

1.170.098



PATENT SPECIFICATION

NO DRAWINGS

1.170.098

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COMPLETE SPECIFICATION

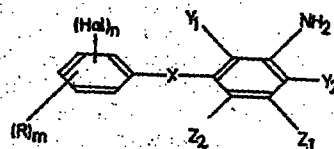
New 1,2-Nitranilines and their production

We, AGRIPAT S.A. a body corporate organised according to the laws of Switzerland of 215, Schwarzwaldallee, Basle, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention concerns a new process for the production of halogenated 1,2-nitraniline, as well as the new compounds obtained by this process.

It is known that 4-phenoxy-2-nitraniline can be produced from phenol and p-chloronitrobenzene in a 5-step process [cf. M. Oesterlin, Monatshefte 57, 31—44 (1941) and H. A. Scarborough, J. Chem. Soc. 1929, p. 2361—2367]. McCombie et al, J. Chem. Soc. 1931, p. 529—537, also describes halogenations of nitro-, amino- and acetamido-diphenyl ethers which, however, only lead to compounds monohalogenated in the phenoxy radical or to tar products. It is also known, on the one hand, that aromatic nitro compounds react with aromatic primary amines on being heated in an alkaline medium, azoxy and azo compounds being formed, and on the other hand, that halogenated nitrobenzenes react with aromatic primary amines to form diphenylamines. Phenoxy- and phenylthio-1,2-nitranilines which are mono- or poly-halogenated in the aniline nucleus have not been described hitherto and their production by the methods described by McCombie et al [J. Chem. Soc. 1931, page 529—537] presents several difficulties.

It has now been found that very pure halogenated 1,2-nitranilines of the general formula I



(I)

wherein one of the symbols Y_1 and Y_2 represents the nitro group and the other represents hydrogen or halogen, Z_1 and Z_2 each represent hydrogen or halogen,

Hal represents halogen, particularly chlorine or bromine,

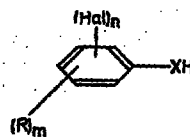
R represents the trifluoromethyl radical or methoxy radical,

X represents oxygen or sulphur,

n represents 0, 1, 2 or 3, and

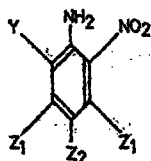
m represents 0, 1 or 2,

whereby at least one of the symbols Z_1 , Z_2 , Y_1 and Y_2 must be halogen, can be produced in good yields by reacting a phenol or thiophenol of the general formula II



(II)

wherein Hal, R, X, n and m have the meanings given in formula I, at a temperature ranging between 100 and 200°C in the presence of a strong inorganic base, with a halogen-2-nitraniline of the general formula II



(III)

wherein one of the two Z_1 represents halogen, the other Z_1 and Z_2 and Y represent hydrogen or halogen, whereby at least the last-mentioned Z_1 or Z_2 or Y must be halogen.

As is generally known and apparent from the above, when aromatic amines are reacted with halogenated, aromatic nitro compounds substituted by an additional amino group, said additional amino group must be protected by acylation in order to prevent the formation of diphenylamines and condensation products of the aromatic nitro compounds. It was, therefore, extraordinarily surprising, on the one hand, that the amino group of the halogen-2-nitraniline did not have to be protected by acylation for the reaction with phenols or thiophenols in the presence of strong inorganic bases, and, on the other hand, when using such halogen-2-nitranilines, phenoxy- or phenylthio-2-nitranilines are obtained in yields of 70—95% due to the halogen-2-nitranilines not condensing among each other or only so to a limited extent whilst usually in reactions with halogenated acylamino nitranilines, yields of 10—30% are attained.

In the reaction products of the general formula I the nitro group can be reduced to the amino group by methods known per se, e.g. with catalytically activated hydrogen in the presence of metal catalysts such as Raney nickel or palladium with nascent hydrogen by means of base metals and acids or with stannous salts in acid solution. In this way, corresponding 1,2-phenylenediamines are obtained which, like the 1,2-nitranilines produced according to the invention, are valuable intermediary products.

Preferably the reduction of the nitro group is performed by Béchamp's method, i.e. with pulverised iron in weakly acid to neutral aqueous solution.

The process according to the invention is carried out at temperatures ranging between 100 and 200°C, and it is of advantage to add the inorganic base as concentrated aqueous solution. The principal bases are the hydroxides of alkali and alkaline earth metals. The condensation can be accelerated by the addition of catalysts such as copper.

