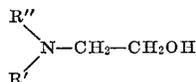


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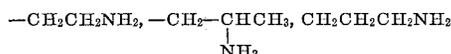
Further, because of our discovery certain aminocarboxylic acids and their salts can now be prepared at reaction conditions that can enable economically commercial feasible processes.

Therefore, in accordance with our process, selected aminoalcohols are heated in the presence of an alkali metal hydroxide and a cadmium catalyst at a temperature in the range of about 245° C. to 350° C., preferably about 250° C. to 300° C., for a time in the range of about 5 to 45 minutes, preferably in the range of about 10 to 35 minutes.

Starting materials, i.e., the aminoalcohols that can be employed according to our invention can be representatively depicted by the following formula:



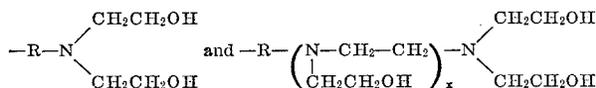
wherein R' represents hydrogen, or a radical selected from —CH<sub>2</sub>CH<sub>2</sub>OH, C<sub>1</sub> to C<sub>15</sub> alkyl, or an aminoalkyl radical containing two to three carbon atoms, such as



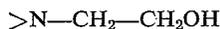
and the like, and R'' represents hydrogen or a radical selected from phenyl, a C<sub>1</sub> to C<sub>15</sub> alkyl substituted phenyl, or a C<sub>1</sub> to C<sub>15</sub> alkyl; and when R' represents the



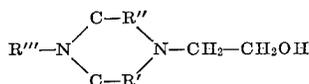
radical, R'' can be further selected from the following additional radicals



wherein R represents an alkylene radical containing two to three carbon atoms and x represents an integer of 1 to 3; and wherein each R' and R'' can also represent methylene radicals or lower C<sub>1</sub> to C<sub>3</sub> alkyl substituted methylene radicals such that when taken with



they comprise a portion of an N-substituted piperazine compound which compound can be further represented by the following formula:



wherein R''' represents hydrogen, or a radical selected from a C<sub>1</sub> to C<sub>4</sub> alkyl or —CH<sub>2</sub>CH<sub>2</sub>OH.

Representative aminoalcohols corresponding to the above representative formulas include

monoethanolamine;  
N-phenylethanolamine;  
N-nonylethanolamine;  
N-nonylethanolamine;  
N-nonylphenylethanolamine;  
diethanolamine;  
N-phenyldiethanolamine;  
N-ethyldiethanolamine;  
N-isopropyldiethanolamine;  
N-nonylphenyldiethanolamine;  
N-ethyl, N-phenylethanolamine;  
N,N-(diethyl)ethanolamine;  
N-ethyl,N-nonylphenylethanolamine;  
N-(2-aminoethyl)ethanolamine;  
N-(3-aminopropyl)ethanolamine;  
N-phenyl, N-(2-aminoethyl)ethanolamine;  
N-ethyl, N-(2-aminoethyl)ethanolamine, and the like.

Cadmium salts, such as the acetate, propionate, butyrate, oxide, chloride, sulfate, admixtures thereof, and the

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like, are representative catalysts and can be suitably employed in amounts effectively determined by the skilled artisan. Generally, an effective amount is within the practical range of about .4 to 10 grams of cadmium salt per mol of the aminoalcohol employed.

Conversion of the aminoalcohol to the aminocarboxylic acids is conducted in the presence of alkali metal hydroxides, or admixtures thereof, such as sodium hydroxide, potassium hydroxide, and the like. They are generally employed in amounts to provide a stoichiometric quantity relative to the aminoalcohol employed. Excess alkali metal hydroxides are usually provided however. Sufficient water is employed to essentially maintain the components in the reaction medium essentially in solution. Sufficient pressure is usually employed to essentially maintain the water in the liquid phase. The reaction medium can be prepared by mixing the reactants in any order that is desired. If desired, all the reactants can be added to the vessel and the contents then heated to the reaction temperature or alternatively a portion can be added incrementally and good results achieved.

In general, the aminocarboxylic acids produced by this process are known compounds with many known uses for them. Thus, they are chemical intermediates and are valuable raw materials and will undergo reactions characteristic of carboxylic acids.

In addition, the salts are useful in their own rights. For example, the iminodiacetic acid compounds and the substituted iminodiacetic acid compounds are water softeners and chelating agents. The long chain alkyliminodiacetic acids are particularly useful for foam-promoting additives in detergent formulations and related products. The piperazine diacetic acid compounds are particularly useful to enhance the strength of paper.

The aminocarboxylic acids and their salts produced according to this invention can be recovered by techniques well within the skill of the artisan in this field. For example, the reaction mixture can be acidified and the aminocarboxylic acid recovered by solvent separation. Likewise, the aminocarboxylic acid salts can be recovered by solvent separation. Suitable solvents include acetone, benzene, chloroform, diethylether, methanol, ethanol, isopropanol, and the like.

To illustrate the foregoing discussion and description and not to be interpreted as a limitation on the scope thereof, or on the materials herein employed, the following examples are presented. The following examples are accordingly demonstrative of our invention and demonstrate seemingly impossible achievements according to prior art standards and beliefs.

#### EXAMPLE I

In a 1-liter stirred Monel lined reactor 2.0 mols of diethanolamine, 6.0 mols sodium hydroxide, 300 grams water and 16.0 grams cadmium oxide were admixed. The mixture was heated under nitrogen at 250° C. for 15 minutes and 6.2 cubic feet of hydrogen off-gas was liberated. The reaction mixture was then diluted with water, filtered and methanol added to precipitate the disodium salt of the iminodiacetic acid. The disodium salt of the iminodiacetic acid was washed with cold methanol and dried in a heated (60 C.) vacuum desiccator. Infrared spectrum analysis was identical with that of a pure authentic sample. The yield of disodium salt of iminodiacetic acid (monohydrate) was surprisingly 84.5%.

#### EXAMPLE II

As in the method of Example I, 2.0 mols of N,N-dimethylethanolamine, 5.0 mols sodium hydroxide, 250 grams water and 11.0 grams cadmium oxide were heated under nitrogen for 30 minutes at 250° C. to 280° C. liberating 2.4 cubic feet of hydrogen. To the reaction mixture was added 300 ml. water and the solids were mostly dissolved by stirring overnight. The mixture was filtered and the filtrate treated with isopropanol and white crystals