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(54) Benævnelse: **FREMGANGSMÅDE TIL FREMSTILLING AF SUBSTITUEREDE 2-ARYL-ETHANOLER**

(56) Fremdragne publikationer:
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Description

The present invention relates to a process for preparing substituted 2-arylethanols, and to novel substituted 2-arylethanols.

Substituted 2-arylethanols are important intermediates for the manufacture of bioactive compounds which can be used specifically for controlling pests in crop protection. In particular, they serve for the manufacture of insecticidal, acaricidal or herbicidal cyclic ketoenols (for example *EP-A-456 063, EP-A-521 334, EP-A-596 298, EP-A-613 884, EP-A-613 885, WO 95/01 971, WO 95/26 954, WO 95/20 572, EP-A-0 668 267, WO 96/25 395, WO 96/35 664, WO 97/01 535, WO 97/02 243, WO 97/36 868, WO 97/43275, WO 98/05638, WO 98/06721, WO 98/25928, WO 99/24437, WO 99/43649, WO 99/48869, WO 99/55673, WO 01/17972, WO 01/23354, WO 01/74770, WO 03/013249, WO 03/062244, WO 04/007448, WO 04/024 688, WO 04/065366, WO 04/080962, WO 04/111042, WO 05/044791, WO 05/044796, WO 05/048710, WO 05/049569, WO 05/066125, WO 05/092897, WO 06/000355, WO 06/029799, WO 06/056281, WO 06/056282, WO 06/089633, WO 07/048545, WO 07/073856, WO 07/096058, WO 07/121868, WO 07/140881, WO 08/067873, WO 08/067910, WO 08/067911, WO 08/138551, WO 09/015801, WO 09/039975, WO 09/049851, WO 09/115262, WO 10/052161, WO 10/102758, WO 10/063378, WO 10/063670, WO 10/102758, WO 11/098443, WO 11/098440, WO 11/067135, WO 11/067240, WO 12/110519*), where the substituted 2-arylethanols can be used to prepare the required substituted phenylacetic acids (*WO 2013/080896*).

A large number of methods for preparing substituted 2-arylethanols has already become known. One method often found in the literature consists in reducing substituted phenylacetic acid esters with a complex hydride such as, for example, lithium aluminium hydride (see for example *WO 2011/123937*). Thus, the starting materials used here are precisely those compounds which can often only be obtained by complex methods and which should be easier to obtain direct from the substituted 2-arylethanols.

Furthermore, it is known to react a haloaromatic with acetylene or a mono-protected acetylene such as for example trimethylsilylacetylene or 2-methylbut-3-yn-2-ol in a Sonogashira reaction with palladium catalysis to give the corresponding protected arylacetylene, to remove the protective group and then to subject the alkyne function to an anti-Markovnikov addition of water, for example catalyzed by ruthenium komplexes (*J. Amer. Chem. Soc.* ***136*** *(2014) 7058-67*). This method has the disadvantage of involving two transition-metal-catalysed steps, one of which uses the very expensive metal palladium.

A further known method consists in metallating a haloaromatic with butyllithium and then reacting it with ethylene oxide (see for example *Eur. J. Med. Chem.* ***25*** *(1990) 603-8*). This process has the disadvantage that the metallation with butyllithium generally has to be carried out at very low temperatures, for example -78°C, which can be realized industrially only in a complex and expensive manner and thus renders the process uneconomical.

A further known method consists in reacting a haloaromatic with magnesium to give the corresponding Grignard compound and then allowing this Grignard compound to react with ethylene oxide to give the substituted 2-arylethanol. This method has the disadvantage that under certain circumstances a mixture of the desired substituted 2-arylethanol and undesired substituted 1-arylethanol is obtained (see comparative experiments), as a result of which complex purification operations are necessary and the yield is unsatisfactory.

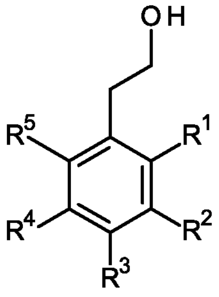
Although it has already been described that the rate of the reaction of Grignard compounds with oxiranes, including ethylene oxide, can be increased by adding copper compounds such as copper iodide (see for example *Tetrahedron Letters* ***1978,*** *4069-72*; *Tetrahedron Letters* ***1979,*** *1503-6*; *Org. Biomol. Chem.* ***2010,*** *3552-62*), there has hitherto been no indication made known that the selectivity can also be improved in the desired way.

