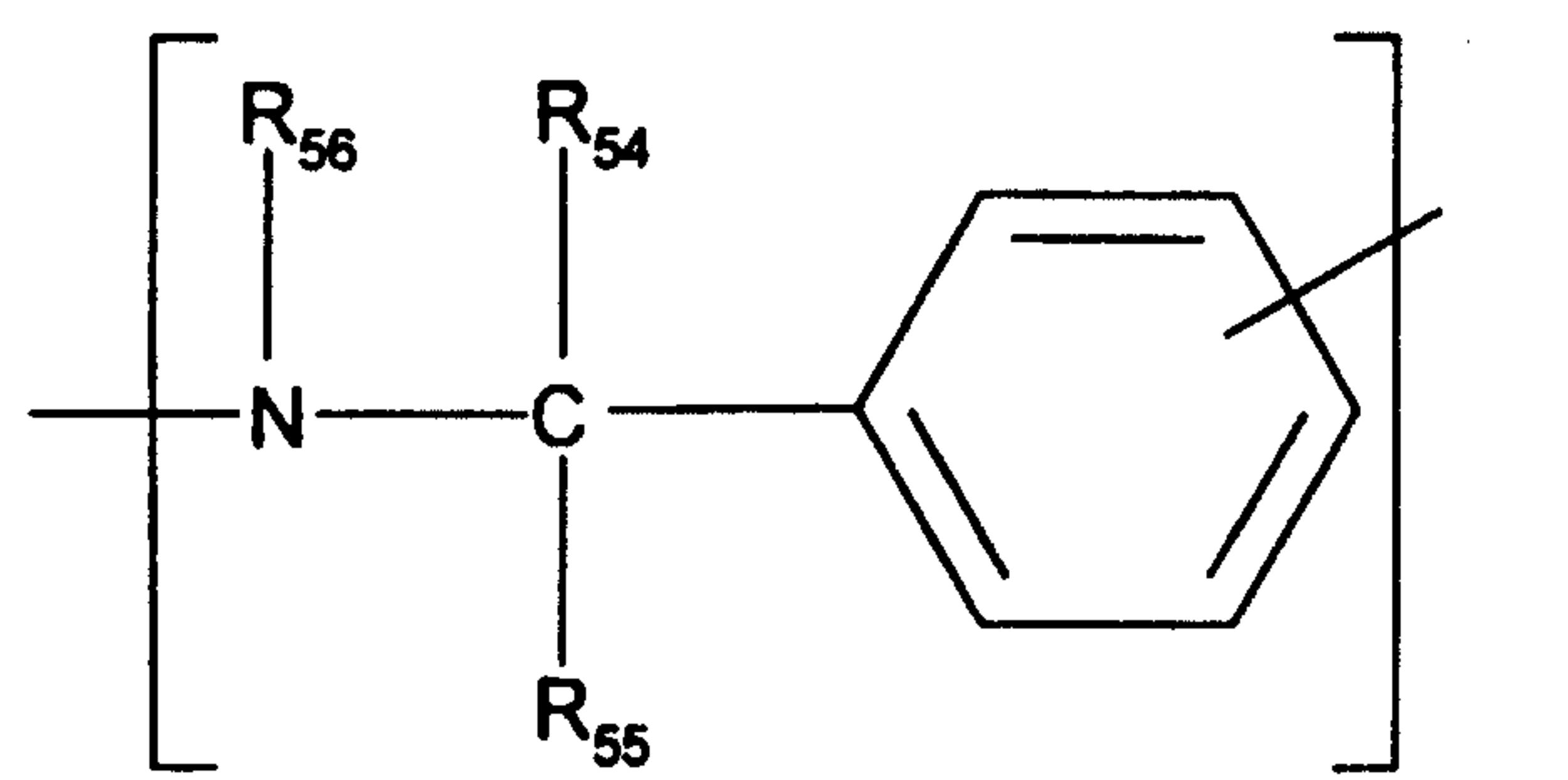
-55-

-C(O)-, and -S-, and each R₄₀ is independently selected from hydrogen, C₁-C₈ alkyl, aryl, C₁-C₈ alkaryl, C₁-C₈ alkoxy, aralkyl, and halo.

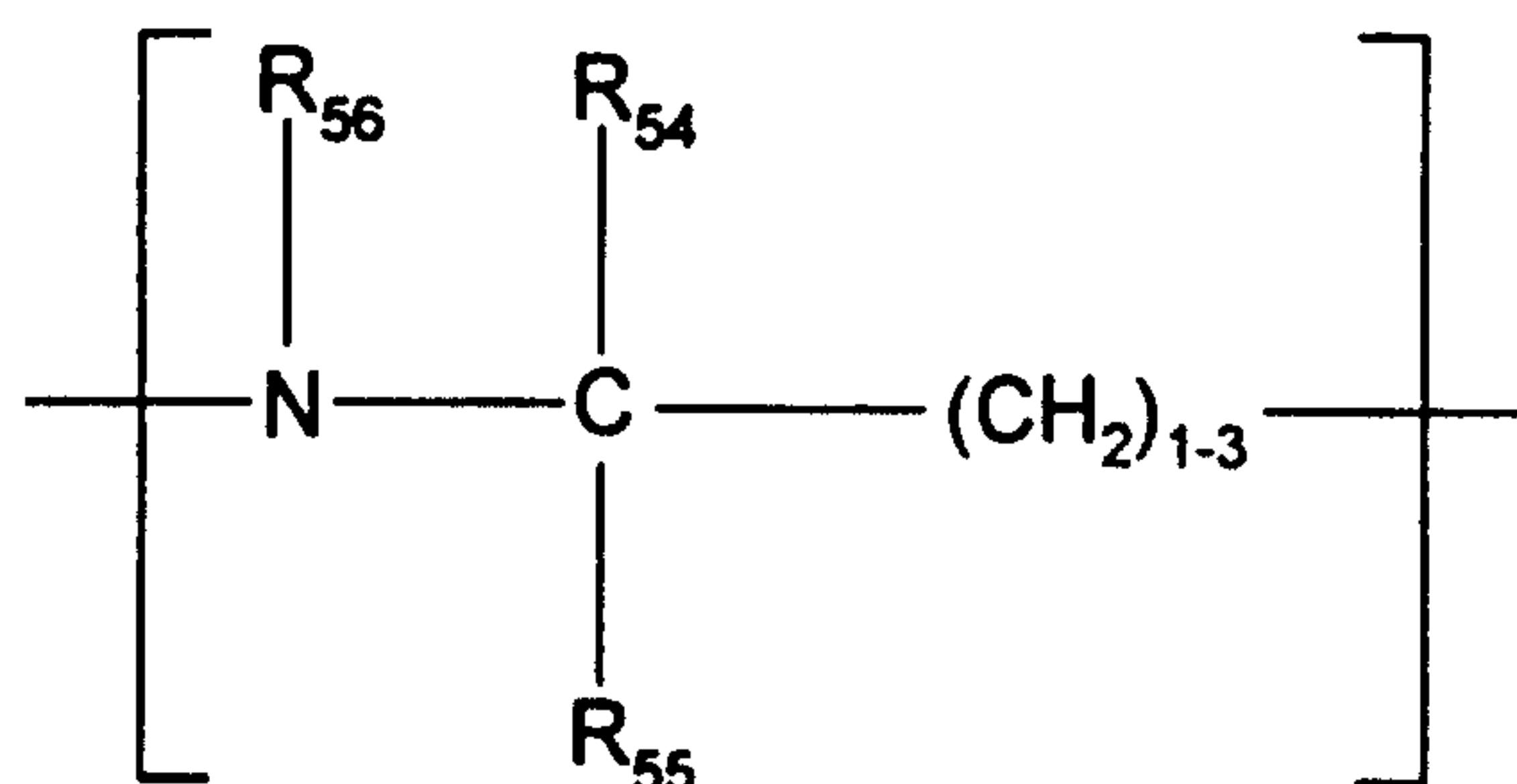
5 4. The compound of Claim 1 wherein the linker, -(L_a)-, for R₅ is selected from a group represented by the formulae consisting of;



