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2,948,753

N-BIS(p-DIALKYLAMINOPHENYL)METHYL SULFONAMIDES

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14 Claims. (Cl. 260—556)

This invention relates to compounds which are derivatives of bis(p-dialkylaminoaryl)methane in which nitrogen is linked to the methane carbon atom. It relates more particularly to compounds of said type having superior properties as compared to known compounds of said general class.

An object of the present invention is to provide novel derivatives of bis(p-dialkylaminoaryl)methane, and especially of bis(p-dimethylaminophenyl)methane, in which the methane carbon atom thereof is linked to the nitrogen atom of a nitrogen-containing radical having a beneficial effect upon the properties of said derivatives.

A further object of the present invention is to provide novel bis(p-dialkylaminoaryl) methyl derivatives of said type which are lightly colored or substantially colorless but which when contacted with acidic electron acceptors produce colored compositions.

Another object of the present invention is to provide novel compounds of said type having superior stability as compared to N-bis(p-dimethylaminophenyl)methyl aniline (also known as N-phenyl leucoauramine) and derivatives of the latter, when embodied in manifold record systems of the type disclosed in U.S. Patents 2,505,470 and 2,548,366, for example.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

It is known that derivatives of benzhydrol and such compounds as crystalline violet lactone, when dissolved in non-polar solvents, such as, benzene, toluene or chlorinated biphenyl, and brought into contact with acidic electron acceptors such as kaolin, bentonite, attapulgite, silica gel, feldspar, pyrophyllite, halloysite, magnesium trisilicate zinc sulphate, zinc sulfide, calcium fluoride, and calcium citrate, as well as organic acids such as tannic acid and benzoic acid, turn from colorless to a deep blue or violet shade.

Compounds which are derivatives of bis(p-dimethylaminophenyl)methane in which the nitrogen atom of a phenylamino radical replaces one of the methane hydrogen atoms, such as N-phenyl leucoauramine, i.e., N-bis(p-dimethylaminophenyl)methyl aniline, are known compounds which are colorless or substantially colorless, but which constitute color-reactants of the electron donor type since they turn blue on coming into absorptive contact with acidic electron acceptor materials such as acidic clays (for example, attapulgite, halloysite, kaolin and bentonite), as well as aluminum sulfate, zeolite material, silica gel, magnesium trisilicate, and zinc sulphide, among others. They have been proposed for use heretofore in solution in toluene or chlorinated biphenyl for printing in color on paper or other material coated or filled with such acidic materials. Thus, they have been proposed for use in so-called "colorless carbon papers," impact printing papers and duplicating manifold record systems, for example, of the type disclosed in U.S.P. 2,505,470, wherein a solution of the N-bis(p-dimethyl-

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aminophenyl)methyl aniline is provided in the form of discrete particles in conjunction with a solid insulating material including an organic hydrophilic film-forming material and an acidic clay which, upon pressure by a stylus or impact, as by a typewriter key, causes combination of the color-forming reactant with the clay and a resulting colored mark; and, for example, of the type disclosed in U.S.P. 2,548,366, wherein the rear surface of each top sheet of a series of overlying sheets is coated with a dispersion of a suitable solution of the N-bis(p-dimethylaminophenyl)methyl aniline in a rupturable hydrophilic colloid film, and the adjacent top surface of the next underlying sheet is coated or filled with an electron-acceptor acidic material, so that pressure of a stylus or impact upon the top sheet causes color formation on the surface containing the acidic material at the points of pressure or impact.

I have discovered that sulfonamide derivatives of bis(p-dimethylaminophenyl)methane and related compounds, in which the nitrogen atom of a sulfonamide replaces one of the methane hydrogen atoms, possess advantageous properties which render them particularly useful in systems of the above type.

The compounds of the present invention are N-bis(p-dialkylaminoaryl)methyl sulfonamides in which the alkyl groups of the dialkylamino radical each have 1 to 5 carbon atoms, and the aryl radicals are mononuclear aryl radicals. They include compounds which in themselves are colored (containing chromophoric groups) and compounds which are lightly colored, or colorless, or substantially colorless (free from chromophoric groups). Further, they include compounds which include in their molecules acidic groups containing a hydrogen cation (for example, a sulfonic acid or carboxylic acid radical), and compounds free from such acidic groups. In this connection it is noted that groups which do not contain a hydrogen cation, such as salts of acidic groups (e.g., alkali metal, ammonium, organic base and other salts of carboxylic and sulfonic acids) are included herein as being free from acid groups containing a free hydrogen cation.

