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(54) Title: COLOURLESS AND TRANSPARENT BINDER

(57) Abstract: A colourless and transparent binder composition is disclosed. The binder composition comprises 10 to 80% by weight, in terms of total weight of the binder composition, of an oily substance wherein the viscosity index (VI) is not less than 120; and 20 to 90% by weight, in terms of total weight of the binder composition, of a resin wherein the acid number is not more than 1.0 mg KOH/g and the bromine number is not more than 1.0 g Br/100g. The ASTM colour of the binder composition is not more than 1.5. The binder composition is suitably used to prepare paving.



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COLOURLESS AND TRANSPARENT BINDER

Field of the Invention

This invention relates to binder compositions suitable for use in landscape paving installed in public parks, pedestrian walkways and the like, and in particular relates to a colourless and transparent binder suitable for improving transparency.

Background of the Invention

In general, when installing coloured paving in public parks, pedestrian walkways and the like, a binder composition which can be coloured by adding pigments is used. Such binder compositions used for coloured paving include, for example, those in which a resin and/or thermoplastic elastomer and a petroleum-based softener are blended together in specified proportions, anti-oxidants and additional components being added where necessary.

Normally, binder compositions used for coloured paving are exposed outdoors for long periods, so it is necessary to inhibit as far as possible deterioration due to moisture, heat, oils and ultraviolet rays. Binder compositions for use in coloured paving have therefore previously been proposed in which a hydrogenated resin and a hydrogenated thermoplastic elastomer are used respectively for the resin and thermoplastic elastomer with a view to improving weathering properties (see, for example, JP 2001 172469 and JP 2001 329117). Binder compositions for use in coloured paving have also been proposed which use the above mentioned resins and hydrogenated thermoplastic elastomers and where in addition the softener is changed from a petroleum-based

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solvent-extracted oil to a petroleum-based lubricating oil base oil which has a low content of aromatics and double bonds (see, for example, JP 2002 206047).

5 When installing coloured paving as described above, there are also cases where it is desired to constitute a colourless and transparent binder composition without even adding pigments. For example, as described above, it may be possible to treat walkways and so on for which coloured paving is desired from the outset by using
10 colourable binder compositions, but when it is desired to express the colours of the aggregates (especially yellow and white pea gravels) as they are, it is necessary for the binder composition to be colourless and transparent. When white paving especially is desired, it becomes
15 impossible to bring out the whiteness on the surface if a colorant-based binder composition is used. For this reason, it is desirable to use a colourless and transparent binder composition whenever white paving is desired. If it is possible to make such a colourless and
20 transparent binder composition, it will become possible to bring out the whiteness on the surface when coating the surface with gravel, especially white pea gravel, and it will also be possible to use it in other similar applications.

25 In other words, the binder compositions most required in landscape paving work must be capable of improving the aforementioned performance and sustaining the basic performance focused on mechanical strength, while also making it possible to improve production of
30 colours including pale colours such as white and to sustain colour tones.

In the prior art, as described in the aforementioned cited patents, there is the problem that the products

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are, pale yellow in colour and it has not been possible to make them colourless and transparent, ultimately because a solvent extracted oil is used for the base oil.

The present inventors have sought to provide a colourless and transparent binder composition.

Summary of the Invention

Accordingly, the present invention provides a colourless and transparent binder composition comprising: 10 to 80% by weight, in terms of total weight of the binder composition, of an oily substance wherein the viscosity index (VI) is not less than 120; and 20 to 90% by weight, in terms of total weight of the binder composition, of a resin wherein the acid number is not more than 1.0 mg KOH/g and the bromine number is not more than 1.0 g Br/100g; wherein the ASTM colour of the binder composition is not more than 1.5.