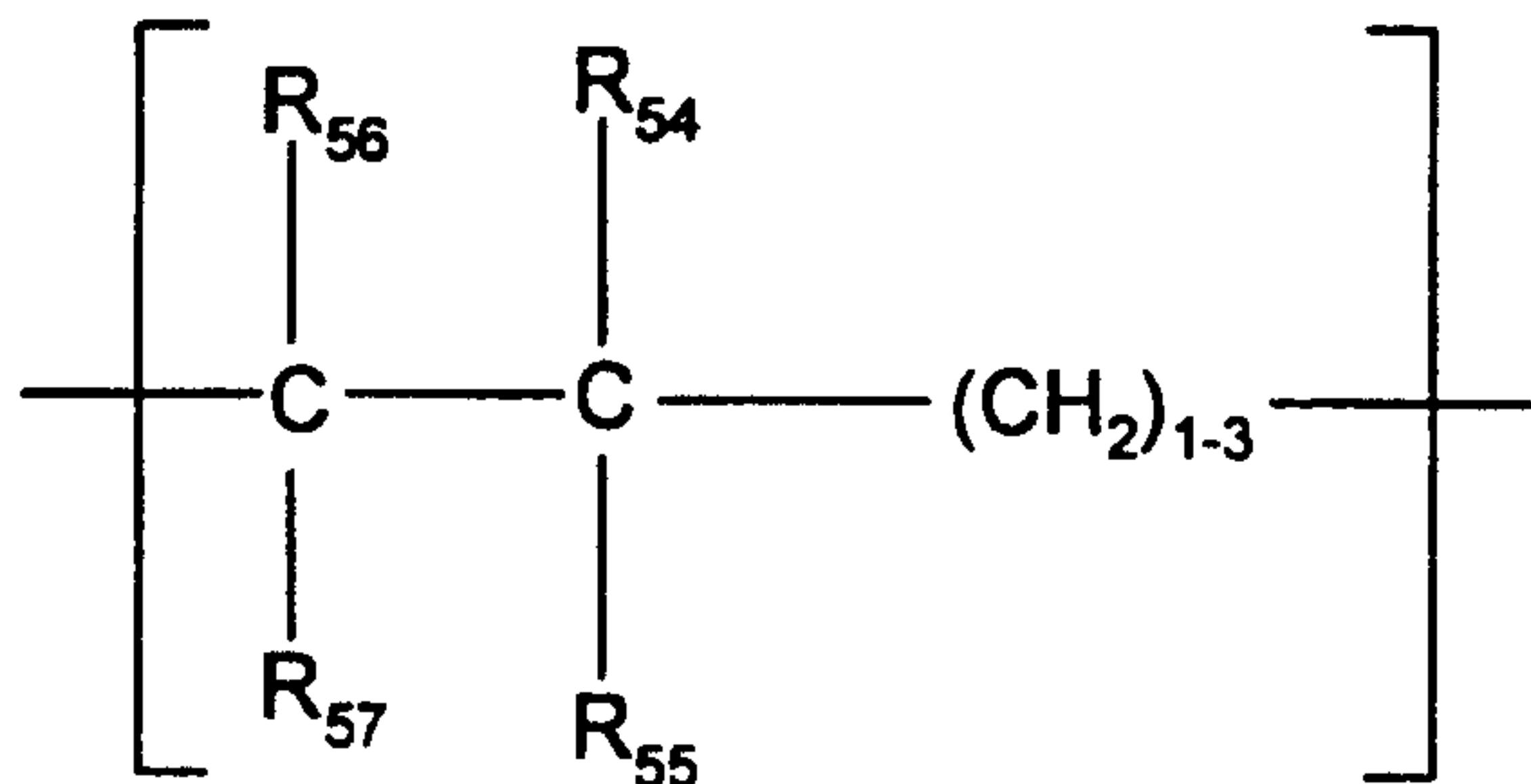
-56-



-57-



and

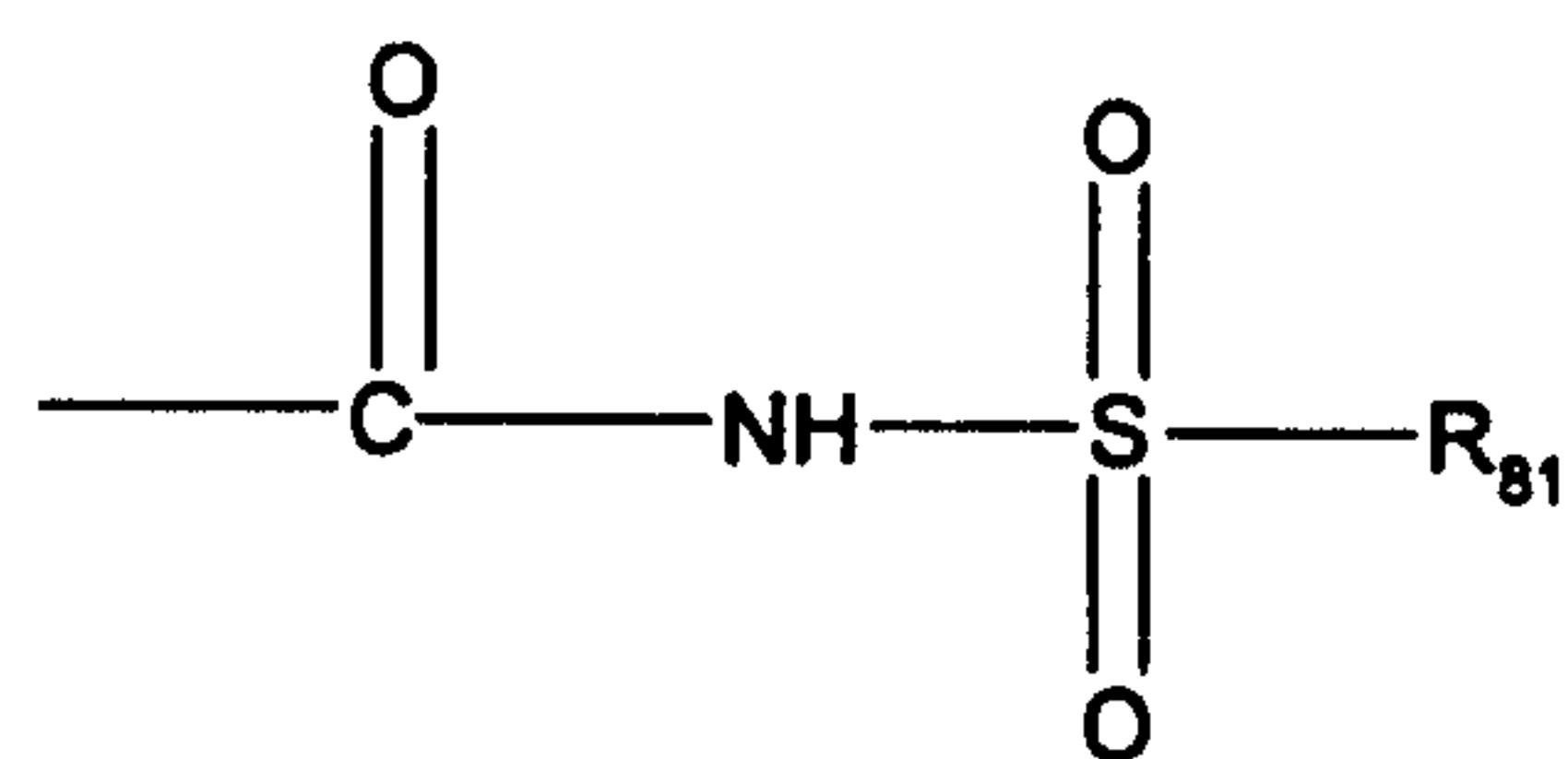


wherein R₅₄, R₅₅, R₅₆ and R₅₇ are each independently hydrogen, C₁-C₈ alkyl, C₁-C₈ haloalkyl, aryl, C₁-C₈ alkoxy, or halo.