Preferred compounds of the present invention are free from both chromophoric groups and from acidic groups containing a hydrogen cation, since such preferred compounds are lightly colored or substantially colorless or colorless in the solid form (leuco form), which renders them of special utility in the manufacture of impact printing and duplicating materials of the types referred to above.

The alkyl radicals of the p-dialkylamino radicals include methyl, ethyl, propyl, butyl and amyl radicals. Compounds in which they are methyl or ethyl are preferred.

The mononuclear aryl radicals include unsubstituted phenylene radicals and phenylene radicals containing one or more inert substituents such as alkyl, alkoxy, halogen or acylamino substituents; for example, tolylene, methoxyphenylene, chlorophenylene, bromophenylene, etc. Compounds in which they are mononuclear aryl hydrocarbon radicals, and especially phenylene, are preferred.

The sulfonamide radicals of the compounds of the present invention include various types of such radicals. Thus they include sulfonamide radicals in which the radical attached to the sulfon group is an alkyl, cycloalkyl, aralkyl, aryl, or heterocyclic radical, or part of a sultam (in which the



group is linked to different carbon atoms of the same radical), a number of which are illustrated below.

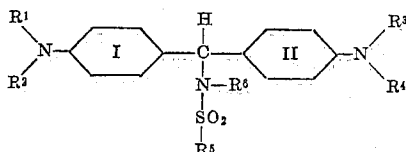
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They also include radicals in which the hydrogen atom of the



group is substituted by an alkyl, cycloalkyl, aralkyl, aryl or heterocyclic radical. Preferably they are free from chromophoric groups and from acidic groups containing a hydrogen cation, which would interfere with their use as leuco electron-donor color reactants. They may, however, contain such substituents as alkyl, alkoxy, halogen, dialkylamino, acylamino and sulfonamido groups.

The N-bis(p-dialkylaminoaryl)methyl sulfonamides of the present invention have the formula

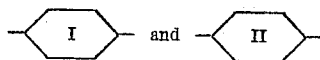


wherein:

R¹, R², R³ and R⁴ are each an alkyl radical having 1 to 5 carbon atoms (such as, methyl, ethyl, propyl, butyl or amyl),

R⁵ is selected from the group consisting of alkyl (such as, methyl, ethyl, propyl, butyl, amyl, hexyl, octyl, dodecyl, hexadecyl, octadecyl or octadecenyl), cycloalkyl (such as, cyclopentyl, cyclohexyl or methyl cyclohexyl), aralkyl (such as, benzyl or phenylethyl), aryl (such as, phenyl, tolyl, xylyl, naphthyl, biphenyl or indene) and heterocyclic (such as, pyridyl, quinolyl, benzothiazyl, benzofuryl or phenothiazyl) radicals, including substituted derivatives of such radicals and preferably those free from chromophoric groups and from acidic groups containing a hydrogen cation (such as the alkyl, alkoxy, fluorine, chlorine, bromine, dialkylamino, acylamino or sulfamido derivatives of the radicals referred to above), and sultam radicals which are part of the same radicals jointly with R⁶ (such as, naphthsultam),

R⁶ is selected from the group consisting of hydrogen and the radicals represented by R⁵, and



are selected from the group consisting of the phenylene radical and substituted derivatives thereof, preferably those free from chromophoric groups and from acidic groups containing a hydrogen cation (such as the alkyl, alkoxy, fluorine, chlorine, bromine, dialkylamino, acylamino or sulfamido derivatives thereof).

Those compounds are of particular value in which R¹, R², R³ and R⁴ are methyl or ethyl, the phenylene radicals are mononuclear aryl hydrocarbon radicals, R⁶ is hydrogen or methyl, and R⁵ is phenyl, tolyl, methoxyphenyl, or dimethylaminophenyl.

The compounds of the present invention are soluble in a wide variety of non-polar organic solvents, such as benzene, toluene, kerosene, mineral oil, dioctylphthalate, chlorinated biphenyls, etc. When applied as a solution in such solvents to a paper or other material coated with an acidic material, such as bentonite, kaolin, felspar, mono- or dibasic barium or calcium phosphates, they produce generally greenish blue to violet colorations. In addition, by virtue of the sulfonamido radical, they possess relatively low volatility and high stability to air and light. These advantageous properties render the lightly colored to colorless sulfonamides of the present invention outstanding for use in systems of the above type.