The halogenated 1,2-nitranilines to be prepared according to the invention are valuable intermediate products for the production of pharmaceuticals, pest control agents, optical brighteners and dyestuffs. For example, 1,2-

phenylenediamines prepared therefrom may be used for the production of blue fluorescent bis - benzimidazol - 2 - yl - ethylenes which, as valuable optical brighteners, have become of industrial importance. On condensing 1,2-phenylenediamines with 1,4,5,8-naphthalene tetracarboxylic acid, valuable vat dyestuffs may be obtained. 1,2-Nitranilines are valuable diazo components for the production of ice dispersion and pigment dyestuffs.

The following examples serve to illustrate the process according to the invention. Parts are given therein as parts by weight and the temperatures are in degrees Centigrade.

EXAMPLE 1

48.2 Parts of 2 - nitro - 3,4,6 - trichloro - aniline are added to 18.82 parts of melted phenol at 90° and the whole is heated to 130°. At this temperature, 11.2 parts of aqueous 50% potassium hydroxide solution are added dropwise within 1 hour. The water is continuously distilled from the mixture. The reaction mixture is then heated for 6 hours at 140°—150° while being stirred whereupon it is cooled to 100° and 300 parts by volume of boiling water are added. The solution is then stirred for 3 hours and afterwards left to stand for 12 hours. 1500 Parts by volume of water are then added to the reaction mixture, then 50 parts by volume of 30% aqueous sodium hydroxide solution are added and finally it is stirred for 2 hours. The precipitate formed is filtered off under suction, washed several times with water and dried in vacuo over solid NaOH. (Yield of crude product 65 parts = 93.2% of the theoretical, M.P. 113—155°). After recrystallization from ethanol, 2 - nitro - 3 - phenoxy - 4,6 - dichloro - aniline melts at 133—135°. The yield of pure product is 41.5 parts (69.4% of the theoretical).

EXAMPLE 2

48.2 parts of 2 - nitro - 3,4,6 - trichloro - aniline are added to 29.4 parts of melted 4-chlorothiophenol at 100° and the whole is heated to 130°. 11.2 Parts of aqueous 50% potassium hydroxide solution are then added dropwise to the melt within 1 hour. The theoretical amount of water is distilled off within 5 hours at a temperature of 130—145°. The melt is then stirred for another 4 hours at 145°, then cooled to 100° and 200 parts by volume of hot water are added. The mixture is then left to stand for 12 hours at room temperature. 1000 Parts by volume of water and 50 parts by volume of 30% aqueous sodium hydroxide solution are then added and the whole is stirred for 2 hours at room temperature. The crystalline precipitate is isolated, washed several times with water and dried in the air. Yield of crude product: 65 parts (93.2% of the theoretical), M.P. 113—115°. Recrystallised from ethanol,

2 - nitro - 3 - (4' - chlorophenylthio) - 4,6 - dichloroaniline melts at 119—120°. The yield of pure product is 49.5 parts = 71% of the theoretical.

5 The compound so obtained can be reduced to the corresponding 1,2-phenylenediamine derivative as follows:

14 Parts by volume of 80% acetic acid are added to 66 parts of iron powder in 350 parts by volume of water and the mixture is heated for 15 minutes at 90—100°. 69.8 Parts of 2 - nitro - 3 - (4' - chlorophenylthio) - 4,6 - dichloroaniline are then added in portions within 2 hours at the same temperature and the reaction mixture is refluxed for 18 hours. The reaction is carefully made alkaline to phenolphthalein with 18 parts of sodium carbonate, the reaction mixture is cooled to 80° and, at this temperature, 400 parts by volume of chlorobenzene are added. After stirring for a short time, it is filtered hot. The residue is washed with a little hot chlorobenzene. The chlorobenzene phase is separated in a separating funnel, washed with water, dried over sodium sulphate and then evaporated to dryness under water jet vacuum. Recrystallised from benzene, the obtained 4,6 - dichloro - 3 - (4' - chlorophenylthio) - 1,2 - phenylenediamine melts at 116—117° (yield: 48.2 parts = 75.5% of the theoretical).