According to this invention, it is possible to obtain a colourless and transparent binder composition because it is a mixture of, in terms of the total weight, 10 to 80% by weight of an oily substance wherein the viscosity index (VI) is not less than 120, and, in terms of the total weight, 20 to 90% by weight of a resin wherein the acid number is not more than 1.0 mg KOH/g and the bromine number is not more than 1.0 g Br/100g. Thus, for example in cases where it is desired to express the colours of the aggregates (especially yellow and white pea gravels) as they are, and in cases where it is necessary for the binder composition to be colourless and transparent and also where a white-coloured paving is desired, it becomes impossible to bring out the whiteness on the surface if a colorant-based binder composition is used, but with this invention, where a colourless and

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transparent binder composition is possible, it will be possible to bring out the whiteness on the surface when implementing paving based on such white colours. Also with this invention it is possible, when coating the surface of the gravel, to bring out the whiteness on the surface when using white gravel in particular, and it is also possible to use it in other similar applications.

Detailed Description of the Invention

Given below is an explanation of the details of the optimum configuration by which this invention can be implemented. The colourless and transparent binder composition applied to this invention (referred to below as the binder composition of this invention) contains, in terms of the total weight, 10 to 80% by weight of an oily substance wherein the viscosity index (VI) is not less than 120, and, in terms of the total weight, 20 to 90% by weight of a resin wherein the acid number is not more than 1.0 mg KOH/g and the bromine number is not more than 1.0 g Br/100g. The ASTM colour of the binder composition of this invention is not more than 1.5.

The invention is explained below with reference to the details of the constituent components which form the binder composition and to the reasons for the limits on the numerical values.

The viscosity index (VI) of the oily substance of this invention is set at not less than 120. The viscosity of oily substances varies according to temperature, and is lower the higher the temperature. But this process is not fixed and may vary according to the type of oily substance. In this invention, a definition is made by using the VI as an index which shows the viscosity properties of the oily substance of this invention. This means that by making the VI of the oily substance of this

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invention not less than 120, it is possible to effect performance whereby the viscosity falls gently as the temperature rises. In other words, it is possible to keep the viscosity of the oily substance of this invention high over a wide temperature domain. Also, by establishing the VI in the above mentioned range, it is possible to enhance the thermal stability, so that it becomes possible to inhibit change of colour in the mixture due to heat.

The oily substance of this invention is preferably one synthesised by the Fischer-Tropsch (FT) process or is a poly- α -olefin (PAO) in which linear α -olefins have been polymerised. Linear α -olefins are olefins which have double bonds only at one of the terminals of the molecular chain.

The Fischer-Tropsch (FT) process takes as its raw materials synthesis gas containing a mixture of hydrogen and carbon monoxide and effects a reaction to manufacture hydrocarbons by bringing these into contact with a Fischer-Tropsch catalyst. For example, FT synthesis is carried out by isolating methane from natural gas and using as its raw material the synthesis gas based on an oxidative reaction of this methane portion. By fractional distillation or solvent extraction of the flow of product after this synthesis, the chain-type hydrocarbons are isolated and this can become the oily substance of this invention. As instances of the oily substance of this invention, it is possible to use, for example, Shell XHVITM 5.2 or Shell XHVITM 8.2. The VI of the oily substance of this invention produced on the basis of such an FT process can be 120 or higher.

Also, the poly- α -olefins (PAO), in which linear α -olefins are polymerised, are those where linear α -olefins

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with 6 to 18 carbons (usually 10 carbons) are polymerised into several molecules (usually 2 to 4), and then the double bonds in the molecules are removed by hydrogenation.

5 The ASTM colour of the oily substance is preferably 1.0 or less. In cases where the ASTM colour of the oily substance of this invention before mixing with the resin of this invention exceeds 1.0, the inventors have not
10 been able to make the ASTM colour of the binder composition obtained by mixing it with the resin of this invention 1.5 or less.

 The percentage content of the oily substance of this invention is set, in terms of the total weight, at 10 to 80% by weight. This is because, if the oily substance of
15 this invention is less than 10% by weight, it will be difficult to exhibit the expected effect in respect of the binder composition obtained, and it will also be difficult to mix it with the resin of this invention. It is also because, if the oily substance of this invention
20 exceeds 80% by weight, there is a problem in that the viscosity of the binder composition becomes too low, and the expected performance may not be exhibited.