It is likewise known that 2-arylethanols are obtained by reacting an aryl-Grignard compound with 2-bromoethanol, likewise in the presence of a catalytic amount of copper(I) bromide (*Tetrahedron Letters* ***1977,*** *3263-66*). In this connection, it is very disadvantageous that the Grignard compound is used in a very high excess of 3 mol equivalents, as a result of which this process becomes uneconomical.

Accordingly, there continues to be a high requirement for an improved process for preparing substituted 2-arylethanols.

It has now been found that in the reaction of Grignard compounds with ethylene oxide the formation of undesired 1-arylethanols can surprisingly be suppressed by adding catalytic amounts of copper salts.

The present invention therefore involves a novel process for preparing substituted 2-arylethanols of the formula (I)



(I) ,

in which

R^1 is methyl,

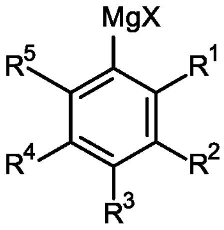
R^2 is hydrogen,

R^3 is chlorine,

R^4 is hydrogen,

R^5 is methyl,

characterized in that a Grignard compound of the formula (II)



(II) ,

in which the radicals R^1 to R^5 have the definitions specified above and

X is chlorine, bromine or iodine (preferably bromine or iodine, particularly preferably bromine),

is reacted with ethylene oxide in the presence of a copper compound, wherein the copper compound used is copper(I) iodide, copper(I) bromide, copper(II) bromide or copper(I) chloride.

The compound of the formula (II) is also intended to include the other forms of the Schlenk equilibrium known to the person skilled in the art, with and without complexation of solvent molecules.

Emphasis is given to the preparation of 2-(4-chloro-2,6-dimethylphenyl)ethanol.

The preparation of the Grignard compounds of the formula (II) takes place by generally known methods of organic chemistry from the corresponding substituted aryl halide and magnesium. The aryl halides that can be used here are the chloro-, bromo- or iodoaromatics. Preference is given to using the bromo- and iodoaromatics, particularly preferably the bromoaromatics.

Suitable solvents for the preparation of the Grignard compounds of the formula (II) are for example open-chain and cyclic ethers such as, for example, diethyl ether, methyl tertiary-butyl ether, tertiary-amyl methyl ether, tetrahydrofuran, 2-methyltetrahydrofuran, 2,5-dimethyltetrahydrofuran, methyl cyclopentyl ether or 1,4-dioxane; aromatic hydrocarbons such as toluene, xylenes or mesitylene; mixtures of these solvents. Preference is given to working in cyclic ethers or in mixtures of cyclic ethers with aromatic hydrocarbons.

The temperature during the preparation of the Grignard compounds of the formula (II) can vary within wide limits. Preference is given to working at between 20°C and 100°C.

The magnesium is generally used in an excess based on the haloaromatics, usually 1.05 to 1.2 equivalents.

After the reaction of the haloaromatic with the magnesium has taken place, the not fully reacted excess magnesium can be removed by a filtration.

In the step according to the invention of the process, the Grignard compound of the formula (II) prepared as described above is reacted in the presence of a copper compound with ethylene oxide.

Suitable solvents for the step according to the invention of the process are the solvents that are used for the preparation of the Grignard compound of the formula (II): Open-chain and cyclic ethers such as diethyl ether, methyl tertiary-butyl ether, tertiary-amyl methyl ether, tetrahydrofuran, 2-methyltetrahydrofuran, 2,5-dimethyltetrahydrofuran, methyl cyclopentyl ether or 1,4-dioxane; aromatic hydrocarbons such as toluene, xylenes or mesitylene; mixtures of these solvents. Preference is given to working in cyclic ethers or in mixtures of cyclic ethers with aromatic hydrocarbons. Particular preference is given to tetrahydrofuran, 2-

methyltetrahydrofuran, methyl cyclopentyl ether, mixtures of these ethers and mixtures of these ethers with toluene.