5

5. The compound of claim 1 wherein only one of R₄ and R₅ is the group, -(L_a)-(acylsulfonamide group) and wherein the (acylsulfonamide group) is represented by the formula,

10

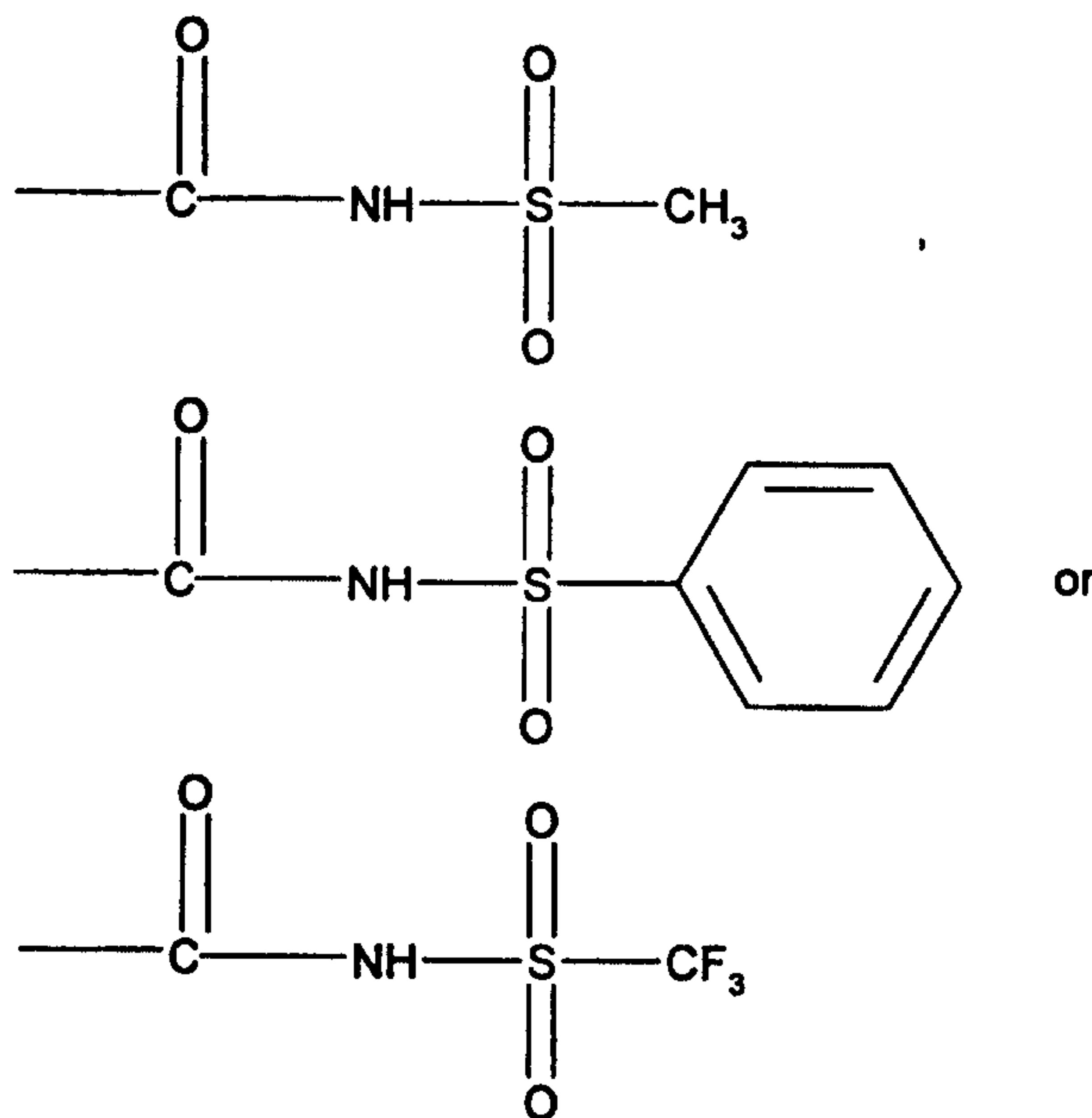


15 where the group R₈₁ is selected from -CF₃, C₁-C₈ alkyl, C₁-C₈ alkoxy, C₁-C₈ alkylthio, C₁-C₈ alkylamino, C₁-C₈ haloalkyl, C₁-C₁₄ aralkyl, C₁-C₁₄ alkylaryl, aryl, thioaryl, C₃-C₁₄ carbocycle, C₃-C₁₄ heterocycle.

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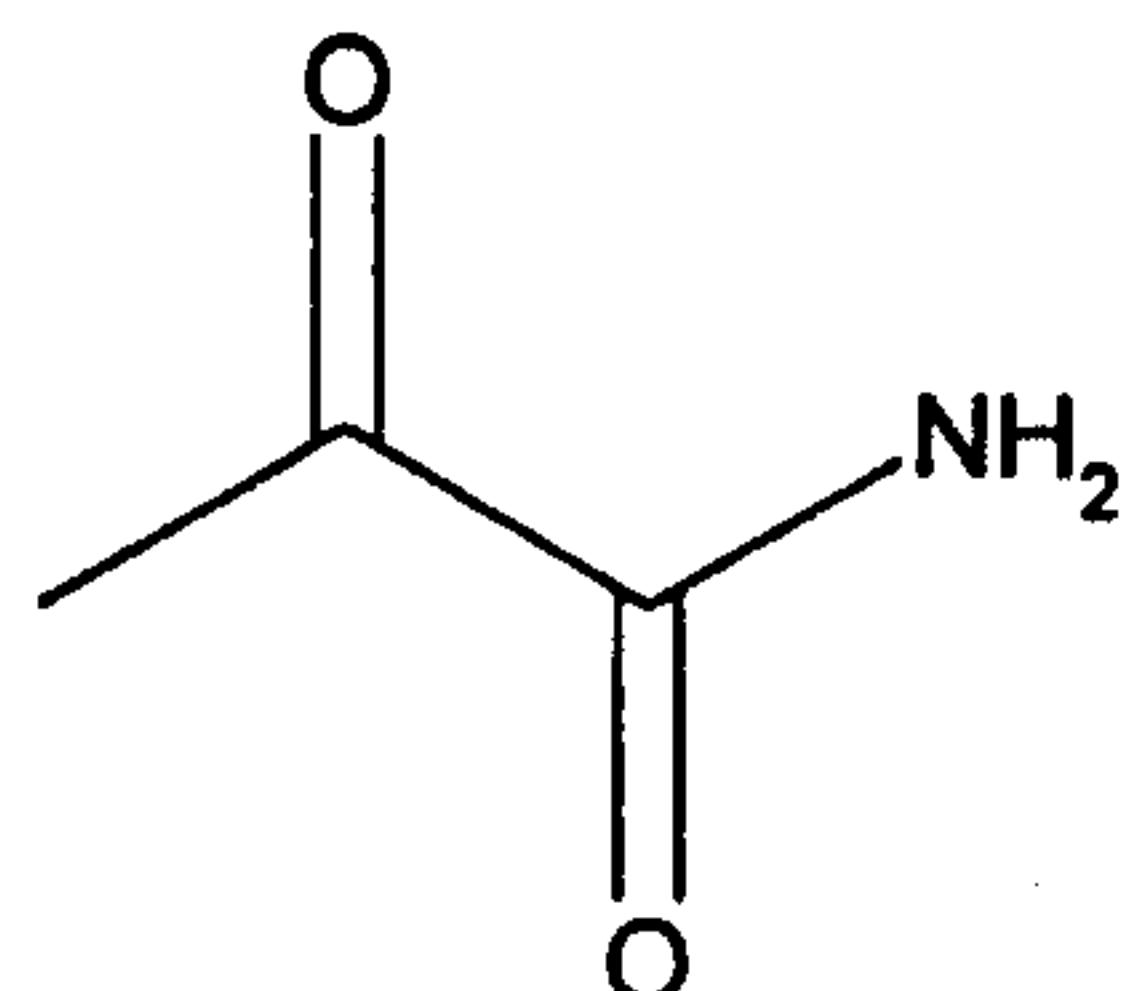
6. The compound of claim 1 wherein only one of R₄ and R₅ is the group, -(L_a)-(acylsulfonamide group) and wherein the (acylsulfonamide group) is selected from the group:

5



7. The compounds of claim 6 wherein the
10 (acylsulfonamide group) are -(CO)NHSO₂CH₃ and
- (CO)NHSO₂C₆H₅ .

8. The compound of claim 1 wherein for R₃, Z is
15 the group represented by the formula;



and the linking group -(L₃)- is a bond.