 For the resin of this invention it should be regarded as a necessary and key condition that the acid
25 number be not more than 1.0 mg KOH/g and the bromine number be not more than 1.0 g Br/100g.

 The value of the acid number is influenced by the number of carboxyl groups or hydroxyl groups contained in the resin. In specific terms, by setting the acid number
30 at not more than 1.0 mg KOH/g, it is possible to reduce the carboxyl or hydroxyl groups in the resin, and it becomes possible to prevent the binder composition losing transparency when it is mixed with the oily substance of

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this invention. This means that with a view to regulating the acid number in the resin of this composition, the upper limit of the polarity of the resin of this invention is regulated when adding it to the oily substance of this invention, which has virtually no polarity.

The value of the bromine number is influenced by the number of double bonds the resin contains. In specific terms, by setting the bromine number at not more than 1.0 g Br/100g, it is possible to reduce the number of double bonds in the resin of this invention, and by this means it is possible to prevent deterioration (decomposition of the binder composition, hardening, colour changes) due to ultraviolet rays in the sun's radiation, or to rainwater, when it serves as paving outdoors. If the number of double bonds is reduced, it is also possible to prevent coloration of the binder composition due to heating during manufacture.

The resin of this invention is a constituent which functions as structural component in the binder composition of this invention, and if its total content is less than 20% by weight relative to the total weight of the binder composition of this invention, the strength of the binder composition decreases and the durability of the paving becomes low. On the other hand, if the content of the resin of this invention exceeds 90% by weight relative to the total weight of the binder composition of this invention, problems will arise in that admixture with the oily substance of this invention will be difficult. For this reason, the content of the resin of this invention is set at 20 to 90% by weight. By making the oily substance of this invention 30% by weight and setting the content of the resin of this invention at 70%

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by weight, it is possible to optimise the viscosity of the resulting binder composition of this invention, and by mixing these while rotating a homomixer at 3000 revolutions/minute for 1 hour at 180°C, it becomes possible to obtain a binder composition of this invention which has a viscosity of 50 ~ 2000 mPa•s at 180°C.

If the bromine number is not more than 1.0 g Br/100g, then the bromine (atomic symbol Br) which may be attached to the double bonds which are present in 100g of the target substance is not more than 1.0g. If the bromine number is more than 1.0 g Br/100g, the number of double bonds increases relatively and the resin will take on colour because of these additional double bonds, or it will take on colour during mixing with the oily substance. For this reason, it is necessary to set the bromine number of the resin of this invention at not more than 1.0 g Br/100g in order to ensure colourlessness and transparency, as expressed by the desired ASTM colour, in respect of the resulting binder composition of this invention.

Examples of the resin of this invention are one or more kinds of any of hydrogenated rosin resins, hydrogenated C5 petroleum resins, hydrogenated C9 petroleum resins, copolymer resins of hydrogenated C5 petroleum resins and C9 petroleum resins, hydrogenated dicyclopentadiene resins, and aromatic modified terpenes, and also unhydrogenated rosin resins, unhydrogenated C5 petroleum resins, unhydrogenated C9 petroleum resins, copolymer resins of unhydrogenated C5 petroleum resins and C9 petroleum resins, unhydrogenated dicyclopentadiene resins, and terpenes.

The examples of the resin of this invention are preferably one or more kinds of any of hydrogenated rosin

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resins, hydrogenated C5 petroleum resins, hydrogenated C9 petroleum resins, copolymer resins of hydrogenated C5 petroleum resins and C9 petroleum resins, hydrogenated dicyclopentadiene resins, aromatic modified terpenes, polyethylene (PE) or polypropylene (PP).

Rosin resins are obtained by distilling pine resin, which is the sap of plants of the Pinaceae family. They are tree resins that have rosin acids as their main constituents.