The copper compounds used in the step according to the invention of the process are copper(I) or copper(II) compounds. By way of example, mention may be made of copper(I) iodide, copper(I) bromide, copper(I) chloride, copper(I) oxide, copper(II) bromide, copper(II) chloride, copper(II) oxide, copper(II) sulphate, copper(II) nitrate, copper(II) acetate. Preference is given to using copper(I) iodide, copper(I) bromide, copper(II) bromide and copper(I) chloride, particularly preferably copper(I) iodide, copper(I) bromide and copper(II) bromide.

The amount of copper compound in the step according to the invention of the process can be varied within wide limits. Preference is given to using the smallest amount of copper compound necessary to bring about the desired effect. Preference is given to using 0.1 to 50 mol per cent, based on the Grignard compound of the formula (II); particularly preferably 0.5 to 15 mol per cent.

The amount of ethylene oxide in the step according to the invention of the process can likewise be varied within wide limits. Preference is given to using between 0.9 and 3 mol equivalents of ethylene oxide, based on the Grignard compound of the formula (II). Particular preference is given to using between 1 and 2 mol equivalents of ethylene oxide.

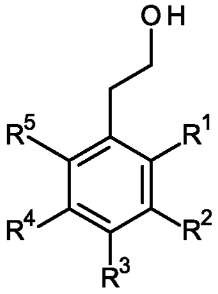
The ethylene oxide can either be introduced as a gas into the solution of the Grignard compound of the formula (II), or the ethylene oxide is metered in as a solution. Suitable solvents here are preferably those solvents that have been used in the preparation of the Grignard compound of the formula (II).

The reaction temperature in the step according to the invention of the process is between -30 and + 100°C. Preferably, it is between 0 and 80°C, particularly preferably between +10 and +50°C.

The reaction in the step according to the invention of the process can in principle also be carried out under reduced or increased pressure. Preference is given to working at atmospheric pressure.

The work-up of the reaction mixtures takes place by customary and known methods of organic chemistry.

The following substituted 2-arylethanols of the formula (I) are mentioned



(I) ,

in which the radicals R^1, R^2, R^3, R^4, R^5 have the definitions given in **Table 1.**

Table 1

Compound	R^1	R^2	R^3	R^4	R^5
I-1	Me	H	Cl	H	Me
I-2	Me	H	Cl	H	Et
I-3	Et	H	Cl	H	Et
I-4	Me	H	Cl	H	*n*-Pr
I-5	Et	H	Cl	H	*n*-Pr
I-6	*n*-Pr	H	Cl	H	*n*-Pr
I-7	Me	H	Cl	H	*iso*-Pr
I-8	Et	H	Cl	H	*iso*-Pr
I-9	*iso*-Pr	H	Cl	H	*iso*-Pr
I-10	*iso*-Pr	H	Cl	H	*n*-Pr
I-11	Me	H	F	H	Me

I-12	Me	H	F	H	Et
I-13	Et	H	F	H	Et
I-14	Me	H	CF_3	H	Me
I-15	Me	H	CF_3	H	Et
I-16	Et	H	CF_3	H	Et
I-17	Me	H	OCF_3	H	Me
I-18	Me	H	Me	H	Et
I-19	Me	H	Et	H	Et
I-20	Me	H	Et	H	Me
I-21	Me	Cl	H	H	Me
I-22	Et	Cl	H	H	Me
I-23	Et	H	H	Cl	Me

Me = Methyl, Et = Ethyl, *n*-Pr = *n*-Propyl, *iso*-Pr = *iso*-Propyl

Particular preference is given to substituted 2-arylethanols of the formula (I) in which the radicals R^1, R^2, R^3, R^4, R^5 have the definitions given in **Table 2.**

Table 2

Compound	R^1	R^2	R^3	R^4	R^5
I-1	Me	H	Cl	H	Me
I-2	Me	H	Cl	H	Et
I-3	Et	H	Cl	H	Et
I-4	Me	H	Cl	H	*n*-Pr
I-5	Et	H	Cl	H	*n*-Pr
I-6	*n*-Pr	H	Cl	H	*n*-Pr
I-11	Me	H	F	H	Me
I-12	Me	H	F	H	Et
I-13	Et	H	F	H	Et
I-18	Me	H	Me	H	Et
I-19	Me	H	Et	H	Et
I-20	Me	H	Et	H	Me
I-21	Me	Cl	H	H	Me
I-22	Et	Cl	H	H	Me
I-23	Et	H	H	Cl	Me