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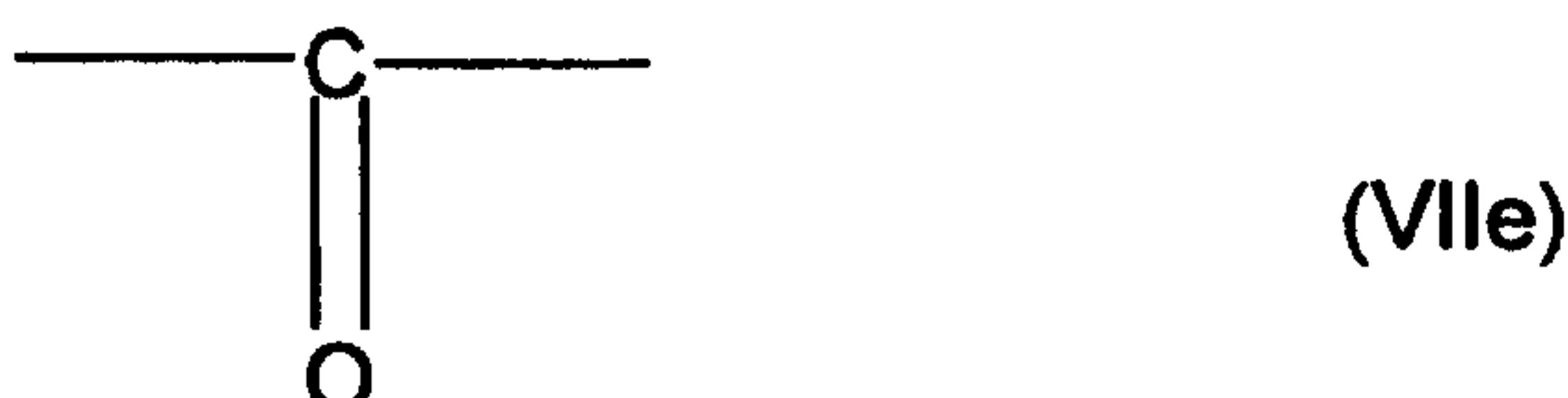
9. The compound of Claim 1 wherein, for R₆ the non-interfering substituent is hydrogen, C₁-C₈ alkyl, C₂-C₈ alkenyl, C₂-C₈ alkynyl, C₇-C₁₂ aralkyl, C₇-C₁₂ alkaryl, 5 C₃-C₈ cycloalkyl, C₃-C₈ cycloalkenyl, phenyl, tolulyl, xylene, biphenyl, C₁-C₈ alkoxy, C₂-C₈ alkenyloxy, C₂-C₈ alkynyloxy, C₂-C₁₂ alkoxyalkyl, C₂-C₁₂ alkoxyalkyloxy, C₂-C₁₂ alkylcarbonyl, C₂-C₁₂ alkylcarbonylamino, C₂-C₁₂ alkoxyamino, C₂-C₁₂ 10 alkoxyaminocarbonyl, C₁-C₁₂ alkylamino, C₁-C₆ alkylthio, C₂-C₁₂ alkylthiocarbonyl, C₁-C₈ alkylsulfinyl, C₁-C₈ alkylsulfonyl, C₂-C₈ haloalkoxy, C₁-C₈ haloalkylsulfonyl, C₂-C₈ haloalkyl, C₁-C₈ 15 hydroxyalkyl, -C(O)O(C₁-C₈ alkyl), -(CH₂)_n-O-(C₁-C₈ alkyl), benzyloxy, phenoxy, phenylthio, -(CONHSO₂R), -CHO, amino, amidino, bromo, carbamyl, carboxyl, carbalkoxy, -(CH₂)_n-CO₂H, chloro, cyano, cyanoguanidinyl, fluoro, guanidino, hydrazide, hydrazino, hydrazido, hydroxy, hydroxyamino, iodo, 20 nitro, phosphono, -SO₃H, thioacetal, thiocarbonyl, or C₁-C₈ carbonyl; where R is C₁-C₈ alkyl and n is from 1 to 8.

10. The compound of Claim 1 wherein for R₁ the 25 divalent linking group -(L₁)- is selected from a group represented by the formulae (VIIa), (VIIb), (VIIc), (VIIId), (VIIe), and (VIIIf):

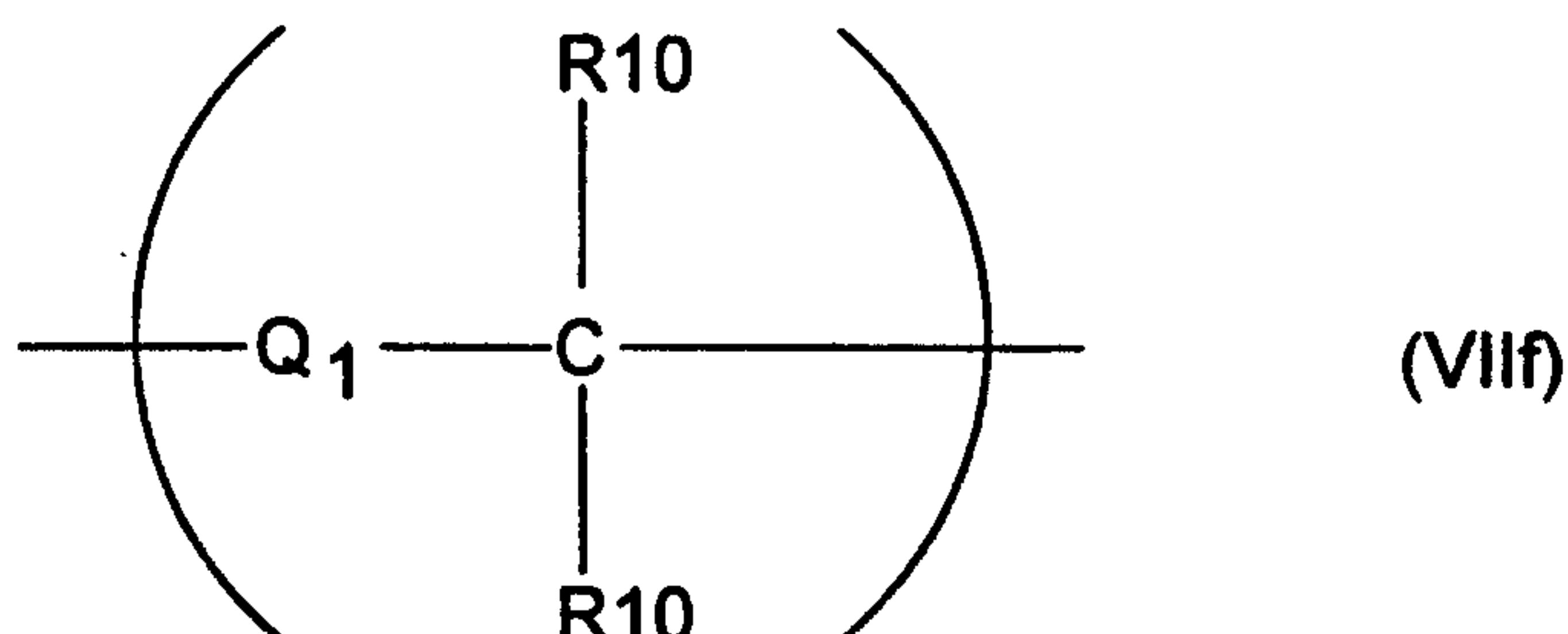
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or



5

where Q_1 is a bond or any of the divalent groups VIIa, VIIb, VIIc, VIId, and VIIe and R_{10} is independently -H, C₁₋₈ alkyl, C₁₋₈ haloalkyl or C₁₋₈ alkoxy.

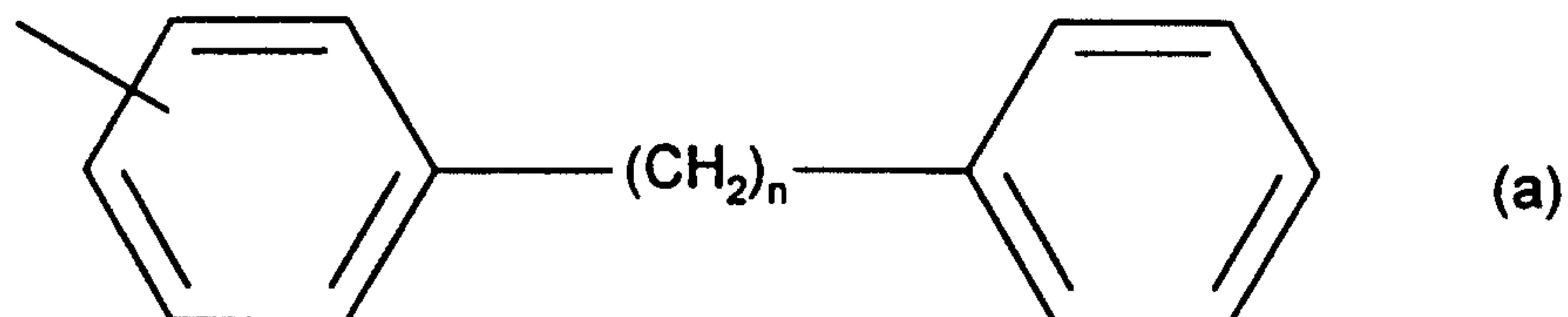
11. The compound of claim 1 wherein the linking group $-(L_1)-$ of R_1 is $-(CH_2)-$ or $-(CH_2-CH_2)-$.