Petroleum resins are polymers of unsaturated hydrocarbons present in thermally cracked fractions in petroleum refining processes. Their molecular weights are of the order of 100 to 2000, and usually 200 to 1500. They are pale yellow materials with a softening point of the order of 60 to 150°C. Addition of hydrogen to the double bonds in the molecules of such resins which have not been hydrogenated will constitute a hydrogenated resin of this invention, and the softening point of such a hydrogenated resin of this invention will normally be of the order of 90 to 130°C. C9 petroleum resins are petroleum resins in which C9 fractions form the raw material, and C5 petroleum resins are petroleum resins in which C5 fractions form the raw material.

The binder composition of the invention preferably further comprises a thermoplastic elastomer.

The thermoplastic elastomer is added in order to demonstrate elasticity in respect of the resulting binder composition of this invention. The thermoplastic elastomer is a constituent which functions as a structural component as well as imparting flexibility to the binder composition of this invention. The thermoplastic elastomer of this invention also supports a role as a vibration dampening material. Furthermore, the

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thermoplastic elastomer of this invention also has the effect of reducing temperature dependency in the viscoelastic properties in the binder composition of this invention. This means that, by controlling the mixing ratio of the thermoplastic elastomer of this invention, it is possible to keep the elastic modulus of the resulting binder composition of this invention within an expected range.

It is desirable that the bromine number of the thermoplastic elastomer of this invention should be set at not more than 1.0 g Br/100g. The reason for this is that eliminating double bonds in the molecules not only prevents change of colour and coloration during mixing with other structural constituents, but it also prevents change of properties, deterioration or colour change, not least molecular separation and polymerisation due to ultraviolet rays from exposure to the sun, or due to water and acid from rainfall, when used for the binder composition of this invention.

The content of the thermoplastic elastomer of this invention is preferably set at not more than 10% by weight. The reason for this is that if the content of the thermoplastic elastomer of this invention exceeds 10% by weight, the viscosity of the binder composition of this invention will rise and it will be difficult to use it with current implementation machinery.

Examples of the thermoplastic elastomer of this invention are one or more kinds of any of SEBS (styrene-ethylene-butylene-styrene block copolymer), SEPS (styrene-ethylene-propylene-styrene block copolymer) or EEA (ethylene-ethylacrylate block copolymer). Of these examples of the thermoplastic elastomer of this invention, it is especially preferable to use SEBS, with

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which modification of properties is not likely to occur when it is offered for use.

ASTM colour is a classification between the pale colour of the pale yellow of 0.5 and the dark colour of 8.0 for refined petroleum products. The numerals in this ASTM colour denote the number of an ASTM standard colour when there is almost identity after comparing an actual sample with a standard colour. The details of the actual ASTM experimental method are set out in JIS K 2580. Referring to an ASTM colour of not more than 1.5 as here means that for practical purposes it is colourless and transparent.

In other words, according to this invention, it is possible to obtain a colourless and transparent binder composition. Thus, for example in cases where it is desired to express the colours of the aggregates (especially yellow and white pea gravels) as they are, and in cases where it is necessary for the binder composition to be colourless and transparent and also where a white-coloured paving is desired, it becomes impossible to bring out the whiteness on the surface if a colorant-based binder composition is used, but with this invention, where a colourless and transparent binder composition is possible, it will be possible to bring out the whiteness on the surface when implementing paving based on such white colours. Also with this invention it is possible, when coating the surface of the gravel, to bring out the whiteness on the surface when using white gravel in particular, and it is also possible to use it in other similar applications.

The present invention further provides an asphalt composition comprising a binder composition according to the invention and aggregate. The term "asphalt" is used

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in the present invention to denote a mixture of binder and aggregate, and does not imply that the composition is bituminous. Preferably the aggregate is yellow or white in colour, and is most preferably yellow and/or white pea gravel. The asphalt is suitably used to provide paving, and the present invention further provides paving comprising a binder composition according to the invention. In a further aspect the present invention provides the use of a binder composition according to the invention to prepare paving. The binder composition is suitably mixed with aggregate to prepare asphalt using procedures known to the person skilled in the art and the asphalt is laid using conventional paving techniques.

