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PROCESS TO INCREASE THE VISCOSITY OF AQUEOUS GELATIN SOLUTIONS

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This invention relates to a process to increase the viscosity of aqueous gelatin solutions.

The viscosity of aqueous gelatin solutions depends notoriously on several factors, as for instance gelatin quality, concentration, temperature, presence of hardeners and the like, and represents therefore a very variable indefinite quantity. To work up technical gelatin solutions, for instance to spin filaments or to cast gelatin layers for the manufacture of foils or coatings for sizes, protective layers and the like, it is of great importance to adjust the viscosity independently of other factors influencing the viscosity and to have means at hand which make it possible to increase the viscosity in a regulatable and sufficient manner without noticeably influencing on the other hand the physical or chemical properties of the gelatin solution. An increase of the viscosity was hitherto accomplished by decreasing the temperature. This process, however, has the disadvantage that the temperature cannot be chosen at pleasure and that at a certain point skin-formation on the surface or other troubles may exist. An increase of the gelatin concentration is very often not possible, since hereby the thickness of the finished gelatin layer is probably increased to an extent not desired. An admixture of hardening agents is in such cases out of the question, where the melting point of the finished product must not exceed a certain value.

It is therefore an object of this invention to increase the viscosity of aqueous gelatin solutions without noticeably changing its physical properties.

This and other objects will be apparent from the following specification.

The increase of the viscosity of such gelatin solutions in a manner sufficient for all requirements may be accomplished according to the present invention by an admixture of acyl amino compounds of aromatic sulfo- and carboxylic acids, in which the acyl radical consists of an aliphatic group of at least 10 carbon atoms or contains such a group. The aqueous solutions of these organic compounds show for themselves scarcely any higher viscosity than the solvent. The increase of the viscosity is therefore connected probably with a colloid chemical reaction which advantageously is so, that the usual properties of the gelatin are unchanged, when added in normal proportions. The naphthalene derivatives possess generally a higher effectiveness than the benzene derivatives. The disulfo acids, moreover, are often more effective than the monosulfo acids which also show reduced solubility. Also polyacids are very well suited. The sulfo acids may be employed also in the form of their salts or acid salts, if necessary together with organic bases. Their effectiveness is maintained also in various pH-regions. In the presence of soluble salts, for instance common salts, the effectiveness is somewhat decreased. The quantity of the admixture depends entirely on the desired effect. It is mostly sufficient to add 0.5–5% of the dry-weight of the gelatin, however more may be added. In such cases it can be attained, that for instance a 10% gelatin solution at 35° C.—that is a temperature at which it is normally still very movable—has nearly completely stopped to flow. The sulfo acids or their salts may be employed also in mixtures between each other in any proportion. Gelatin- and glue-qualities which furnish solutions of higher viscosity are more influenced than qualities which form low viscous solutions only at the same concentration.

It has been found furthermore that the effect also occurs, if other admixtures commonly used for technical purposes like dyestuffs, organic or inorganic pigments like permanent white, titanium white, pyrolusite or silver halide (the latter in the form of photographic emulsions of any kind) are suspended in the gelatin. The admixture of the viscosity-increasing compounds according to the present invention may take place also at any phase during the manufacture of the gelatin, in order to set up a certain viscosity. In any case one starts from a gelatin solution which does not possess the viscosity necessary for instance for casting. Therefore is added so much of the sulfo acid or its salts, until the desired value is attained.

The atom groupings mentioned are also effective, when they are contained in the dyestuffs. Besides numerous other azo-dyestuffs the one obtained from tetrazotized diamino diphenyl cyclohexane and 1-stearoylamino-8-naphthol-4,6-disulfo-acid increases also the viscosity of gelatin solutions.

As a long-chained acyl radical the radical of the stearic acid is of special interest, because it yields relatively high effective compounds and also because the stearic acid is one of the cheapest of the respective acids. But also acids with less C-atoms, as for instance palmitic acid, myristic acid, lauric acid are well suited as substituents, naturally also longer-chained acids like eicosane acid or montanic acids or unsaturated acids like the undecylic acid, oleic acid, eruic acid

or also substitution products of these fatty acids, as for instance oxy compounds, halogen compounds and polyvalent acids like octadecyl dicarboxylic acid, sulfo stearic acid and others. Furthermore the acids may also contain ring systems, as for instance the chaulmoogric acid or di-p-octadecyl benzoic acid. The fatty acid may also be connected by intermediate members with the benzene- or naphthalene sulfo acids, as for instance by the acid radical of amino fatty acids, aromatic amino acids (amino benzoic acid, amino benzoyl benzoic acid) or mixed aromatic-aliphatic acids like benzyl amino carboxylic acid, i. e. acyl amino groups and acid groups may belong also to different ring systems.