Very particular preference is given to substituted 2-arylethanols of the formula (I) in which the radicals R^1, R^2, R^3, R^4, R^5 have the definitions given in **Table 3.**

Table 3

Compound	R^1	R^2	R^3	R^4	R^5
I-1	Me	H	Cl	H	Me
I-2	Me	H	Cl	H	Et
I-3	Et	H	Cl	H	Et
I-11	Me	H	F	H	Me
I-12	Me	H	F	H	Et
I-13	Et	H	F	H	Et
I-18	Me	H	Me	H	Et
I-19	Me	H	Et	H	Et
I-20	Me	H	Et	H	Me
I-21	Me	Cl	H	H	Me

Over and above this, preference is given to the following compound:

2-(4-chloro-2,6-dimethylphenyl)ethanol (compound I-1).

The oxidation of the substituted 2-arylethanols of the formula (I) to the substituted phenylacetic acids required as building blocks for example for insecticidal or herbicidal cyclic ketoenols can take place by methods of organic chemistry known in principle. By way of example, mention may be made of the oxidation with potassium permanganate or the Zhao-Anelli oxidation with 2,2,6,6-tetramethylpiperidinyloxyl, sodium hypochlorite and sodium chlorite (Organic Syntheses, 81, 195-203; 2005).

The present invention will be illustrated in more detail by the examples below.

Examples

Example 1: 2-(4-Chloro-2,6-dimethylphenyl)ethanol (compound I-1)

To a solution of bromo(4-chloro-2,6-dimethylphenyl)magnesium, prepared at 30 - 35°C from 50 mmol of 4-chloro-2,6-dimethylbromobenzene, 1 mmol of bromo(4-chloro-2,6-dimethylphenyl)magnesium (to start the Grignard synthesis) and 55.5 mmol of magnesium in 50 ml of tetrahydrofuran, were added 5 mmol of copper(I) iodide. Then, 48 ml of a 2.5 - 3.3 molar solution of ethylene oxide in tetrahydrofuran (120 mmol, calculated for a concentration of 2.5 M) were metered in at 20°C over the course of 30 minutes. After 16 hours at 20°C, the reaction mixture was placed on 100 g of ice and adjusted to pH 1 with sulphuric acid. After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was > 99:1.

GC/MS: m/e = 184 (M^+ (^{35}Cl), 25%), 153 (^{35}Cl, 100%).

^1H-NMR (600 MHz, d-DSMO): δ = 2,28 (s, 6H), 2,75 (m, 2H), 3,45 (m, 2H), 4,74 (m, 1H), 7,0 (s, 2H)ppm.

Example 2: 2-(4-Chloro-2,6-dimethylphenyl)ethanol (compound I-1)

To a solution of bromo(4-chloro-2,6-dimethylphenyl)magnesium, prepared at 30 - 35°C from 10 mmol of 4-chloro-2,6-dimethylbromobenzene, 1 mmol of bromo(4-chloro-2,6-dimethylphenyl)magnesium (to start the Grignard synthesis) and 11.1 mmol of magnesium in 10 ml of tetrahydrofuran, were added 0.1 mmol of copper(I) iodide. Then, 9.6 ml of a 2.5 - 3.3 molar solution of ethylene oxide in tetrahydrofuran (24 mmol, calculated for a concentration of 2.5 M) were metered in at 20°C over the course of 30 minutes. After 16 hours at 20°C, the reaction mixture was placed on 100 g of ice and adjusted to pH 1 with sulphuric acid. After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was > 99:1.

Example 3: 2-(4-Chloro-2,6-dimethylphenyl)ethanol (compound I-1)

To a solution of bromo(4-chloro-2,6-dimethylphenyl)magnesium, prepared at 30 - 35°C from 10 mmol of 4-chloro-2,6-dimethylbromobenzene, 1 mmol of bromo(4-chloro-2,6-dimethylphenyl)magnesium (to start the Grignard synthesis) and 11.1 mmol of magnesium in 10 ml of tetrahydrofuran, were added 1 mmol of copper(I) iodide. Then, 9.6 ml of a 2.5 - 3.3 molar solution of ethylene oxide in tetrahydrofuran (24 mmol, calculated for a concentration of 2.5 M) were metered in at 50°C over the course of 30 minutes. After 16 hours at 50°C, the reaction mixture was placed on 100 g of ice and adjusted to pH 1 with sulphuric acid. After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was > 99:1.

