Electrochemical synthesis of alkoxy-substituted phenols

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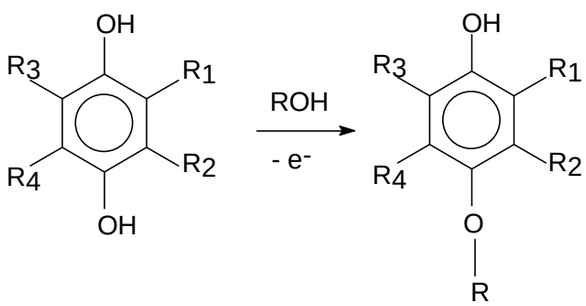
An electrochemical procedure for the synthesis of alkoxy-substituted phenols from hydroquinone (*p*-hydroxyphenol) and substituted hydroquinones will be presented. The procedure is simple and gives excellent yields and current efficiencies, and shows superior performance when compared to the conventional methods of synthesizing alkoxy-substituted phenols.

Alkoxy-substituted phenols are compounds that can be used as is, or as intermediates for the preparation of a wide range of chemical products that include polymerisation inhibitors, antioxidants, herbicides, flavors, fragrances and pharmaceuticals.

Monoethers of hydroquinone have been prepared by treating hydroquinone with alcohols in the presence of an heteropoly acid [(1)] or using a catalytic mixture of a strong acid and hydrogen peroxide [(2)]. The monoalkylation of dihydroxybenzenes is generally affected by the complex separation of mono-, di- and un-alkylated products, whilst the alkylating agents used, such as dialkylsulfates, are extremely carcinogenic and renders the reaction inherently hazardous.

The electrochemical conversion can be represented in its simplest form by the following scheme:



R_1, R_2, R_3 and R_4 can be hydrogen or alkyl, whilst R can be either a substituted or unsubstituted alkyl group.

The proposed electrochemical method can be performed in an undivided cell, consisting of an anode and cathode, to which constant current is supplied, and containing the substrate dissolved in a suitable solvent aswell as a supporting electrolyte. The process can readily be carried out efficiently in a flow cell arrangement.

The electrochemical mechanism for the reaction will be presented and experimental data for the synthesis of a variety of alkoxy-substituted phenols will be discussed.

(1) JP60215643 (1985)
(2) US4933504 (1990)