In order to illustrate the effect of the new process, there are mentioned in the following the time of out-flow of an 8% gelatin solution measured by a calibrated delivery pipette at 35° C. with and without admixtures. The admixture amounts hereby to only 1% of the weight of the applied dry gelatin, i. e. the concentration of the admixture in the solution was in all tests 0.08% (the time of out-flow for water was 28 sec.).

Admixture (as sodium salts)	Time of out-flow in sec. (faults ±0.2")
Without admixture	35.1
1-stearoylamino naphthalene-3.8-disulfo acid	37.3
1-stearoylamino naphthalene-5.7-disulfo acid	37.3
1-stearoylamino naphthalene-6.8-disulfo acid	37.0
1-stearoylamino naphthalene-4.8-disulfo acid	37.2
1-stearoylamino naphthalene-4.7-disulfo acid	36.7
2-stearoylamino naphthalene-6.8-disulfo acid	36.8
1-stearoylamino naphthalene-4.6-disulfo acid	36.6
1-stearoylamino naphthalene-2.4-disulfo acid	36.8
1-stearoylamino naphthalene-3.6-disulfo acid	36.5
1-stearoylamino naphthalene-2.5-disulfo acid	36.5
1-stearoylamino naphthalene-2.8-disulfo acid	36.1
1-palmitoylamino naphthalene-5.7-disulfo acid	36.6
1-laurylamino naphthalene-5.7-disulfo acid	36.1
3-stearoylamino-5-sulfo benzoic acid	36.4
1-palmitoylamino benzene-3.5-disulfo acid	36.4
1-stearoylamino naphthalene-3, 6, 8-trisulfo acid	36.9
1-stearoylamino naphthalene-8-sulfo acid	35.7
1-stearoylamino-8-naphthol-4, 6-disulfo acid	37.3

Further suitable compounds are for instance 2-stearoyl-amino-5-naphthol-7-sulfo-acid, 1-stearoyl-amino-5-naphthol-7-sulfo-acid, 1-stearoyl-amino-8-naphthol-3,6-disulfo-acid, stearoyl-dehydrothio-p-toluidinesulfo-acid, 5-(m-stearoylamino-phenyl)-(naphtho-1',2':2,3-imidazol)-5',7'-disulfo-acid, 1-(m-sulfo-phenyl)-3-(p-stearoyl-amino-phenyl)-pyrazolone-(5), 5-oleylamine-2,6-dimethyl-quinoline-8-sulfo-acid, 2-palmitoyl-amino-anthraquinone-6-sulfo-acid, 5-lauryl-amino-acenaphthene-8-sulfo-acid, 1-stearoyl-amino-benzene-3,5-dicarboxylic-acid.

We claim:

1. Process for increasing the viscosity of aqueous solutions of gelatin, which comprises adjusting the necessary viscosity to the desired degree by adding a substance selected from the class consisting of acyl-amino compounds of aromatic sulfo and carboxylic acids, in which the acyl radical consists of an aliphatic group of at least 10 carbon atoms.

2. Process for increasing the viscosity of aqueous solutions of gelatin, which comprises adjusting the necessary viscosity to the desired degree by adding a substance selected from the class consisting of acyl-amino compounds of aromatic sulfo and carboxylic acids, in which the acyl radical contains an aliphatic group of at least 10 carbon atoms.

3. Process for increasing the viscosity of aqueous solutions of gelatin, which comprises adjusting the necessary viscosity to the desired degree by adding a substance selected from the class consisting of acyl-amino compounds of aromatic sulfo and carboxylic acids, in which the acyl radical contains the salts of an aliphatic group of at least 10 carbon atoms.

4. The process as defined in claim 1, wherein the amount of the acylamino compound which is added is from about .5 to 5% of the dry weight of the gelatin.

5. The process as defined in claim 1, wherein the gelatin solution contains a coloring agent.

6. The process as defined in claim 1, wherein the gelatin solution contains a silver halide.

7. Thickened aqueous solutions of gelatin containing an addition of a viscosity increasing agent selected from the class consisting of acylamino compounds of aromatic sulfo- and carboxylic acids in which the acyl radicle consists of an aliphatic group of at least 10 carbon atoms.

8. Compositions as defined in claim 7, wherein the viscosity increasing agent is present in an amount from .5 to 5% of the dry weight of the gelatin.

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