12. The compound of claim 1 wherein for R_1 the group

15 R₁₁ is a substituted or unsubstituted carbocyclic radical selected from the group consisting of cycloalkyl, cycloalkenyl, phenyl, spiro[5.5]undecanyl, naphthyl, norbornanyl, bicycloheptadienyl, toluyl, xlenyl, indenyl, stilbenyl, terphenylyl, diphenylethlenyl, phenyl-cyclohexenyl, acenaphthyl, and anthracenyl,

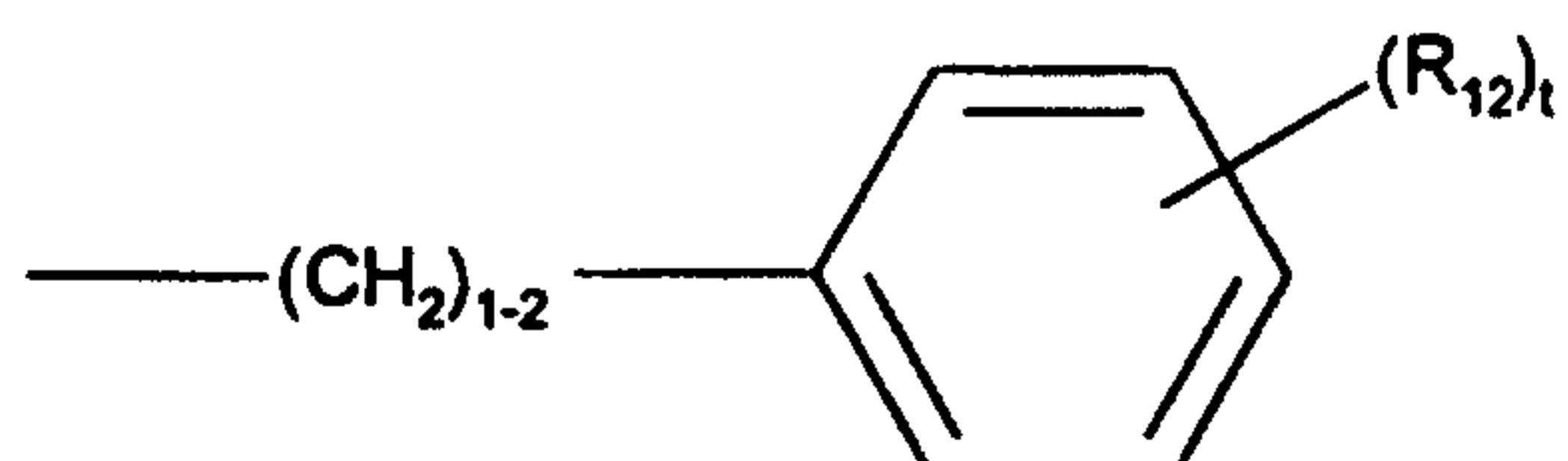
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biphenyl, bibenzyl and related bibenzyl homologues represented by the formula (a):

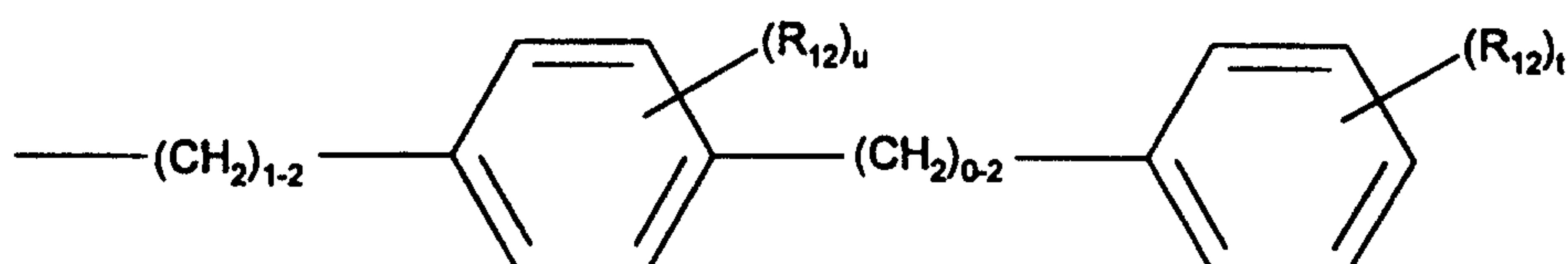


5 where n is a number from 1 to 8.

13. The compound of Claim 11 wherein for R_1 the combined group $-(L_1)-R_{11}$ is selected from the groups;



or



10

where R_{12} is a radical independently selected from halo, C_1-C_{10} alkyl, C_1-C_{10} alkoxy, $-\text{S}-$ (C_1-C_{10} alkyl), and C_1-C_{10} haloalkyl, C_1-C_{10} hydroxyalkyl and t is a 15 number from 0 to 5 and u is a number from 0 to 4.

14. The compound of claim 1 wherein for R_1 the radical R_{11} is a substituted or unsubstituted heterocyclic radical selected from pyrrolyl, 20 pyrrolodinyl, piperidinyl, furanyl, thiophenyl, pyrazolyl, imidazolyl, phenylimidazolyl, triazolyl, isoxazolyl, oxazolyl, thiazolyl, thiadiazolyl, indolyl, carbazolyl, norharmanyl, azaindolyl, benzofuranyl,