The binder composition of this invention is not limited to coloured paving applications. It may also be suitable for naturally washed paving applications where no pigments are used, and apart from as a paving material it may also be used in roofing sheets, damp-proofing sheets, adhesives, vibration-damping materials, sound-proofing materials, ceiling materials and pipe-coating materials. In all these cases it is possible to demonstrate the benefit of being able to make it colourless and transparent.

This resulting binder composition may also be made so as to have a viscosity of 20 to 5000 mPa.s at 180°C, and preferably should be made to have a viscosity of 50 to 2000 mPa.s at 180°C. For example, when using it for paving roadways, because it will be heated to a temperature of the order of 180°C (140 to about 200°C) and will take on a molten state, if it is so structured that the viscosity is within the above mentioned range at the said temperatures, it will be possible to produce a

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suitable state when actually paving the roadways therewith.

Examples

5 The effect of the invention is explained in concrete terms below by giving examples of embodiment and comparative examples. In both the examples of embodiment and comparative examples, oily substances and resins are mixed together, being mixed for 1 hour at a speed of 3000 revolutions/minute at 180°C using a homomixer and thus
10 preparing the binder compositions of each of the examples of embodiment and comparative examples. The resulting binder compositions were then evaluated for two items, transparency and ASTM colour.

The method of evaluating transparency was that,
15 after mixing the component substances, the prepared binder compositions in a thickness of 1.0 mm were sandwiched between two PyrexTM glass plates of 1.2 mm thickness and left to cool to room temperature (25°C). Those that had lost transparency to visible light (direct
20 observation) were marked "X" and those that were still transparent were marked "O".

The acid number as specified for the oily substances and resins was evaluated according to the method disclosed in JIS K0070, the bromine number according to
25 the method disclosed in JIS K2605 and the viscosity index (VI) according to the method disclosed in JIS K2283.

The ASTM colour was evaluated on the basis of the ASTM experimental method specified in the above mentioned JIS K 2580.

30 The ASTM colour was measured only in respect of cases where transparency was maintained (designated "O") and was not measured (shown in the tables as "--") where transparency was not maintained (designated "X").

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Cases in respect of the binder composition where transparency was maintained and the ASTM colour was not more than 1.5 were given an overall evaluation of "O". Cases where transparency was lost or the ASTM colour exceeded 1.5 were given an overall evaluation of "X".

Oily substance 1 is an oily substance synthesised on the basis of the Fischer-Tropsch (FT) process. This oily substance 1 has a kinetic viscosity at 100°C of 5.2 mm²/s, a VI of 146 and an ASTM colour of L0.5. In each case, these lie within the range specified for the physical properties in this invention.

Oily substance 2 is an oily substance of this invention wherein α -olefins have been synthesised, and a poly- α -olefin (PAO) was used for the present sample. This oily substance 2 has a kinetic viscosity at 100°C of 4.0 mm²/s, a VI of 136 and an ASTM colour of L0.5. In each case, these lie within the range specified for the physical properties in this invention.

Oily substance 3 is an oily substance manufactured by solvent refining. This oily substance 3 has a kinetic viscosity at 100°C of 11.1 mm²/s, a VI of 96 and an ASTM colour of 1.0. The VI is therefore outside the range specified for the physical properties in this invention.

Oily substance 4 is an oily substance manufactured by solvent refining. This oily substance 4 has a kinetic viscosity at 100°C of 31.5 mm²/s, a VI of 96 and an ASTM colour of 2.0. The VI and ASTM colour are therefore outside the range specified for the physical properties in this invention.

As for the samples of the resin of this invention, resin 1 is a hydrogenated DCPD (dicyclopentadiene). This resin 1 has an acid number of less than 0.1 mg KOH/g, a bromine number of less than 0.1 g Br/100g, and an ASTM

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colour of L0.5. This resin 1 lies within the range specified for the physical properties in this invention.

