SANHO CHEMICAL CO., LTD.
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KINGMIDE 550-G

KINGMIDE 550G is a solid type fatty polyamide resin synthesized by a polycondensation of mainly the dimerized fatty acid and the alkylenepolyamines.The major applications of KINGMIDE 550G are in the rotogravure printing inks .

1：Major Characteristics

KINGMIDE 550G shows superior adhesion onto wide variety of surface so that it is highly useful for rotogravure ink formulation .The followings are the major characteristics of the KINGMIDE 550G as used in a rotogravure ink formulation;

(a). Good solubility into various conventional industrial solvents.
(b). Superior adhesion onto many kind of substrates.
(c). Good wetting(=dispersion,)of the pigments and dyestuffs.
(d). Good resistance to water, oil and chemicals..
(e). Fast release of the solvent from the printed film..
(f). Smooth and hard film surface with high gloss.
(g). Smooth and hard film surface with high gloss, which is suitable for over-printings.
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2：Sales Specifications

Appearance	：Brown Yellow Pellets.
Softening Point(Ball and Ring / ℃)	：110 ±5
Viscosity (Gardner-Holdt / 25℃)	：F ~ I *
Color (Gardner Hellige)	：10 max.
Sp.Gr. (25℃)	：0.98

*The solution viscosity of KINGMIDE 550 are of 50% solution in Toluene/ IPA (7：3)

3：Solubility Data

SOLVENT	KINGMIDE 50

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	Resin content (%)	Resin content (%)
Acetone	40	**In**
Methyl-Ehtyl Ketone	40	**In**
Methyl-Isobutyl Ketone	40	**In**
Ethylacetate	40	**In**
ISOBUTYL ACETATE	40	**In**
N-heptane	40	**In**
Nitropropylene	40	**In**
Toulene	40	**D~E**
I P A / n-Hexane=1 ：1 I P A / n-Hexane=1 ：1 I P A / n-Hexane=1 ：1	40 30 20	**<A** **<A** **Gel**
Ethylalcohol / Isopropanol=1：3 Ethylalcohol / Isopropanol=1：3 Ethylalcohol / Isopropanol=1：3	40 30 20	**C** **<A** **Gel**
Ethylalcohol / Isopropanol=1：1 Ethylalcohol / Isopropanol=1：1 Ethylalcohol / Isopropanol=1：1	40 30 20	**In** **In** **<A**
Isopropanol/Toluene/Ethylacetate=1：1：1 Isopropanol/Toluene/Ethylacetate=1：1：1 Isopropanol/Toluene/Ethylacetate=1：1：1	40 30 20	**D~E** **<A** **<A**

*The alphabets above are for the Gardner-Holdt Scale, at 20~22 ℃.

*In = Insoluble, Gel =Gelled.

An optimum solvent release(=drying,) rate can be attained by the proper combination of the solvent.

4：Low Temperature Characteristics

KINGMIDE 550 solutions may become gelled when subjected to low temperature for a long time.

5：Factors to influence gelation

(1)：Concentration(N.V.%) of the solution;

－KINGMIDE 550G and the solvent system has the optimum balance for low temperature stability.

－Low solid content is not more stability

(2)：Type of the solvent , or solvent system;

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- A mixed solvent system of alcohol(s) and hydrocarbon(s), in general, give better stability at lower environmental temperature compared with any single solvent.
- Thus, when the resin content is the same, a solution of toluene and propanol mixture is more stable and retains fluidity far more down to the low temperature range than dose the one which contains either alcohol(s) or hydrocarbon(s) as the sole solvent.
- Alcohol have more solubility than any other conventional solvents for KINGMIDE 550g. Among alcohols, those of linear carbon-carbon structure (=normal alcohols,) produce more stability than do those of branched chain(=Iso alcohol,).
- Also , the longer the carbon chain , generally the better is the anti-gelling property at low temperature.

  For example , among solution of the same N.V.%,

  The one of xylene-butanol shows better stability than that of toluene-propanol (=normal,) which is in turn still more stable than that of toluene-isopropanol combination, provided the ratios of the each pair of solvents are all the same.

  In this case, the xylene-butanol solution shows a higher solution viscosity in the room temperature range, compared with the toluene-IPA system of the same resin content. However , as the environmental temperature goes down, toluene-IPA solution gel at a higher temperature than does the xylene-butanol system.
- The level of solution viscosity at the room temperature (i.e.,at 25℃ range) does not seem to have much to do with the low temperature characteristics of the solution.
- Aromatic hydrocarbons usually give more stability than the aliphatic hydrocarbons do.