EXAMPLE 3

120.5 Parts of 2 - nitro - 3,4,6 - trichloroaniline and 64.25 parts of p-chlorophenol are heated in a sulphonating flask on an oil bath to 140° and 56 parts of aqueous 50% potassium hydroxide solution are added dropwise within 40 minutes. The whole is then heated for 12 hours at an oil bath temperature of 160° whereupon, in all, 36 parts by volume of water are removed as condensate. The reaction mixture is then cooled to 100° and stirred for 2 hours in 4000 parts by volume of water and 100 parts of 30% aqueous sodium hydroxide solution. The precipitate formed is filtered off and dried in the air. (Yield of crude product: 153 parts (91% of the theoretical), M.P. 118—121°). Recrystallisation of the crude product from 1300 parts by volume of ethanol yields 110 parts (66.2% of the theoretical) of pure 2 - nitro - 3 - (4' - chloro - phenoxy) - 4,6 - dichloro - aniline, M.P. 125—127°.

As a comparison, the production of 2 - nitro - 3 - (4' - chloro - phenoxy) - 4,6 - dichloroaniline by the hitherto usual methods is described in examples 4 to 5, starting from 2 - acetyl amino - 3,4,6 - trichloro - nitrobenzene and p-chlorophenol and using 1 or 2 equivalents of potassium hydroxide.

EXAMPLE 4

56.7 Parts of 2 - acetyl amino - 3,5,6 - trichloro - nitrobenzene and 25.7 parts of p-chlorophenol are heated in an oil bath to

135° whereupon a melt is formed. At an oil bath temperature of 140—170° and an inner temperature of 135—160°, 22.4 parts of an aqueous 50% potassium hydroxide solution (1 equivalent) are added dropwise within 40 minutes, the water being continuously distilled off.

The reaction mixture is left to stand for 12 hours at an oil bath temperature of 160° and then cooled to 100° and the oil formed is poured into 1000 parts by volume of water and 200 parts by volume of 1N sodium hydroxide solution. The semi-solid product which precipitates is filtered off, treated with 2N sodium hydroxide solution, again filtered and well washed with water. The yield of this crude product is 42 parts (56% of the theoretical). 6.3 g of a product melting at 185—188° can be isolated from 500 parts by volume of ethanol. This product corresponds neither to the expected 2 - nitro - 3 - (4' - chlorophenoxy) - 4,6 - dichloroacetaniline nor to the saponified free 2 - nitro - 3 - (4' - chlorophenoxy) - 4,6 - dichloroaniline. 7.5 Parts (11.2% of the theoretical) of 2 - nitro - 3 - (4' - chlorophenoxy) - 4,6 - dichloro - aniline can be isolated by concentrating the mother lye, (M.P. of the pure product 126—128°). Another fractional distillation yields only semi-solid products which cannot be further identified.

EXAMPLE 5

56.7 Parts of 2 - acetyl amino - 3,5,6 - trichloro - nitrobenzene and 25.7 parts of p-chlorophenol in a sulphonating flask are heated in an oil bath at 150°. 44.8 Parts of aqueous, 50% potassium hydroxide solution (2 equivalents) are added dropwise within 40 minutes to the melt formed, the water being continuously distilled off. The whole is left to stand for 12 hours at an oil bath temperature of 160°, then cooled to 100° and the reaction product formed is poured into 2000 parts by volume of water and 200 parts by volume of 1N sodium hydroxide solution. The mixture is then stirred for 30 minutes and the precipitate formed is filtered off under suction. The crude product is recrystallised from 800 parts by volume of ethanol. The yield of 2 - nitro - 3 - (4' - chlorophenoxy) - 4,6 - dichloroaniline is 20.7 parts (31.2% of the theoretical). It melts at 125—127°.

It can be seen from examples 3 to 5 that considerably higher yields are obtained by the process according to the invention (example 3) than by the known methods.

The phenoxy- or phenylthio-2-nitranilines given in the Table below are obtained by the processes described in examples 1, 2 and 3 from equivalent amounts of correspondingly substituted halogen-2-nitranilines and phenols or thiophenols. These products can be reduced to form the corresponding 2-phenylenediamines.

TABLE

	Nitraniline	M.P. °C	Phenylendiamine	M.P. °C
1.		133—135°		85—87°
2.		127—129°		99—97°
3.		137—139°		82—84°
4.		131—133°		Oil
5.		134—135°		115—117°
6.		92—94		105—107°
7.		138—140°		117—120°

TABLE (Continued)