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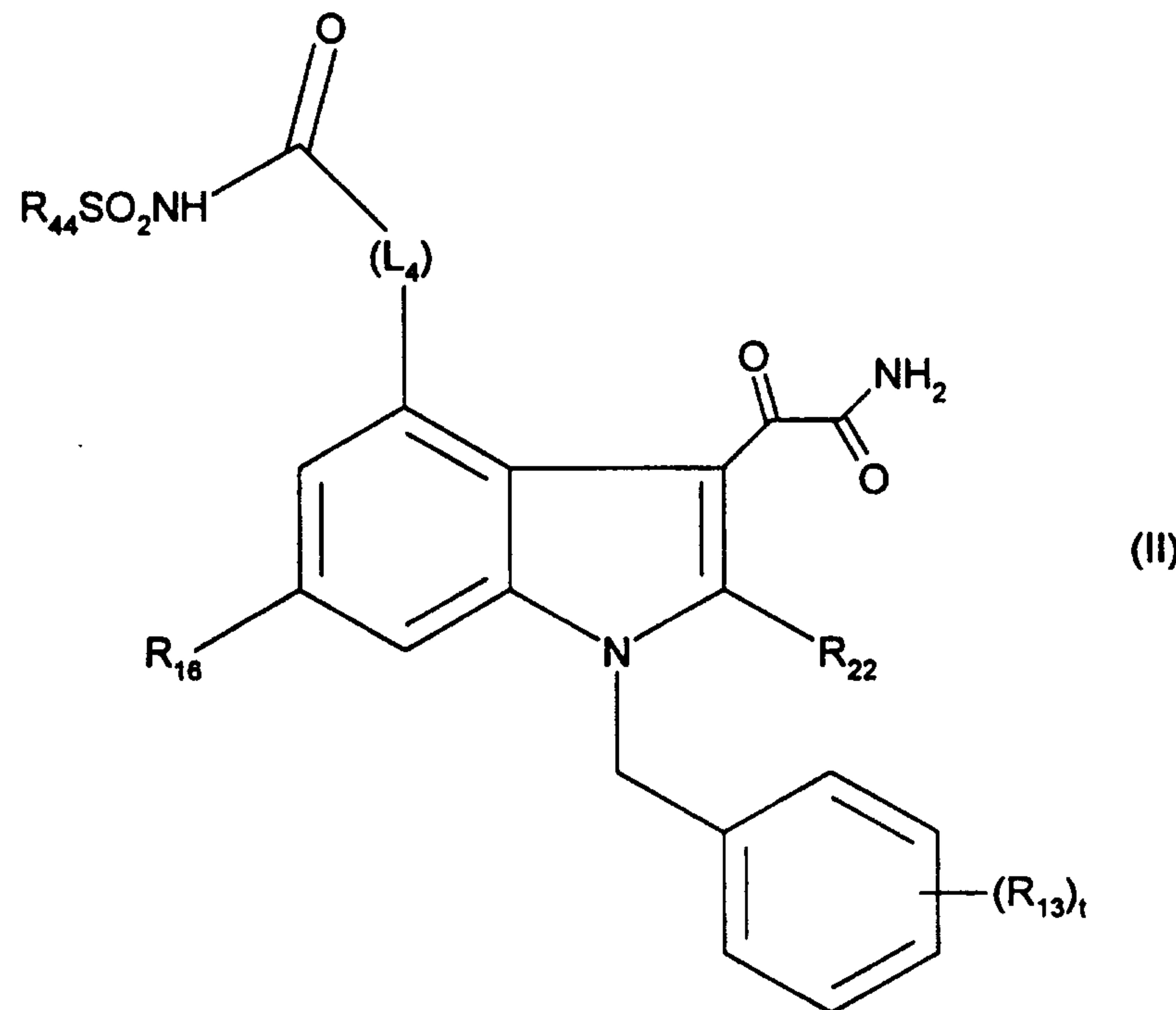
dibenzofuranyl, dibenzothiophenyl, indazolyl,
imidazo(1,2-A)pyridinyl, benzotriazolyl, anthranilyl,
1,2-benzisoxazolyl, benzoxazolyl, benzothiazolyl,
purinyl, pyridinyl, dipyridylyl, phenylpyridinyl,
5 benzylpyridinyl, pyrimidinyl, phenylpyrimidinyl,
pyrazinyl, 1,3,5-triazinyl, quinolinyl, phthalazinyl,
quinazolinyl, morpholino, thiomorpholino,
homopiperazinyl, tetrahydrofuranlyl, tetrahydropyranyl,
oxacanyl, 1,3-dioxolanyl, 1,3-dioxanyl, 1,4-dioxanyl,
10 tetrahydrothiophenyl, pentamethylenesulfadyl, 1,3-dithianyl,
1,4-dithianyl, 1,4-thioxanyl, azetidinyl,
hexamethyleneiminium, heptamethyleneiminium,
piperazinyl or quinoxalinyl.

15 15. The compound of claim 1 in the form of a
salt.

16. The compound of claim 1 in the form of
solvate.

20 17. A indole compound represented by the
formula (II), or a pharmaceutically acceptable salt or
solvate thereof;

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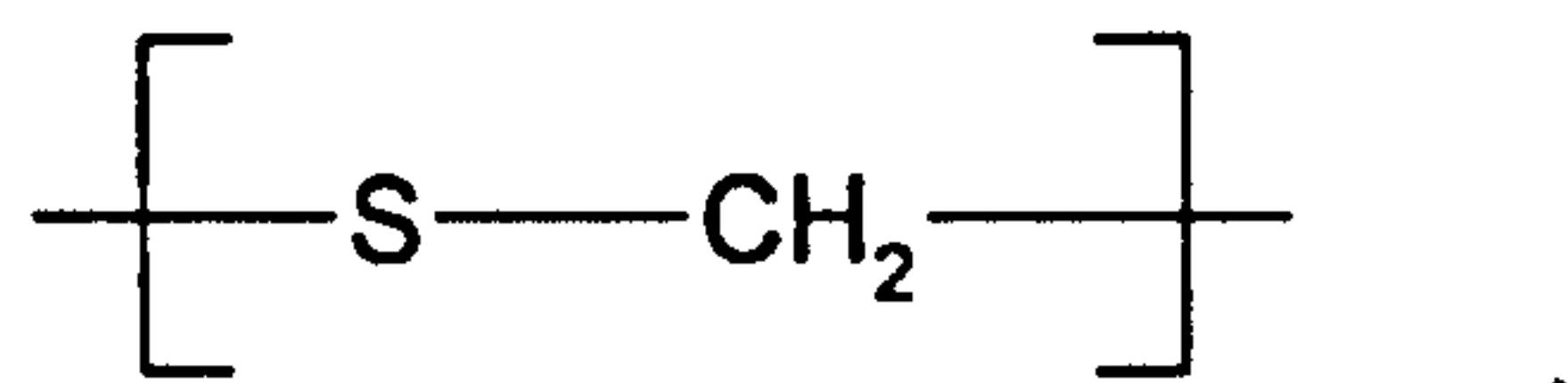
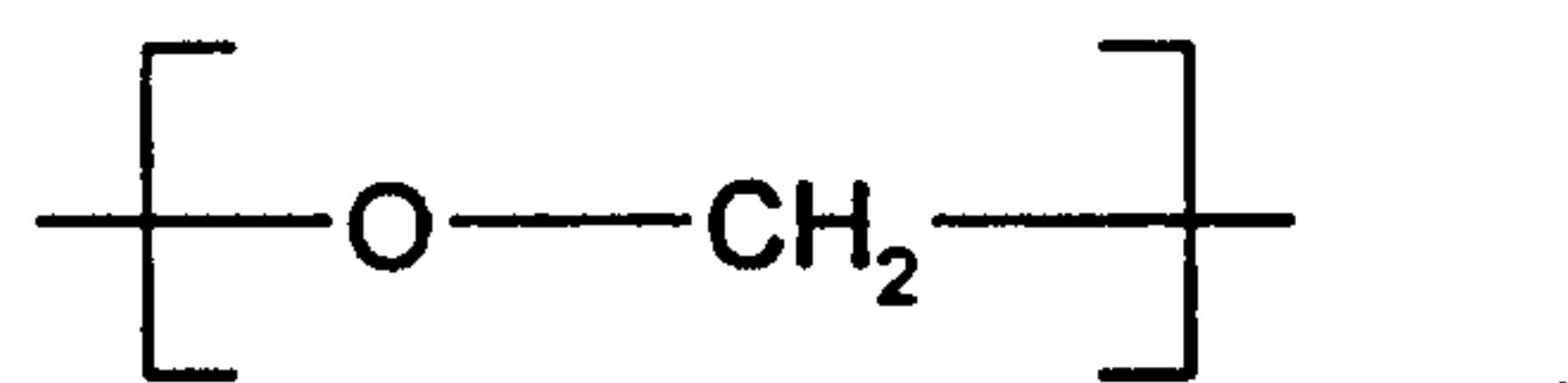


wherein ;

