

# ALIEN PROPERTY CUSTODIAN

## SOLUTIONS OF POLYAMIDES

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This invention relates to new compositions of matter and more particularly to a new and valuable process for the production of solutions and pastes comprising synthetic linear polyamides.

These polyamides, the utility of which is enhanced by the practice of this invention, are of two types, namely those derived from monoamino monocarboxylic acids and their amide-forming derivatives, and those derived from the reaction of suitable diamines with suitable dicarboxylic acids or amide-forming derivatives of dibasic carboxylic acids. It will be noted that the polyamides are derived from the functional amide-forming derivatives. Mixed polycondensation products are also obtained by heat-condensation of bifunctional compounds. There are condensed for instance  $\omega$ -aminocarboxylic acids with at least five chain-forming atoms between amino group and carboxyl group or their amide-forming derivatives, such as esters, chlorides, lactams, furthermore diamines with four and more carbon atoms between the two amino groups and finally dicarboxylic acids with at least three, preferably more carbon atoms between the two carboxyl groups or their amide-forming derivatives. The condensation products thus obtained are at ordinary temperature insoluble in aliphatic and aromatic hydrocarbons, chloro-hydrocarbons, esters, ketones, in the simple monohydric and polyhydric alcohols, their ethers and also in cyclic ethers.

According to German patent application I.64 433 IVd/120, filed April 24, 1939, it has been proposed to bring into solution by heating with an aliphatic alcohol the mixed-condensates obtained from dicarboxylic acids and diamines on the one hand and  $\omega$ -aminocarboxylic acids or their functional derivatives on the other hand. However, when cooling at room-temperature these solutions are not stable and can be worked up with great difficulties only. In order to work up the polyamides by means of a solution it is therefore necessary to use their feebly basic properties and to employ acids as suitable solvents. Though it is possible by this method to obtain a solution already at normal temperature, it is rather inconvenient to work with strongly acid agents. It also may be left undecided whether or not far reaching changes of the polyamide molecules are brought about by the effect of the acid.

This invention has as an object, therefore, the preparation of solutions and pastes from mixed-polycondensation products of dibasic acids, diamines and  $\omega$ -aminocarboxylic acids.

Further objects will appear hereinafter.

It has been found that polyamides obtained by mixed-condensation of dicarboxylic acids with diamines of four and more carbon atoms between the amino groups and with  $\omega$ -aminocarboxylic

acids of five and more carbon atoms between the amino- and the carboxyl group or their amide-forming derivatives, such as lactams, esters, acid chlorides, can be dissolved in ethylene chlorohydrine ( $\beta$ -chloro ethyl alcohol) at normal temperature within a very short time. In this way clear solutions free from structures are formed. Preferably there are employed mixed-condensates being formed from adipic acid, hexamethylene diamine on the one side and  $\xi$ -caprolactam on the other side. Most suitable are such mixed-condensates which contain at least 40% and not far above 60% of the total weight in the form of  $\xi$ -caprolactam. Since the chlorohydrine represents an acid-free liquid, all disadvantages connected with the handling of acid liquids are overcome, when working up the solutions prepared thereof. The 25%-solutions of the polyamide in ethylene chlorohydrine leave, for instance, behind after evaporation of the solvent a clear and solid film. Whereas the solutions of the polyamide in inorganic or organic acids are already precipitated by small quantities of water, alcohol or similar liquids, even concentrated solutions of the aforementioned polyamide in ethylene chlorohydrine may be mixed without any coagulation with liquids containing hydroxyl, water, alcohols, especially ethyl alcohol. On the contrary these solutions are capable of peptizing further quantities of polyamide. Also the water soluble ethers of the ethylene glycol, for instance the methyl glycol and esters containing hydroxyl may be added in very large quantities to these solutions. Also in these cases the capability of peptizing still further quantities of polyamide has remained. This was highly surprising as for instance methyl glycol does practically not dissolve the polyamide even at 80° C. and also the lactic acid ester for instance does not dissolve it at elevated temperature. The solutions of the polyamide in ethylene chlorohydrine show towards hydrocarbons, esters, ketones, ethers, cyclic ethers and acetals reduced dilution capacity. When using simultaneously liquids containing hydroxyl and representatives of the aforementioned group of substances, it is quite easy to manufacture lacquers from the polyamide, the evaporation curves of which follow the usual rules of spraying- and painting technic. The solutions of the polyamide in ethylene chlorohydrine may be mixed up with plasticizers, pigments and dyestuffs in a known manner. They may be employed then as coating material for structures of any kind, such as paper, textiles, wood, metal, also for the manufacture of artificial leather, floor coatings, motorcar tops and the like. Needless to say it is also possible to work up the solutions into films, foils, filaments, sound records, bristles and similar structures.

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