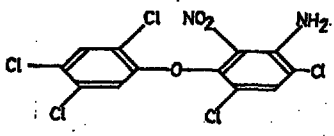
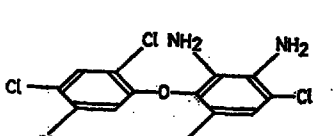
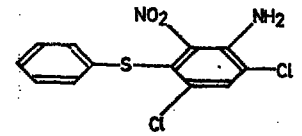
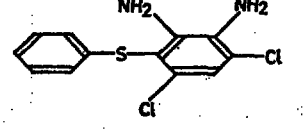
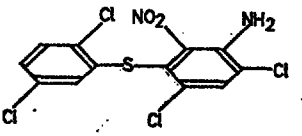
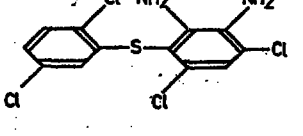
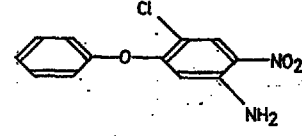
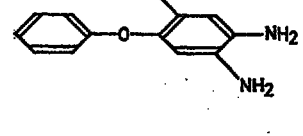
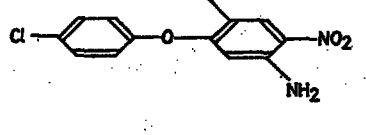
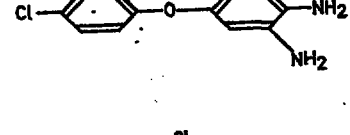
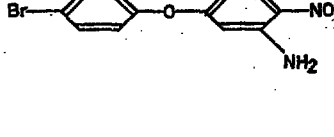
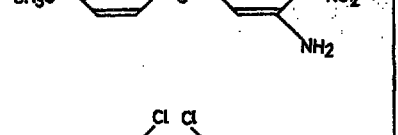
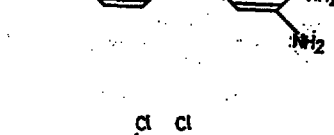
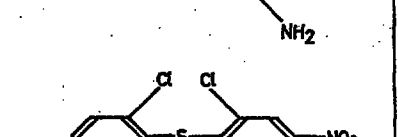
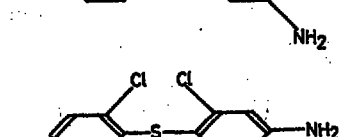
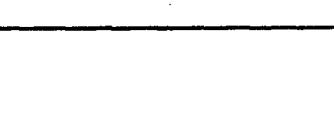
8.		149—151°		143—145°
9.		157—159°		Oil
10.		165—167°		166—168°
11.		136—138°		92—94°
12.		218—220°		136—137°
13.		234—236°		141—143°
14.		164—166°		79—80°
15.		190—192°		Oil
16.		200—202°		160—162°

TABLE (Continued)

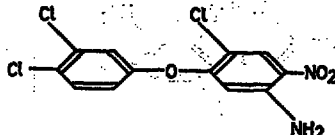
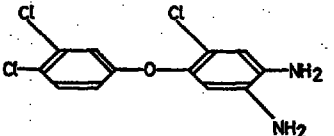
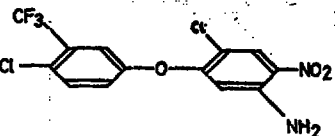
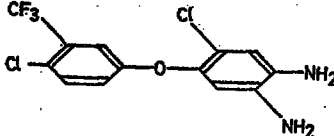
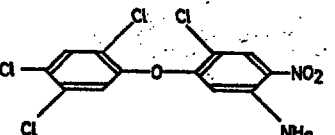
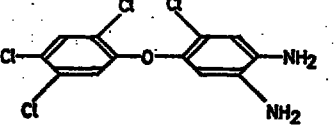
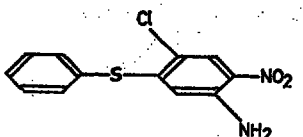
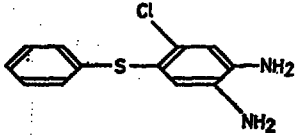
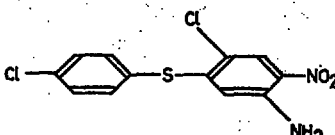
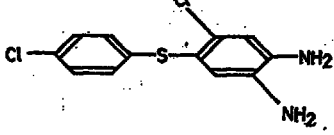
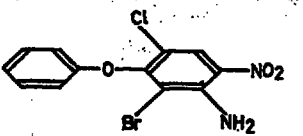
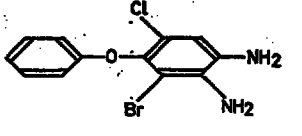
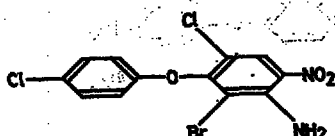
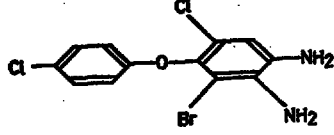
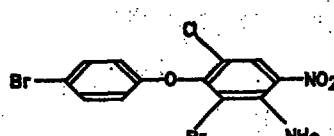
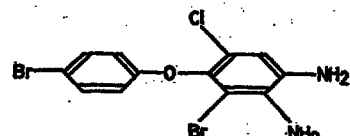
17.		182—184°		95—97°
18.		160—162°		99—101°
19.		180—182°		135—137°
20.		145—148°		77—79°
21.		191—193°		121—122°
22.		168—170°		127—129°
23.		152—153°		156—157,5°
24.		150—152°		182—184°