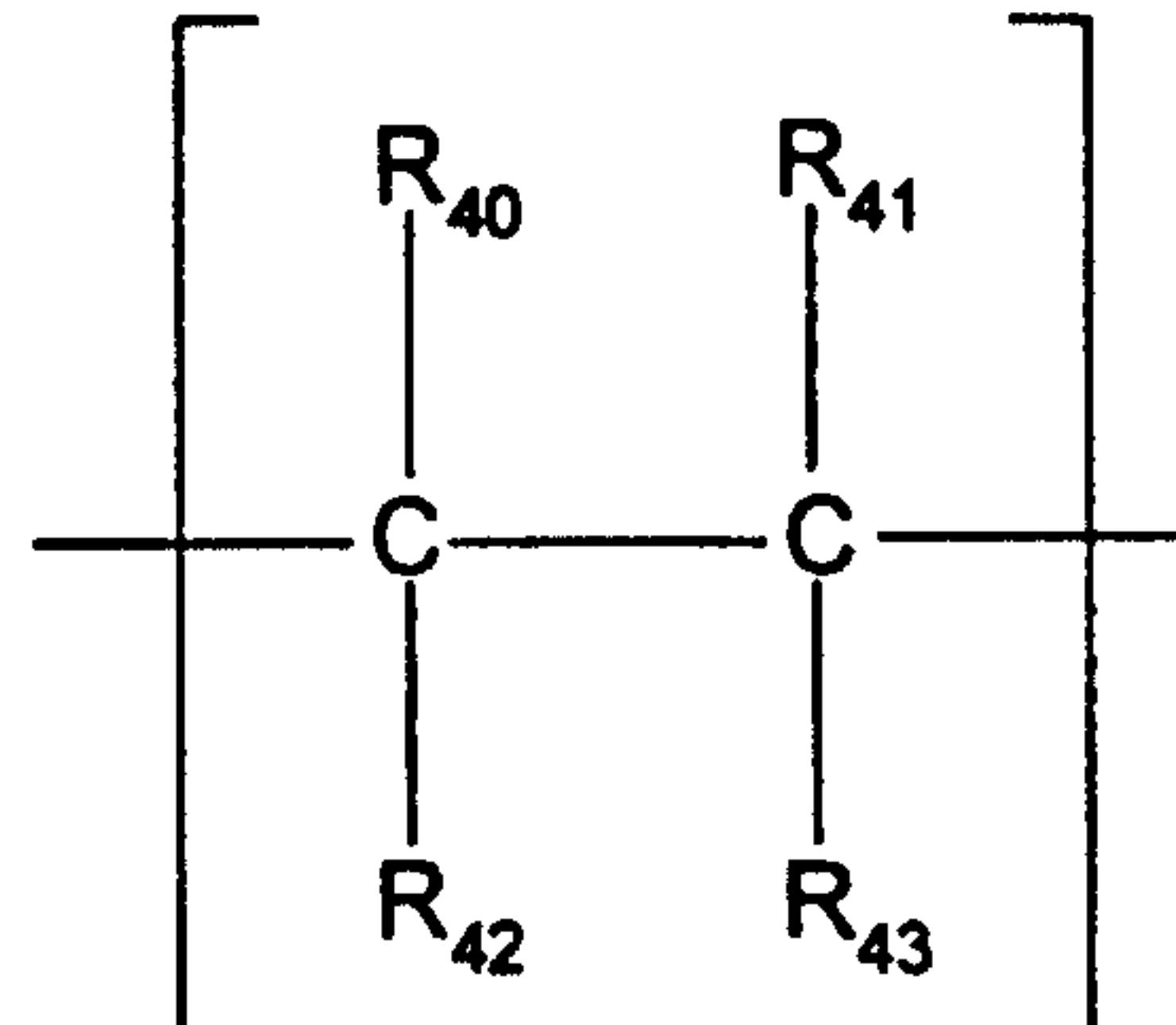
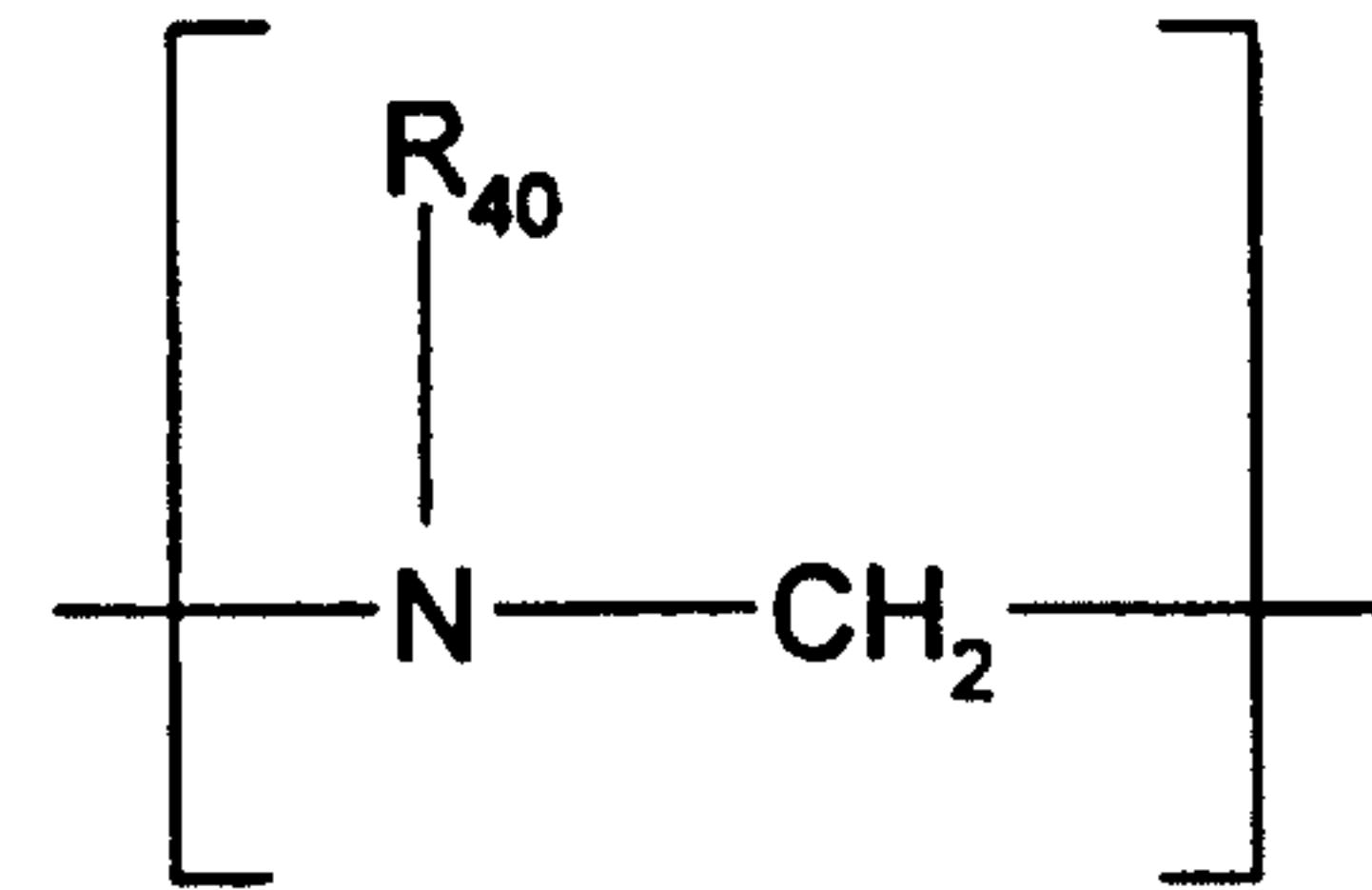
R₁₆ is selected from hydrogen and C₁-C₈ alkyl, C₁-C₈ alkoxy, C₁-C₈ alkylthio C₁-C₈ haloalkyl, C₁-C₈ hydroxyalkyl, and halo;

R₄₄ is methyl, ethyl, phenyl, -CF₃;

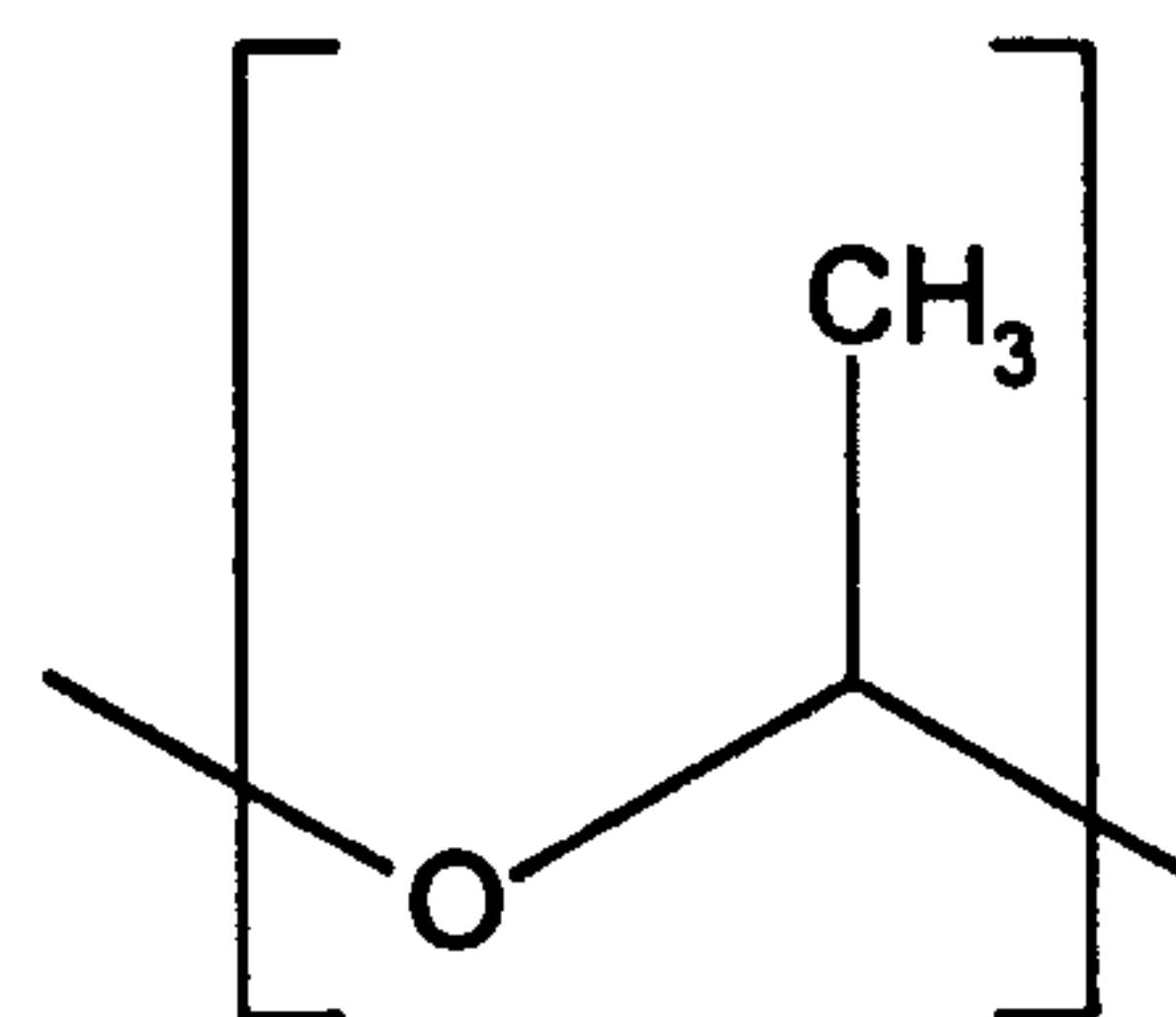
-(L₄)- is a divalent group selected from,