Thus, the compounds of the present invention are useful in the formation of colored compounds or differently colored compounds by contact with electron acceptor or acidic materials which cause a rearrangement

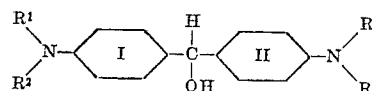
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of the chemical molecule with intensification of the color thereof, such as those enumerated above.

Lightly colored, and especially colorless or substantially colorless, compounds of this invention are particularly useful in so-called "colorless carbon papers" and duplicating manifold record systems of the type referred to above, because of their superior stability both in the leuco form and in the colored form obtained by contact with an acidic electron acceptor. Thus, in the leuco form they are stable to storage in containers open to the atmosphere, as well as when incorporated into record sheets of the type disclosed in U.S. Patents 2,548,366 and 2,712,507 and exposed to the atmosphere and to light. In the form of colored compounds formed by contact with acidic electron acceptors of the type referred to above, they are stable to light and to the atmosphere, even when embodied as record sheet material exposed to sunlight. This is in contrast to N-phenyl leucoauramine and related compounds, which when incorporated into record sheet material of the type disclosed, for example, in U.S. Patents 2,548,366 and 2,712,507, are unstable and/or volatilize or rapidly become ineffective; and in contrast to the rapid fading of the color produced by contact of acidic clays with crystal violet lactone heretofore employed commercially. Further, they do not stain the skin when the record sheets are handled.

For example, when the compound of Example 1 of the present application is substituted for the mixture of crystal violet lactone and methylene base employed in Example 1 of U.S.P. 2,548,366, the resulting sheets are stable during storage for long periods of time and when placed one above the other, with the clay-coated surfaces upward, and marked with a stylus, a blue marking is developed on the clay-coated surface of the lower sheet where pressure was applied, which marking does not fade.

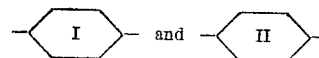
The sulfonamides of the present invention can be prepared in various ways. The simplest method from the standpoint of availability of starting materials and apparatus required involves the condensation of a bis(p-dialkylaminoaryl)methyl hydroxyl having the formula



with a sulfonamide having the formula



wherein R¹, R², R³, R⁴, R⁵, R⁶



have the meaning given above, preferably in substantially equimolar amounts. The condensation is preferably carried out by heating in a solvent at a temperature between 80° and 150° C. (All ranges given herein, including the claims, are inclusive of the limits.)

The general method of preparation preferably consists in refluxing substantially equimolecular proportions of the benzylalcohol and of the sulfonamide in a suitable solvent having a boiling point between 80° and 150° C., at least a fraction of each of the two reactants being soluble in the solvent. Suitable solvents are for example, hydrocarbon solvents, such as petroleum hydrocarbons (such as 2,2,4-trimethylpentane and low boiling kerosene fractions), aromatic hydrocarbons (such as benzene, toluene or xylene), and mixtures preferably having a boiling range between 80° and 150° C., and alcohols, such as ethyl, propyl or butyl alcohols or mixtures thereof. When effected in a hydrocarbon solvent, water formed in the reaction is preferably removed. The bis(p-dialkylaminoaryl)methyl sulfonamides thus obtained may be purified by recrystallization from a suitable solvent.

The following are illustrative of hydrols which are suitable for use in the process:

Michler's hydrol: 4,4'-bis(dimethylamino)benzhydrol
4,4'-bis(diethylamino)benzhydrol
4,4'-bis(dipropylamino)benzhydrol
4,4'-bis(dibutylamino)benzhydrol
4,4'-bis(dimethylamino)-2,2'-dichloro-benzhydrol
4,4'-bis(dimethylamino)3,3'-dimethyl-benzhydrol
4,4'-bis(diethylamino)-2,2'-dibromo-benzhydrol

The following are illustrative of sulfonamides which are suitable for use in the process, alone or in the form of mixtures of two or more of them:

Methane sulfonamide
Ethane sulfonamide
Propane sulfonamides
Butane sulfonamides
Pentane sulfonamides
Hexane sulfonamides
Octane sulfonamides
Decane sulfonamides
Dodecane sulfonamides, especially the normal primary
Hexadecane sulfonamides, especially the normal primary
Octadecane sulfonamides, especially the normal primary
Octadecene sulfonamide (oleyl sulfonamide)
Mixtures of sulfonamides derived from sulfonyl chloride
reaction products of hydrocarbon mixtures
Cyclopentane sulfonamide
Cyclohexane sulfonamide
Methyl-cyclohexane sulfonamide
N-methyl-cyclohexane sulfonamide
Phenylmethane sulfonamide (benzyl sulfonamide)
Phenylethane sulfonamide
Benzene sulfonamide
4-toluene sulfonamide
4-chlorobenzene sulfonamide
4-methoxybenzene sulfonamide
4-dimethylaminobenzene sulfonamide
4-diethylaminobenzene sulfonamide
4-di-n-butylaminobenzene sulfonamide
N-methyl-benzene sulfonamide
1,3-benzene disulfonamide
1-naphthalene sulfonamide
2-naphthalene sulfonamide
4-diphenyl sulfonamide
4-indene sulfonamide
3-pyridine sulfonamide
6-quinoline sulfonamide
2-benzothiazole sulfonamide
6-benzothiazole sulfonamide
5-benzofurane sulfonamide
3-phenothiazine sulfonamide
Naphthosultam

The invention will be illustrated by the following specific examples, but it is to be understood that it is not limited to the details thereof and that changes may be made without departing from the scope of the invention. The temperatures are in degrees centigrade and the parts and percentages are by weight, unless designated as parts by volume. Where parts are by volume, the amount signifies the volume occupied by the same number of parts by weight of water at 4° C.

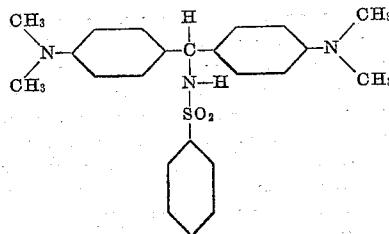
Example 1

75 parts of Michler's hydrol, technical grade (equivalent to 0.2 mol of 100% strength), 31.44 parts of benzenesulfonamide (equivalent to 0.2 mol), 2 parts of sodium hydroxide pellets (to neutralize inorganic acid impurities present in the hydrol), 250 parts by volume of toluene, and 100 parts by volume of benzene were charged to a round bottom flask provided with a thermometer, an agitator, and a reflux condenser connected to a water separator of the conventional type which continu-

ously collects the reflux condensate of water, benzene and toluene, separates the water from the hydrocarbons, and returns the latter to the reaction. The charge was heated to boiling and refluxed (at about 100°) for 40 hours, while removing the water generated by the condensation reaction. The reaction mixture was then cooled to room temperature, and the resulting needle-like crystals were separated by filtration.

The crude product thus obtained was recrystallized first from benzene (about 400 parts by volume) and then from toluene (about 500 parts by volume), and dried in a vacuum drier. In carrying out these recrystallizations, the crude crystals were dissolved in the hot solvent and a decolorizing carbon (Nuchar) was added in an amount about 1 to 5% of the weight of the crystals, after which the hot mixture was sludge filtered and the filtrate was allowed to cool, to crystallize the purified product.

The product thus obtained as white crystals having a melting point of 174°-176°, uncorrected, was phenylsulfonamido-bis(p-dimethylaminophenyl)methane of the formula



When dissolved in a liquid nonpolar organic solvent such as toluene or a chlorinated biphenyl, and contacted with a sheet of paper coated with an acid clay, such as bentonite or attapulgite, it produced a blue coloration.

Example 2

A mixture of 60 parts of Michler's hydrol, technical grade (equivalent to 0.2 mol of 100%), 34 parts of p-toluenesulfonamide (equivalent to 0.2 mol), 4 parts by volume of 25% aqueous sodium hydroxide and 350 parts by volume of toluene was refluxed for 32 hours as in Example 1, to complete the condensation reaction. The mixture was then cooled and filtered. The crude product thus obtained was recrystallized from 300 parts by volume of toluene in the presence of a small amount of a decolorizing carbon (Nuchar).

The purified product thus obtained as white crystals melting at 180°-181°, uncorrected, was p-tolysulfonamido-bis(p-dimethylaminophenyl)methane. When a toluene solution thereof was contacted with bentonite a blue coloration was produced.