TABLE (Continued)

25.		157—159°		120—122°
26.		165—167°		130—132°
27.		213—215°		133—135°
28.		129—131°		145—148°
29.		154—156°		107—110°
30.		157—158°		143—144°
31.		155—158°		164—165°
32.		157—158°		Oil
33.		177—179°		126—128°

In the reaction according to the invention of 2-nitro-3,4,5-trihalogeno-anilines of the general formula III with phenols or thiophenols of the general formula II, isomeric 1,2-nitranilines of the general formula I or mixtures of isomers of these 1,2-nitranilines are obtained depending upon whether only one or both of the halogen atoms in the 3- and 5-position react.

The following compounds of general formula I for example are obtained from equivalent amounts of correspondingly substituted phenols or thiophenols and 2-nitro-3,4,5-trichloro-anilines. In these compounds the figures in brackets show the position of the substituents of the isomer.

2-nitro-3,4(4,5)-dichloro-5(3)-(4'-chlorophenoxy)-aniline, M.P. 190—192°C,

2-nitro-3,4(4,5)-dichloro-5(3)-(2',4'-dichlorophenoxy)-aniline, oil (mixture of isomers),

2-nitro-3,4(4,5)-dichloro-5(3)-(3',4'-dichlorophenoxy)-aniline, M.P. 170—173°C,

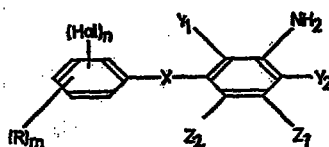
2-nitro-3,4(4,5)-dichloro-5(3)-phenylthio-aniline, oil (mixture of isomers),

2-nitro-3,4(4,5)-dichloro-5(3)-(4'-chlorophenylthio)-aniline, M.P. 131—133°C and

2-nitro-3,4(4,5)-dichloro-5(3)-(3',4'-dichlorophenylthio)-aniline, M.P. 147—150°C.

WHAT WE CLAIM IS:—

1. Process for the production of halogenated 1,2-nitranilines of the general formula I



(I)

wherein one of Y₁ and Y₂ represents the nitro group and the other represents hydrogen or halogen,

Z₁ and Z₂ each represents hydrogen or halogen,

Hal represents halogen, particularly chlorine and bromine,

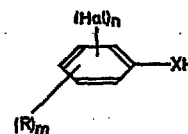
R represents the trifluoromethyl or the methoxy radical,

X represents oxygen or sulphur

n represents 0, 1, 2 or 3,

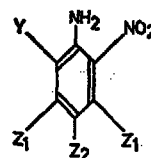
m represents 0, 1 or 2,

whereby at least one of the symbols Z₁, Z₂, Y₁ or Y₂ must be halogen, which comprises reacting a phenol or thiophenol of the general formula II



(II)

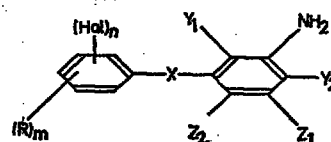
wherein Hal, R, X, n and m have the meanings given above, at a temperature ranging between 100 and 200°C and in the presence of a strong inorganic base, with a halogen-2-nitraniline of the general formula III



(III)

wherein one of the two Z₁ represents halogen, the other Z₁ and also Z₂ and Y represent hydrogen or halogen, whereby at least one of the last-mentioned Z₁ or Z₂ or Y must be halogen.

2. 1,2-Nitranilines of the general formula



whereby one of Y₁ and Y₂ represents the nitro group, the other represents hydrogen or halogen,

Z₁ and Z₂ each represents hydrogen or halogen,

Hal represents halogen, particularly chlorine or bromine,

R represents the trifluoromethyl or the methoxy radical,

X represents oxygen or sulphur,

n represents 0, 1, 2 or 3 and

m represents a whole number from 0, 1 or 2,

whereby at least one of the symbols Z₁, Z₂, Y₁ or Y₂ must be halogen.