Comparative example 1: 2-(4-Chloro-2,6-dimethylphenyl)ethanol

To a solution of bromo(4-chloro-2,6-dimethylphenyl)magnesium, prepared at 30 - 50°C from 10 mmol of 4-chloro-2,6-dimethylbromobenzene and 11.1 mmol of magnesium in 10 ml of tetrahydrofuran, were metered in 8.8 ml of a 2.5 - 3.3 molar solution of ethylene oxide in tetrahydrofuran (22 mmol, calculated for a concentration of 2.5 M) at 50°C over the course of 30 minutes. After 3 hours at 50°C, the reaction mixture was placed on 100 g of ice and adjusted to pH 1 with sulphuric acid. After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was 87:13.

Comparative example 2: 2-(4-Chloro-2,6-dimethylphenyl)ethanol

To a solution of bromo(4-chloro-2,6-dimethylphenyl)magnesium, prepared at 30 - 35°C from 10 mmol of 4-chloro-2,6-dimethylbromobenzene, 1 mmol of bromo(4-chloro-2,6-dimethylphenyl)magnesium (to start the Grignard synthesis) and 11.1 mmol of magnesium in 10 ml of tetrahydrofuran, were metered in 9.6 ml of a 2.5 - 3.3 molar solution of ethylene oxide in tetrahydrofuran (24 mmol, calculated for a concentration of 2.5 M) at 50°C over the course of 30 minutes. After 16 hours at 50°C, the reaction mixture was placed on 100 g of ice and adjusted to pH 1 with sulphuric acid. After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was 78:22.

Example 4: 2-(4-Chloro-2,6-dimethylphenyl)ethanol (compound I-1)

To a solution of 20 mmol of bromo(4-chloro-2,6-dimethylphenyl)magnesium in 20 ml tetrahydrofuran were added 2 mmol of copper(I) bromide. Then, 16 ml of a 2.5 - 3.3 molar solution of ethylene oxide in tetrahydrofuran (40 mmol, calculated for a concentration of 2.5 M) were metered in at 20°C over the course of 30 minutes. After 16 hours at 20°C, the reaction mixture was placed on 100 g of ice and adjusted to pH 1 with sulphuric acid. After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was > 99:1.

Example 5: 2-(4-Chloro-2,6-dimethylphenyl)ethanol (compound I-1)

The procedure was as in Example 4 but now using 1 mmol of copper(II) bromide instead of Cu(I)Br. The ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was > 99:1.

Example 6: 2-(4-Chloro-2,6-dimethylphenyl)ethanol (compound I-1)

The procedure was as in Example 4 but now using 1 mmol of copper(I) chloride instead of Cu(I)Br. The ratio of 2-(4-chloro-2,6-dimethylphenyl)ethanol to 1-(4-chloro-2,6-dimethylphenyl)ethanol was > 99:1.

Example 7: 2-(2,6-Dimethylphenyl)ethanol not according to the invention

To a solution of 2,6-dimethylphenylmagnesium, prepared at 30 - 35°C from 20 mmol of 2,6-dimethylbromobenzene and 22.2 mmol of magnesium in 10 ml of tetrahydrofuran, were added 0.2 mmol of copper(I) iodide. Then, 8.8 ml of a 2.5 - 3.3 molar solution of ethylene oxide in tetrahydrofuran (22 mmol, calculated for a concentration of 2.5 M) were metered in at 20°C over the course of 30 minutes. After 16 hours at 20°C, the reaction mixture was placed on 100 g of ice and adjusted to pH 1 with sulphuric acid.

After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(2,6-dimethylphenyl)ethanol to 1-(2,6-dimethylphenyl)ethanol was 97.5:2.5.