Example 3

The procedure of Example 2 was repeated using 37.4 parts of p-methoxybenzenesulfonamide (0.2 mol) in place of the p-toluenesulfonamide, and 500 parts by volume rather than 350 parts by volume of toluene.

The purified product thus obtained as white crystals melting at 175°-177°, uncorrected, was p-methoxyphenylsulfonamido-bis(p-dimethylaminophenyl)methane. A solution thereof in toluene gave a blue color when spotted on bentonite.

Example 4

The procedure of Example 3 was repeated using 40 parts (0.2 mol) of p-dimethylaminobenzenesulfonamide in place of the p-methoxybenzenesulfonamide.

The purified product thus obtained as white crystals melting at 208°-214°, uncorrected, was p-dimethylaminophenylsulfonamido-bis(p-dimethylaminophenyl)methane. A solution thereof in toluene gave a greenish blue color, when spotted on bentonite.

Example 5

A mixture of 51.8 parts of Michler's hydrol, technical grade (equivalent to 0.175 mol of 100%), 42.6 parts of *p*-diethylaminobenzenesulfonamide, 4 parts by volume of 25% aqueous sodium hydroxide, and 250 parts by volume of toluene was boiled and refluxed for 12 hours, while continuously removing water as in Example 1. The hot reaction mixture, after dilution with 250 parts by volume of toluene and reheating to produce a clear solution, was sludge filtered hot and the filtrate was allowed to cool to room temperature. The crystals thus obtained were separated by filtration and dried in a vacuum drier at about 40°. The crude crystals were recrystallized from toluene (500 parts by volume) in the presence of a small amount of decolorizing charcoal (Nuchar) and dried as in Example 1.

The product thus obtained as white crystals melting at 145°–150°, uncorrected, was *p*-diethylaminophenylsulfonamido - bis(*p* - dimethylaminophenyl)methane. A solution thereof in toluene produced a greenish blue color when spotted on bentonite.

Example 6

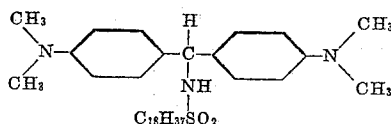
A mixture of 30 parts of Michler's hydrol (90% strength, equivalent to 0.1 mol), 28.4 parts (0.1 mol) of *p*-di-*n*-butylaminobenzenesulfonamide (having a melting point 132°–134°), and 250 parts by volume of toluene was heated to boiling and refluxed (112°) for 48 hours to complete the condensation reaction. The mixture was then cooled to room temperature and filtered. The crystals were washed with 25 parts by volume of toluene and dried in a vacuum drier at 30°–35°.

The crystalline product thus obtained, *p*-di-*n*-butylaminophenylsulfonamido - bis(*p* - dimethylaminophenyl)methane, was essentially colorless and had a melting point of 171°–173°. A toluene solution thereof spotted on paper coated with bentonite produced a blue coloration.

Example 7

The procedure of Example 3 was repeated using 66.6 parts (0.2 mol) of octadecanesulfonamide in place of the *p*-methoxybenzenesulfonamide.

The product thus obtained as essentially colorless crystals was octadecylsulfonamido-bis(*p*-dimethylaminophenyl)methane having the formula:



When a solution thereof in toluene was spotted on bentonite, a blue coloration was obtained.

Example 8

The procedure of Example 3 was repeated using 41.4 parts of 1-naphthalenesulfonamide (0.2 mol) in place of the *p*-methoxybenzenesulfonamide.

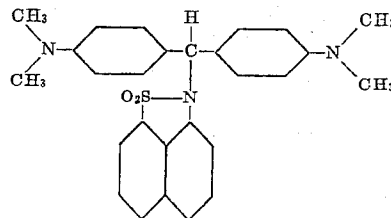
The product thus obtained as colorless crystals was 1-naphthylsulfonamido - bis(*p* - dimethylaminophenyl)methane. When dissolved in toluene and spotted on bentonite, a blue coloration was produced.

Example 9

A mixture of 30 parts of Michler's hydrol (0.1 mol of 100%), 20.5 parts of naphthosultam (0.1 mol of 100%), and 175 parts by volume of ethyl alcohol (2B denatured) was heated to boiling and refluxed (78–80°) for 50 hours. The mixture was then cooled to room temperature and filtered.