3. 1,2-nitroanilines as claimed in claim 2 as hereinbefore described in either of Examples 1 or 2.

4. 1,2-nitranilines as claimed in claim 2 substantially as hereinbefore described in Example 3 and the Table.

5. A process as claimed in claim 1 substantially as hereinbefore described in Example 1 or 2.

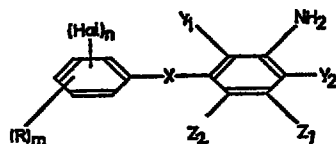
In the reaction according to the invention of 2-nitro-3,4,5-trihalogeno-anilines of the general formula III with phenols or thiophenols of the general formula II, isomeric 1,2-nitranilines of the general formula I or mixtures of isomers of these 1,2-nitranilines are obtained depending upon whether only one or both of the halogen atoms in the 3- and 5-position react.

- 10 The following compounds of general formula I for example are obtained from equivalent amounts of correspondingly substituted phenols or thiophenols and 2-nitro-3,4,5-trichloro-anilines. In these compounds the figures in brackets show the position of the substituents of the isomer.

- 2-nitro-3,4(4,5)-dichloro-5(3)-(4'-chlorophenoxy)-aniline, M.P. 190—192°C,
 20 2-nitro-3,4(4,5)-dichloro-5(3)-(2',4'-dichlorophenoxy)-aniline, oil (mixture of isomers),
 2-nitro-3,4(4,5)-dichloro-5(3)-(3',4'-dichlorophenoxy)-aniline, M.P. 170—173°C,
 25 2-nitro-3,4(4,5)-dichloro-5(3)-phenylthio-aniline, oil (mixture of isomers),
 2-nitro-3,4(4,5)-dichloro-5(3)-(4'-chlorophenylthio)-aniline, M.P. 131—133°C and
 30 2-nitro-3,4(4,5)-dichloro-5(3)-(3',4'-dichlorophenylthio)-aniline, M.P. 147—150°C.

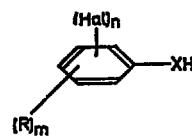
35 WHAT WE CLAIM IS:—

1. Process for the production of halogenated 1,2-nitranilines of the general formula I



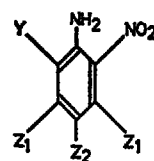
(I)

- wherein one of Y₁ and Y₂ represents the nitro group and the other represents hydrogen or halogen,
 40 Z₁ and Z₂ each represents hydrogen or halogen,
 Hal represents halogen, particularly chlorine and bromine,
 45 R represents the trifluoromethyl or the methoxy radical,
 X represents oxygen or sulphur
 n represents 0, 1, 2 or 3,
 50 n represents 0, 1 or 2,
 whereby at least one of the symbols Z₁, Z₂, Y₁ or Y₂ must be halogen, which comprises reacting a phenol or thiophenol of the general formula II



(II)

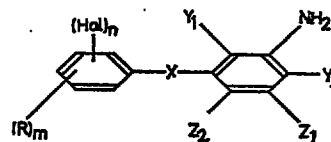
wherein Hal, R, X, n and m have the meanings given above, at a temperature ranging between 100 and 200°C and in the presence of a strong inorganic base, with a halogen-2-nitraniline of the general formula III



(III)

wherein one of the two Z₁ represents halogen, the other Z₁ and also Z₂ and Y represent hydrogen or halogen, whereby at least one of the last-mentioned Z₁ or Z₂ or Y must be halogen.

2. 1,2-Nitranilines of the general formula



whereby one of Y₁ and Y₂ represents the nitro group, the other represents hydrogen or halogen,

Z₁ and Z₂ each represents hydrogen or halogen,

Hal represents halogen, particularly chlorine or bromine,

R represents the trifluoromethyl or the methoxy radical,

X represents oxygen or sulphur,

n represents 0, 1, 2 or 3 and

m represents a whole number from 0, 1 or 2, whereby at least one of the symbols Z₁, Z₂, Y₁ or Y₂ must be halogen.

3. 1,2-nitroanilines as claimed in claim 2 as hereinbefore described in either of Examples 1 or 2.

4. 1,2-nitranilines as claimed in claim 2 substantially as hereinbefore described in Example 3 and the Table.

5. A process as claimed in claim 1 substantially as hereinbefore described in Example 1 or 2.



6. A process as claimed in claim 1 substantially as hereinbefore described in Example 3.

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