Resin 2 is an aromatic modified terpene, and has an acid number of less than 0.1 mg KOH/g, a bromine number of less than 0.1 g Br/100g, and an ASTM colour of 0.5. This resin 2 lies within the range specified for the physical properties in this invention.

Resin 3 is polyethylene, and has an acid number of less than 0.1 mg KOH/g, a bromine number of less than 0.1 g Br/100g, and an ASTM colour of L0.5. This resin 3 lies within the range specified for the physical properties in this invention.

Resin 4 is terpene phenol, and has an acid number of 70 mg KOH/g and an ASTM colour of 1.0. In other words, the acid number of this resin 4 lies outside the range specified for the physical properties in this invention.

Resin 5 is a C5 petroleum resin and C9 petroleum resin co-polymer, and has an acid number of less than 0.1 mg KOH/g, a bromine number of 20 g Br/100mg and an ASTM colour of 4.0. In other words, the bromine number of this resin 5 lies outside the range specified for the physical properties in this invention.

Resin 6 is C9 petroleum resin, and has an acid number of less than 0.1 mg KOH/g, a bromine number of 25 g Br/100g and an ASTM colour of 4.0. In other words, the bromine number of this resin 6 lies outside the range specified for the physical properties in this invention.

Resin 7 is an unhydrogenated DCPD (dicyclopentadiene resin), and has an acid number of 180 mg KOH/g, a bromine number of less than 0.1 g Br/100g and an ASTM colour of 4.0. In other words, the acid number of this resin 7 lies outside the range specified for the physical properties in this invention.

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Resin 8 is a C5 petroleum resin, and has an acid number of 2 mg KOH/g, a bromine number of 60 g Br/100g and an ASTM colour of 5.0. In other words, the acid number and the bromine number of this resin 8 lie outside the range specified for the physical properties in this invention.

The examples of embodiment and the comparative examples were given by mixing each of the resins 1 to 8 with the oily substances 1 to 4. The mixing ratio was, in terms of the total weight, 30% by weight of oily substances 1 to 4 and, in terms of the total weight, 70% by weight of resins 1 to 8. The cases which lay within the range specified for the physical properties in this invention were oily substances 1 and 2 and resins 1 to 3. The cases which lay outside the range specified for the physical properties in this invention were oily substances 3 and 4 and resins 4 to 8. For this reason, the combinations of oily substances 1 and 2 with resins 1 to 3 were taken to be examples of embodiment of this invention and all the others, the combinations of oily substances 3 and 4 with resins 4 to 8, were taken to be comparative examples for this invention.

Table 1 shows the results of the evaluation of transparency and ASTM colour when resins 1 to 8 were mixed in the above mentioned respective mixing proportions relative to oily substance 1.

Table 1

	ASTM Colour	Acid Number mg KOH/g	Bromine Number g Br /100g	Ex. 1	Ex. 2	Ex. 3	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3	Comp. Ex. 4	Comp. Ex. 5
Oily Substance 1	L0.5	Not measured	Not measured	30	30	30	30	30	30	30	30
Resin 1	L0.5	Below 0.1	Below 0.1	70							
Resin 2	0.5	Below 0.1	Below 0.1		70						
Resin 3	L0.5	Below 0.1	Below 0.1			70					
Resin 4	1.0	70	Not measured				70				
Resin 5	4.0	Below 0.1	20					70			
Resin 6	4.0	Below 0.1	25						70		
Resin 7	4.0	180	Below 0.1							70	
Resin 8	5.0	2	60								70
Transparency											
ASTM Colour											
Overall Evaluation											
				0	0	0	X	X	X	X	X
				0.5	1.5	1.5	--	--	--	--	5.0
				0	0	0	X	X	X	X	X

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Table 2 shows the results of the evaluation of transparency and ASTM colour when resins 1 to 8 were mixed in the above mentioned respective mixing proportions relative to oily substance 2.