Comparative example 3: 2-(2,6-Dimethylphenyl)ethanol

Into a solution of 2,6-dimethylphenylmagnesium, prepared at 40 - 55°C, towards the end for a few minutes at 65°C, from 200 mmol of 2,6-dimethylbromobenzene and 222 mmol of magnesium in 100 ml of tetrahydrofuran, were introduced 215 mmol of ethylene oxide at 30 - 35°C over the course of about 2 hours. After 3 hours at 60°C, the reaction mixture was placed on 200 g of ice and adjusted to pH 1 with sulphuric acid. After triple extraction with in each case 50 ml of methylene chloride, the combined organic phases were extracted once by shaking with 30 ml of water, dried over magnesium sulphate and concentrated on a rotary evaporator. There remained an oil, in which, according to GC/MS analysis, the ratio of 2-(2,6-dimethylphenyl)ethanol to 1-(2,6-dimethylphenyl)ethanol was 81:19.

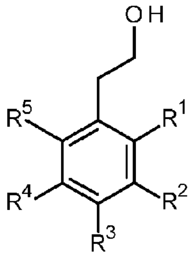
Use example 1: 4-Chloro-2,6-dimethylphenylacetic acid

To a solution of 5 g of 2-(4-chloro-2,6-dimethylphenyl)ethanol (24 mmol, purity 90%) in 20 g of acetonitrile were added 38 mg of 2,2,6,6-tetramethylpiperidinyloxyl (0.24 mmol) at room temperature. To this solution were added, at 45°C, 0.8 ml of 11.05% strength sodium hypochlorite solution and then 4.3 g of sodium chlorite (36 mmol), dissolved in 12.5g of a phosphate buffer (10.65 g of Na_2HPO_4 and 10.21 g of KH_2PO_4 per 1000 ml of water) were added dropwise over the course of one hour using a metering pump. When the addition was complete, the mixture was after-stirred for 30 min and cooled to 5-10°C and 3 g of sodium sulphite were added in portions. The reaction mixture was then after-stirred for one hour and adjusted to pH 13.5 with 45%

strength sodium hydroxide solution and the resulting suspension was extracted twice with in each case 25 ml of MTBE. The aqueous phase was adjusted to pH 3.38 with 10% strength hydrochloric acid and extracted three times with in each case 30 ml of MTBE. The combined organic phases of the acid extraction were dried and concentrated. This gave 4.3 g of product (87% of theory; purity 98% according to HPLC and quant. NMR).

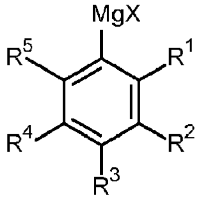
Patentkrav

1. Fremgangsmåde til fremstilling af forbindelser med formel (I)



(I) ,

hvor
R^1 står for methyl,
R^2 står for hydrogen,
R^3 står for chlor,
R^4 står for hydrogen,
R^5 står for methyl,
kendetegnet ved, at en forbindelse med formel (II)



(II) ,

hvor grupperne R^1 til R^5 har de ovenfor nævnte betegnelser, og X står for chlor, brom eller iod,
omsættes med ethylenoxid i nærvær af en kobberforbindelse, idet der som kobberforbindelse anvendes kobber(I)-iodid, kobber(I)-bromid, kobber(II)-bromid eller kobber(I)-chlorid.

2. Fremgangsmåde til fremstilling af forbindelser med formel (I) ifølge krav 1, kendetegnet ved, at kobberforbindelsen anvendes i mængder på 0,1 til 50 molprocent baseret på forbindelsen med formel (II).

3. Fremgangsmåde til fremstilling af forbindelser med formel (I) ifølge krav 1, kendetegnet ved, at kobberforbindelsen anvendes i mængder på 0,5 til 15 molprocent baseret på forbindelsen med formel (II).

4. Fremgangsmåde til fremstilling af forbindelser med formel (I) ifølge krav 1, kendetegnet ved, at ethylenoxid anvendes i mængder mellem 0,9 og 3 molækvivalenter baseret på forbindelsen med formel (II).

5. Fremgangsmåde til fremstilling af forbindelser med formel (I) ifølge krav 1, kendetegnet ved, at ethylenoxid anvendes i mængder mellem 1 og 2 molækvivalenter baseret på forbindelsen med formel (II).