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BLENDING AGENTS FOR ASPHALTS

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This invention relates to improvements in the adhesivity of bitumens when used as bonding agents, especially when used to bond mineral aggregates, coat metals, etc.

It is known that mineral aggregates such as chips, sand, rock or similar material, in a moist condition when intimately mixed with tar, petroleum pitch, mixtures of tars, solutions of petroleum pitch or other bituminous substances, cannot be properly coated by the bitumen, and if coated, the adherence of the two products to each other may be exceedingly poor. It has therefore been necessary in the past to carefully dry the mineral material before the preparation of the bituminous mixture. As a result, long delays in road building were occasioned by bad weather involving loss of time with corresponding mounting of costs.

It is also known that bituminous substances can be made to intimately adhere to rock aggregate by bringing the bituminous substance and the solid aggregate together in the presence of a primary or quaternary amine. While amines of this type improve the adherence of the bituminous substance to stone or rock aggregate, they are not, however, as effective when used with wet or damp road constructional materials. In particular, they suffer the shortcoming of being incapable of imparting complete adhesivity of the bituminous substance to the rock aggregates which are slightly moist or contain a substantial amount of water. Likewise, they do not effect satisfactory adherence of the bitumen to the rock or stone and the partial adherence which may be obtained is easily still further reduced, particularly by cool and damp weather. Moreover, the amines of the prior art are very difficult to synthesize from the commercial point of view since costly reduction methods must be employed in their manufacture. Also, it has been customary in the prior art to use the costly quaternary amines in the proportions ranging from 1% to 5%, these high concentrations of the active agent being necessary to obtain complete coverage of a wet aggregate.

The principal object of this invention is to provide novel means for obtaining a durable bond between the above-mentioned class of rock aggregates and the bitumen binder, whether the rock aggregate is damp, wet or dry.

Another object of this invention is to provide an inexpensive and readily available asphalt-aggregate bonding agent for purposes of road and airport construction.

According to the present invention, the improvements heretofore mentioned are obtained by treating a bitumen, such as an asphalt, with a small amount of an amino alkyl amide of a carboxylic acid having a general formula:

$$R—CONR'R''NHR'$$

wherein R is either a saturated or unsaturated alkyl group ranging from 10 to 23 carbon atoms, R' is either hydrogen or an alkyl group and R'' is an alkyl group ranging from 2 to 6 carbon atoms.

R may be either saturated alkyl group of the following acids:

lauric	stearic
myristic	arachidic
palmitic	carnaubic

or unsaturated alkyl groups of the following acids:

hypogeic	linolinic
oleic	erucic
linoleic	

R may also be a substituted alkyl group such as mono- or dichloro derivatives of the above enumerated acids.

The amides that are particularly suitable for this purpose are amino ethylamide, amino propylamide, amino butylamide, i. e. amino alkylamide of a carboxylic acid such as the mono acid amides of ethylene diamine or of polyethylene polyamines. These amides may be readily obtained in many ways but the most convenient method of preparation consists of heating an ester of a carboxylic acid with ethylene diamine (or polyethylene or polyalkylene polyamine) preferably in some solvent such as alcohol or xylol. A reaction product is obtained which consists primarily of the appropriate amino ethylamides, together with a number of by-products of the main reaction, and as a rule purification of the reaction products is unnecessary.

$$C_{17}H_{35}COOR + H_2N—CH_2CH_2NH_2 \rightarrow C_{17}H_{35}CONHCH_2CH_2NH_2 + HOR$$

For example, amino ethyl stearylamide may be prepared by using 68 grams of n-butyl stearate dissolved in 300 cc. absolute ethyl alcohol. To this 24 grams of anhydrous ethylene diamine is then added. The solution is heated on the steam bath for several days. On cooling the reaction mixture, a precipitate is obtained which upon recrystallization from acetone, yields a white crystalline material having a melting point of 95–106° C. On analysis, the product was found to con-

sist primarily of aminoethyl stearylamide, mixed with a small amount of heptadecyl imidazoline.

Found.....C=74.36, H=12.42, N=7.79
$C_{20}H_{42}ON_2$.....C=73.62, H=12.88, N=8.58

The addition of the amines to the asphalt effects a considerable improvement in the adhesivity and also coating ability of an asphalt for a mineral aggregate but it was found that smaller amounts of the amides are needed to effect the same improvement. This treatment of the asphalt produces bonding agents which are more uniformly effective in giving good results when applied to either acidic, neutral or alkaline aggregates.

The bonding agents of the present invention may be advantageously incorporated with the asphalt blend either by dissolving 0.1% to 1% (based on the asphalt) of the agent in one of the customary solvents such as naphtha, kerosene, tar oils, etc., and thoroughly mixing such solution with the heated asphalt or tar (about 200° F.) or by stirring the agent (amino alkyl amides) directly with the asphalt blend and heating the mixture to a temperature of about 150° F. for one-half to one hour.

The application of the asphalt composition was effected by thoroughly mixing with the rock aggregate and curing one set of samples for one hour and the other set of samples for two hours at 140° F. The results obtained are shown in the following table. A Venezuelan rapid curing type cut-back asphalt was applied to a dry aggragate and a wet trap rock containing 2% of water.

TABLE 1

Aminoethyl stearylamide

[Stripping resistance test]

Percent agent in R. C. T. cutback	Dry trap rock		Wet trap rock (2% H_2O)		
	1 hr. cure	2 hr. cure	Mixing ability	1 hr. cure	2 hr. cure
0.4 percent	100	100	100	100	100
0.2 percent	100	100	95	90	95
0.1 percent	70	80	90	10	30

In the above table, the term "stripping resistance" is defined as the percentage of the aggregate surface still remaining coated with asphalt, after the coated mixture which has been cured for one hour at room temperature has been covered with water maintained at room temperature for a period of 20 hours.

The reaction products of an ester or a glyceride and polyalkylene polyamines as for example ethyl oleate and diethylene triamine, or triethylene tetra-amine may likewise be used.

I claim:

1. An improved bonding agent for bituminous material comprising a bituminous substance in combination with 0.1% to 1.0% of an amino alkylamide of a carboxylic acid having the general formula RCONR'R''NHR' wherein R stands for a member of the group consisting of a saturated and an unsaturated alkyl group ranging from 10 to 23 carbon atoms, R' stands for a member of the group consisting of hydrogen and an alkyl group and R'' is an alkyl group ranging from 2 to 6 carbon atoms.

2. An improved bonding agent for bituminous material according to claim 1 in which a chlorine substituted alkyl group is represented in the formula by R.

3. Road building materials comprising in intimate combination, a bituminous substance, a mineral aggregate and 0.1% to 1.0% of an amino-alkylamide of a carboxylic acid having the general formula RCONR'R''NHR' wherein R stands for a member of the group consisting of a saturated and an unsaturated alkyl group ranging from 10 to 23 carbon atoms, R' stands for a member of the group consisting of hydrogen and an alkyl group and R'' is an alkyl group ranging from 2 to 6 carbon atoms.

4. An improved bonding bituminous material which comprises an asphalt containing from 0.1% to 1.0% of an amino alkylamide of a carboxylic acid.

5. An improved bonding bituminous material which comprises an asphalt containing from 0.1% to 1.0% of an amino ethylamide of a carboxylic acid.

6. An improved bonding bituminous material which comprises an asphalt containing from 0.1% to 1.0% of amino ethyl stearylamide.

7. An improved bonding bituminous material which comprises an asphalt containing from 0.1% to 1.0% of amino propylamide of a carboxylic acid.

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