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or



where R₄₀, R₄₁, R₄₂, and R₄₃ are each independently
 5 selected from hydrogen, C₁-C₈ alkyl;
 R₂₂ is selected from hydrogen, methyl, ethyl,
 propyl, isopropyl, cyclopropyl, -F, -CF₃, -Cl, -Br, or
 -O-CH₃; and
 R₁₃ is C₁-C₈ alkyl, C₁-C₈ alkoxy,
 10 -S-(C₁-C₈ alkyl), C₁-C₈ haloalkyl, C₁-C₈ hydroxyalkyl,
 and halo; and t is an integer from 0 to 5.

18. An indole compound selected from the group
 consisting of:
 15 1-benzyl-2-ethyl-4-methanesulfonamidoymethoxy-
 indole-3-glyoxylamide;

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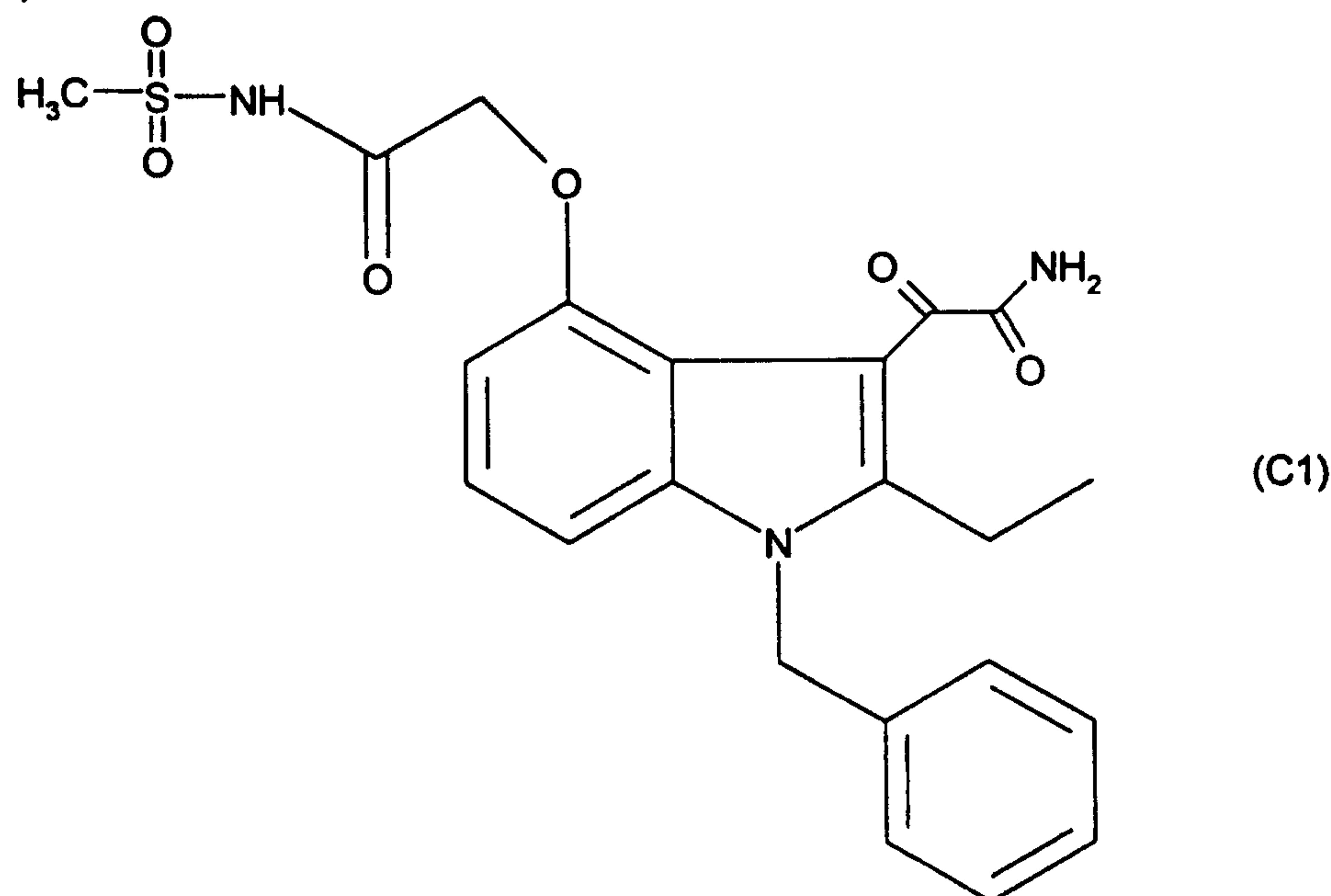
1-benzyl-2-ethyl-4-benzenesulfonylmethoxyindole-3-glyoxylamide;

5 1-benzyl-2-ethyl-4-
trifluoromethanesulfonylmethoxy-indole-3-
glyoxylamide;

10 1-benzyl-2-ethyl-4-(2-methylbenzenesulfonamidoymethoxy)-indole-3-glyoxylamide; and

1-benzyl-2-ethyl-4-(4-(2-aminoethyl)benzenesulfonylmethoxy)-indole-3-glyoxylamide, hydrochloride salt.

19. A indole compound represented by the formula
(C1);



20. A pharmaceutical formulation comprising a
indole compound as claimed in claim 1 together with a
pharmaceutically acceptable carrier or diluent therefor.

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21. A method of inhibiting sPLA₂ mediated release of fatty acid which comprises contacting sPLA₂ with an therapeutically effective amount of indole compound as 5 claimed in claim 1.

22. A method of treating a mammal, including a human, to alleviate the pathological effects of Inflammatory Diseases; wherein the method comprises 10 administration to said mammal of at least one indole compound as claimed in Claim 1 in a pharmaceutically effective amount.

23. A compound of claim 1 or a pharmaceutical 15 formulation containing an effective amount of the compound of claim 1 in treatment of Inflammatory Diseases.

24. A compound of claim 1 or a pharmaceutical 20 formulation containing an effective amount of the compound of claim 1 for use as an inhibitor for inhibiting sPLA₂ mediated release of fatty acid.

25. Use of the compound of Claim 1 for the 25 manufacture of a medicament for treating Inflammatory Diseases.

26. Use of a compound of Claim 1 for the manufacture of a medicament for treating sPLA₂ mediated 30 release of fatty acids.

27. A compound of formula I of Claim 1 substantially as hereinbefore described with reference to any of the Examples.