Table 2

	ASTM Colour	Acid Number mg KOH/g	Bromine Number g Br /100g	Ex. 4	Ex. 5	Ex. 6	Comp. Ex. 6	Comp. Ex. 7	Comp. Ex. 8	Comp. Ex. 9	Comp. Ex. 10
Oily Substance 2	L0.5	Not measured	Not measured	30	30	30	30	30	30	30	30
Resin 1	L0.5	Below 0.1	Below 0.1	70							
Resin 2	0.5	Below 0.1	Below 0.1		70						
Resin 3	L0.5	Below 0.1	Below 0.1			70					
Resin 4	1.0	70	Not measured				70				
Resin 5	4.0	Below 0.1	20					70			
Resin 6	4.0	Below 0.1	25						70		
Resin 7	4.0	180	Below 0.1							70	
Resin 8	5.0	2	60								70
Transparency											
ASTM Colour											
Overall Evaluation											
				0	0	0	X	X	X	X	X
				0.5	1.5	1.5	--	--	--	--	5.0
				0	0	0	X	X	X	X	X

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Table 3 shows the results of the evaluation of transparency and ASTM colour when resins 1 to 8 were mixed in the above mentioned respective mixing proportions relative to oily substance 3.

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Table 4 shows the results of the evaluation of transparency and ASTM colour when resins 1 to 8 were mixed in the above mentioned respective mixing proportions relative to oily substance 4.

Table 4

	ASTM Colour	Acid Number mg KOH/g	Bromine Number g Br /100g	Comp Ex. 19	Comp Ex. 20	Comp Ex. 21	Comp Ex. 22	Comp Ex. 23	Comp Ex. 24	Comp Ex. 25	Comp Ex. 26
Oily Substance 4	2.0	Not measured	Not measured	30	30	30	30	30	30	30	30
Resin 1	L0.5	Below 0.1	Below 0.1	70							
Resin 2	0.5	Below 0.1	Below 0.1		70						
Resin 3	L0.5	Below 0.1	Below 0.1			70					
Resin 4	1.0	70	Not meas.				70				
Resin 5	4.0	Below 0.1	20					70			
Resin 6	4.0	Below 0.1	25						70		
Resin 7	4.0	180	Below 0.1							70	
Resin 8	5.0	2	60								70
Transparency				O	O	O	X	X	X	X	O
ASTM Colour				2.5	2.5	2.5	--	--	--	--	5.0
Overall Evaluation				X	X	X	X	X	X	X	X

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As shown in Table 1, Examples of Embodiment 1 to 3, in which each of resins 1 to 3 have been mixed with oily substance 1, all have excellent transparency and the ASTM colour is 1.5 or less, so that binder compositions with satisfactory hue have been obtained. In contrast, Comparative Examples 1 to 5, in which each of resins 4 to 8 have been mixed with oily substance 1, either lack transparency or have an ASTM colour that exceeds 1.5.

Again, as shown in Table 2, Examples of Embodiment 4 to 6, in which each of resins 1 to 3 have been mixed with oily substance 2, all have excellent transparency and the ASTM colour is 1.5 or less, so that binder compositions with satisfactory hue have been obtained. In contrast, Comparative Examples 6 to 10, in which each of resins 4 to 8 have been mixed with oily substance 2, either lack transparency or have an ASTM colour that exceeds 1.5.

In the case of resin 4, the ASTM colour of the resin itself is low at 1.0, but since the acid number is high at 70 mg KOH/g and it has polarity, once it has been mixed with oily substances 1 and 2 transparency of the binder composition is lost and the ASTM colour cannot be measured. In the case of resins 5 and 6, the bromine number is large at 20 to 25 g Br/100g, and since polarity thus arises in the molecules, once it is mixed with oily substances 1 and 2 transparency of the binder composition is lost and the ASTM colour cannot be measured. In the case of resin 7, since the acid number is high at 180 mg KOH/g and it has polarity, once it is mixed with oily substances 1 and 2 transparency of the binder composition is lost and the ASTM colour cannot be measured.