The crystals were dissolved in 500 parts by volume of a mixture of equal volumes of toluene and isopropyl alcohol, at the boil. The solution was charged with 2 parts of decolorizing carbon (Nuchar) and sludge filtered. The filtrate was cooled to room temperature and filtered.

The nearly white crystalline product thus obtained was naphthosultamyl - bis(*p* - dimethylaminophenyl)methane having the formula

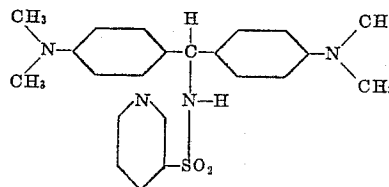


It decomposed at 223° when heated. When a solution thereof in toluene was poured onto paper coated with bentonite clay, a blue coloration was obtained.

Example 10

The procedure of Example 3 was repeated using 31.6 parts (0.2 mol) of 3-pyridinesulfonamide in place of the *p*-methoxybenzenesulfonamide.

The purified product thus obtained was 3-pyridylsulfonamido-bis(*p*-dimethylaminophenyl)methane having the formula



It was essentially colorless, and when dissolved in toluene and spotted on bentonite, gave a blue color.

Example 11

A mixture of 32.6 parts of 4,4'-bis(diethylamino)benzhydrol (0.1 mol of 100%), 15.7 parts of benzenesulfonamide (0.1 mol of 100%), and 200 parts by volume of ethyl alcohol (2B denatured) was heated to refluxing (80°) for 50 hours. The reaction mixture was sludge filtered hot, and the filtrate was cooled to 0° for 3 days. The tacky crystals thus obtained were filtered off and dried in vacuo at 30–35°.

The product was recrystallized from ethyl ether, yielding phenylsulfonamido-bis(*p*-diethylaminophenyl)methane, i.e., *N*-bis(*p*-diethylaminophenyl)methyl benzenesulfonamide, in the form of gray crystals melting at 155°, uncorrected. When dissolved in toluene and poured onto paper coated with bentonite, a greenish blue color was slowly produced, which overnight became deep reddish blue.

Example 12

A mixture of 27 parts of Michler's hydrol (0.1 mol of 100%), 20.7 parts of 2-naphthalenesulfonamide (0.1 mol) and 200 parts by volume of toluene was refluxed at 112° for 40 hours, while removing water as in Example 1, until the condensation was complete. The reaction mixture was sludge filtered at room temperature. The filtrate was refrigerated to –10°, and the crystals obtained were filtered off and dried.

The crude crystals thus obtained were recrystallized from toluene. The purified product thus obtained as tan crystals having a melting point of 164°, uncorrected, was 2-naphthylsulfonamido-bis(*p*-dimethylaminophenyl)methane. A solution thereof in toluene when spotted on paper coated with bentonite gradually gave a greenish blue color, which overnight became deep reddish blue.

Example 13

32.6 parts of 4,4'-bis(diethylamino)benzhydrol (0.1 mol of 100%), 17.1 parts of *p*-toluenesulfonamide (0.1 mol), and 250 parts by volume of toluene was refluxed at 113° for 32 hours, while separating water as in Example 1. The reaction mixture was sludge filtered hot,

the filtrate was cooled to 0°, and the resulting crystals were filtered off and dried in vacuo at 30-35°.

The product thus obtained as cream colored crystals melting at 142°, uncorrected, was p-tolylsulfonamido-bis-(p-diethylaminophenyl)methane. When a solution there-
of in toluene was spotted on bentonite, a greenish blue
color formed gradually and became deep reddish blue
overnight.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative examples and that changes can be made with-
out departing from the scope of the invention.

Thus, instead of the hydrols and sulfonamides em-
ployed in the examples, others of those specified above
may be substituted in equivalent amounts. Further in-
stead of the hydrol, the corresponding bis(p-dialkylamino-
aryl)methyl chloride or bromide may be used.

The Michler's hydrol employed in certain of the ex-
amples was a technical product containing mineral acid
impurities. Accordingly such examples include the addi-
tion of a small amount of sodium hydroxide to neutralize
said impurities. Other neutralizing agents can be used
similarly, such as sodium carbonate.

