n: number of electrons transferred

[Ox]: concentration of the oxidized form

[Red]: concentration of the reduced form

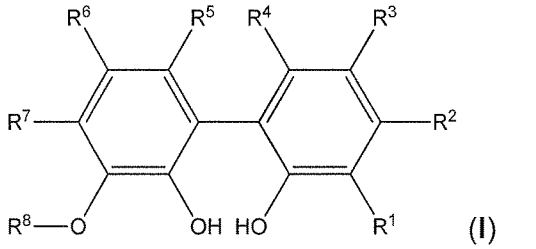
If the processes cited in the literature above were to be applied to two different phenols, the result of this would be to form predominantly free radicals of the molecule having a lower oxidation potential, which would then react with themselves. By far the predominant main product obtained would thus be a biphenol which has formed from two identical phenols. This problem does not occur in the coupling of identical molecules.

The problem addressed by the invention which follows was to provide an electrochemical process in which phenols having different oxidation potentials can be coupled to one another, and the yield of the biphenol formed from two different phenols is above that as achievable by the electrochemical methods known from the literature, i.e. above that of the biphenol formed from two different phenols.

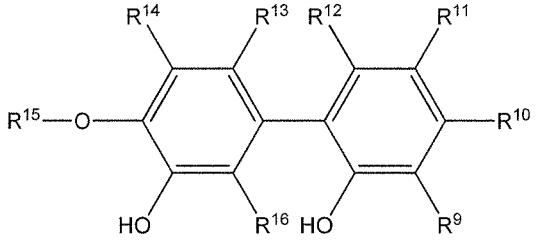
In addition, novel biphenols were to be synthesized.

Summary

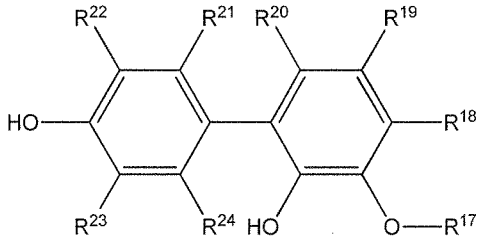
In one aspect, there is provided a compound of one of the general formulae (**I**) to (**III**):



(**I**)



(**II**)



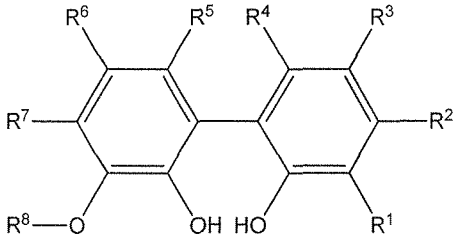
(**III**)

where R^2, R^3, R^4, R^5, R^6, R^7, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{16}, R^{18}, R^{19}, R^{20}, R^{21}, R^{24} are selected from: -H, -alkyl, -O-alkyl; R^6 is –Me;

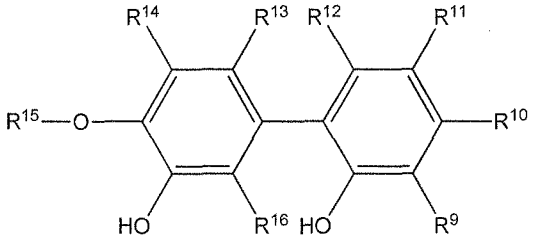
R^8, R^{15}, R^{17} are -alkyl;

Claims

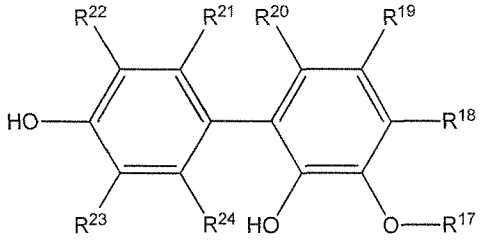
1. Compound of one of the general formulae (**I**) to (**III**):



(**I**)



(**II**)



(**III**)

where R^2, R^3, R^4, R^5, ~~R^6~~, R^7, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{16}, R^{18}, R^{19}, R^{20}, R^{21}, R^{24} are selected from: -H, -alkyl, -O-alkyl; R^6 is –Me;

R^8, R^{15}, R^{17} are -alkyl;

R^1, R^9, R^{22}, R^{23} are selected from: -H, -alkyl;

and, if R^3 is -Me, R^1 and R^2 are not both –H.

2. Compound according to Claim 1,

where R^2, R^3, R^4, R^5, ~~R^6~~, R^7, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{16}, R^{18}, R^{19}, R^{20}, R^{21}, R^{24} are selected from: -H, -alkyl.

3. Compound according to either of Claims 1 and 2,

where R^4 and R^5 are -H.

4. Compound according to any of Claims 1 to 3,
where R^3 is~~and R^6 are~~ -alkyl.

5. Compound according to any of Claims 1 to 4,
where R^{11} is -O-alkyl.

6. Compound according to any of Claims 1 to 5,
where R^{13} is -alkyl.

7. Compound according to any of Claims 1 to 6,
where R^{19} is -alkyl.

8. Electrochemical process for preparing biphenols, comprising the process steps of:
a) introducing a solvent or solvent mixture and a conductive salt into a reaction vessel,
b) adding a first phenol having an oxidation potential $|E_{Ox}1|$ to the reaction vessel,
c) adding a second phenol having an oxidation potential $|E_{Ox}2|$ to the reaction vessel, where: $|E_{Ox}2| > |E_{Ox}1|$ and $|E_{Ox}2| - |E_{Ox}1| = |\Delta E|$,
the second phenol being added in excess relative to the first phenol,
and the solvent or solvent mixture being selected such that $|\Delta E|$ is in the range from 10 mV to 450 mV,
d) introducing two electrodes into the reaction solution,
e) applying a voltage to the electrodes,
f) coupling the first phenol to the second phenol to give a biphenol.

9. Process according to Claim 8,
wherein the second phenol is used at least in twice the amount relative to the first phenol.

10. Process according to either of Claims 8 and 9,
wherein the ratio of first phenol to the second phenol is in the range from 1:2 to 1:4.

11. Process according to any of Claims 8 to 10,
wherein either the first phenol the second phenol has an -O-alkyl group.

12. Process according to any of Claims 8 to 11,