As shown in Table 3, Comparative Examples 11 to 18, in which each of resins 1 to 8 have been mixed with oily substance 3, either lack transparency or have an ASTM

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colour that exceeds 1.5. As shown in Table 4, Comparative Examples 19 to 26, in which each of resins 1 to 8 have been mixed with oily substance 4, either lack transparency or have an ASTM colour that exceeds 1.5.

5 In the case of oily substances 3 and 4, because the VI is low and thermal stability is low, they change colour through heating during mixing, and even when resins 1 to 3 are used the ASTM colour is at least 2.0, so that binder compositions of satisfactory hue cannot be
10 obtained. In the case of resin 4, the ASTM colour of the resin itself is low at 1.0, but since the acid number is high at 70 mg KOH/g and it has polarity, once it has been mixed with oily substances 3 and 4 transparency of the binder composition is lost and the ASTM colour cannot be
15 measured. In the case of resins 5 and 6, the bromine number is large at 20 to 25 g Br/100g, and since polarity thus arises in the molecules, once it is mixed with oily substances 3 and 4 transparency of the binder composition is lost and the ASTM colour cannot be measured. In the
20 case of resin 7, since the acid number is high at 180 mg KOH/g and it has polarity, once it is mixed with oily substances 3 and 4 transparency of the binder composition is lost and the ASTM colour cannot be measured.

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C L A I M S

1. A colourless and transparent binder composition comprising:
10 to 80% by weight, in terms of total weight of the binder composition, of an oily substance wherein the
5 viscosity index (VI) is not less than 120; and
20 to 90% by weight, in terms of total weight of the binder composition, of a resin wherein the acid number is not more than 1.0 mg KOH/g and the bromine number is not more than 1.0 g Br/100g;
10 wherein the ASTM colour of the binder composition is not more than 1.5.
2. A colourless and transparent binder composition according to claim 1, wherein the oily substance has been synthesised by the Fischer-Tropsch (FT) process or is a
15 poly- α -olefin (PAO).
3. A colourless and transparent binder composition according to claim 1 or claim 2, wherein the ASTM colour of the oily substance is not more than 1.0.
4. A colourless and transparent binder composition
20 according to any preceding claim, wherein the resin is one or more kinds of resin chosen from the group consisting of hydrogenated rosin resins, hydrogenated C5 petroleum resins, hydrogenated C9 petroleum resins, copolymer resins of hydrogenated C5 petroleum resins and
25 C9 petroleum resins, hydrogenated dicyclopentadiene resins, aromatic modified terpenes, polyethylene (PE) or polypropylene (PP).
5. A colourless and transparent binder composition according to any preceding claim, further comprising up
30 to 10% by weight, in terms of total weight of the binder

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composition, of a thermoplastic elastomer wherein the bromine number of the thermoplastic elastomer is not more than 1.0 g Br/100g.

5 6. A colourless and transparent binder composition according to claim 5, wherein the thermoplastic elastomer is one or more kinds of elastomer chosen from the group consisting of SEBS (styrene-ethylene-butylene-styrene block copolymer), SEPS (styrene-ethylene-propylene-styrene block copolymer) or EEA (ethylene-ethylacrylate
10 block copolymer).

7. An asphalt composition comprising a colourless and transparent binder composition according to any preceding claim and aggregate.

8. Paving comprising a colourless and transparent
15 binder composition according to any one of claims 1 to 6.

9. Use of a colourless and transparent binder composition according to any one of claims 1 to 6 to prepare paving.

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/059448

A. CLASSIFICATION OF SUBJECT MATTER

INV. C08L91/00 C08L95/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE WPI Week 200233 Thomson Scientific, London, GB; AN 2002-286062 XP002504813 & JP 2001 329117 A (IDEMITSU KOSAN CO LTD) 27 November 2001 (2001-11-27) cited in the application abstract	1-9
X	DATABASE WPI Week 200164 Thomson Scientific, London, GB; AN 2001-568141 XP002504814 & JP 2001 172469 A (SHOWA SHELL SEKIYU KK) 26 June 2001 (2001-06-26) cited in the application abstract ----- -/--	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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- *E* earlier document but published on or after the international filing date
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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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International application No

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