I claim:

1. N-bis(p-dialkylaminoaryl)methyl sulfonamides in
which the alkyl groups of the dialkylamino radicals each
have 1 to 5 carbon atoms; the aryl radicals are each se-
lected from the group consisting of phenylene and phenyl-
ene monosubstituted by a member of the group consist-
ing of lower alkyl, lower alkoxy, fluorine, chlorine, bro-
mine, di-lower alkylamino, lower alkanoylamino, and
-SO₂NH₂; and the sulfonamide radicals have the form-
ula:



wherein:

R⁵ represents a radical selected from the group consist-
ing of (A) alkyl up to 18 carbon atoms; octadecenyl;
cycloalkyl in which the ring contains 5 to 6 carbon
atoms; phenyl-lower alkyl; (B) phenyl, tolyl, xylyl,
naphthyl, biphenyl, indenyl, pyridyl, quinolyl, benzo-
thiazyl, benzofuryl and phenothiazyl, and the radicals
of (B) monosubstituted by a member of the group
consisting of lower alkyl, lower alkoxyl, fluorine,

chlorine, bromine, di-lower alkylamino, lower alkanoyl-
amino and -SO₂NH₂; and the naphthosultam radical
which is part of the same radical jointly with R⁵, and
R⁶ represents a radical selected from the group consist-
ing of hydrogen and the radicals represented by R⁵.

2. N-bis(p-dialkylaminoaryl)methyl alkyl sulfona-
mides having 1 to 18 carbon atoms in the alkyl group in
which the alkyl groups of the dialkylamino radicals each
have 1 to 2 carbon atoms, and the aryl radicals are mon-
onuclear aryl hydrocarbon radicals.

3. N-bis(p-dialkylaminoaryl)methyl aryl sulfonamides
in which the alkyl groups of the dialkylamino radicals
each have 1 to 2 carbon atoms, and the aryl radicals are
mononuclear aryl hydrocarbon radicals.

4. N-bis(p-dialkylaminophenyl)methyl alkyl sulfona-
mides having 1 to 18 carbon atoms in the alkyl group
the alkyl groups of the dialkylamino radicals each hav-
ing 1 to 2 carbon atoms.

5. N-bis(p-dialkylaminophenyl)methyl aryl sulfona-
mides the alkyl groups of the dialkylamino radicals each
having 1 to 2 carbon atoms and the aryl radical is a mono-
nuclear aryl hydrocarbon radical.

6. N-bis(p-dimethylaminophenyl)methyl alkyl sulfon-
amides having 1 to 18 carbon atoms in the alkyl group.

7. N-bis(p-dimethylaminophenyl)methyl cycloalkyl sul-
fonamides in which the cycloalkyl ring contains 5 to 6
carbon atoms.

8. N-bis(p-dimethylaminophenyl)methyl phenyl-lower
alkyl sulfonamides.

9. N-bis(p-dimethylaminophenyl)methyl aryl sulfon-
amides in which the aryl radical is a mononuclear aryl
hydrocarbon radical.

10. N-bis(p - dimethylaminophenyl)methyl phenylsul-
fonamide.

11. N-bis(p-dimethylaminophenyl)methyl naphthylsul-
fonamide.

12. N-bis(p - dimethylaminophenyl)methyl p-tolylsul-
fonamide.

13. N-bis(p-dimethylaminophenyl)methyl p-methoxy-
phenylsulfonamide.

14. N-bis(p-dimethylaminophenyl)methyl p-dimethyl-
aminophenylsulfonamide.

References Cited in the file of this patent

Bogert et al.: J. Am. Chem. Soc., vol. 44, pp. 2612-21
(1922).

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

August 9, 1960

Patent No. 2,948,753

Frederick H. Kranz

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 43, for "crystalline" read -- crystal --;
column 5, line 46, for "4-diphenyl sulfonamide" read
-- 4-biphenyl sulfonamide --; column 6, line 20, for
"phenylsul-" read -- phenyl- --; line 51, Example 2, for
"p-tolysulfon-" read -- p-tolylsulfon- --; column 8, line 37,
Example 11, for "100%" read -- 100% --; column 9, line 47,
for "alkaxy" read -- alkoxy --.

Signed and sealed this 4th day of April 1961.

(SEAL)

Attest: ERNEST W. SWIDER

~~XXXXXXXXXXXX~~
Attesting Officer

ARTHUR W. CROCKER
Acting Commissioner of Patents