6：Solution viscosity and low temperature stability

KINGMIDE 550 is dissolved at the 40% resin concentration in the mixed solvents of toluene and isopropanol (IPA) blend at several different ratios. Each varnish was then subjected to the designed temperature for 24 hours, and solution stabilities under low temperature were observed;

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Solvent system ratio	Bubble Viscosity(25℃ Gardner-Holdt)	Stability	
		10℃	5℃
8 / 2	H	HG	HG
6 / 4	F	SG	HG
4 / 6	F	HG	HG
2 / 8	G ~ H	HG	HG

SG = Soft gel HG = Hard gel

Similar tests as above were conducted in a mixed solvent system of toluene ：IPA：ethylactate =2：2：1 in weight . In this case , the resin content (N.V.%) was made defference.

N.V.%	Bubble Viscosity(25℃ Gardner-Holdt)	Stability		
		15℃	10	5℃
40	E	HG	HG	HG
30	<A	F	PG	HG
20	<A	F	F	PG

F = Remains in solution form (fluid)
PG = Partially gelled HG = Hard gel

7：Gel recovery time of KINGMIDE 550G **in the mixed solvent system of toluene / isopropanol / ethylacetate.**

KINGMIDE 550G solutions of various resins contents(N.V.%) in a solvent system of toluene / IPA / ethylacetate = 2：2：1 in weight ,have been kept at 10℃ for 24 hours. Afterwards, some of the samples become gelled , and those cold gels were then kept at the room temperature of 20℃ where the time (in minutes,) needed to recover original fluidity were observed as follows;

N.V.% of KINGMIDE 550G	Gel recovery time (in minutes)
40%	>400
30%	30
20%	F

F = not gelled at 10℃.

8：Selection of pigments and dyes

KINGMIDE 550G is very low in the chemical reactivities as seen by the low acid , and amine values, so that practically no particular pigments and dyes are to be avoided for use in the KINGMIDE 550G based ink formulations.

Pigment：Pigments of high acidity should be refrained.

Dyes ：Dyes to be employed must be soluble type.

Pigments and dyes for KINGMIDE 550G based ink should not contain any manganese

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and/or cobalt components, as those colourant are likely to cause deterioration of the ink film after printing due to oxidation.
This deterioration results in blocking of the ink film as well as bad odor.

Example of formulation：

For rotogravure ink：

KINGMIDE 550G	23 parts
Organic pigment	10
Nitrocellulose H 1/4s	4
Toluene	37
Isopropylalcohol(IPA)	16
Ethylacetate	10
Anti-oxidant (B.H.T)	0.1
Anti-oxidant (D.L.T.P)	0.1
TOTAL	100.2

*D .L .T.P =DILAURYL THIODIPROPIONATE

$S[(CH_2CH_2COO(CH_2)_{11}CH_3)]_2$

9：Individual characteristics of KINGMIDE 550G

The viscosity , heat resistance (heat blocking resistance) , oil resistance , and soap resistance are measured as follows when employ cyanine blue as organic pigment into the KINGMIDE 550G resin, in accordance with the formulation given for the rotogravure inks.

Viscosity of inks：30 sec. at 18℃ , by Zahn Cup NO.4

Heat blocking resistance ：

Heat blocking resistance of inks printed on two ply of aluminium foil were measured as follows , by pressing them at each specified temperature by Heat-Sealing Test Machine.

Press load：1 kgf /cm^2

Press time： 1 second

(a) In case of Face to Face;

Temperature on the Heat-Sealing Bar				
100℃	110℃	120℃	130℃	140℃
G	G	PB	B	B

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(b) In case of Face to Glassine paper;

Temperature on the Heat-Sealing Bar				
100℃	110℃	120℃	130℃	140℃
G	G	PB	PB	B

G = good PB = partially blocking B = totally blocking.

Oil resistance ：Good .

Smear ink films printed on the treated polyethylene films with margarine , and leave them alone for 24 hour at room temperature. Abrasion test was conducted after wiping down margarine on the ink films.

Load ：250 grs.

Frictional oscillation ：100 times.

Soap resistance ：Excellent .

Immerse ink films printed on aluminium foil into one % of soap solution at room temperature ; and put them out after 18 hours to conduct the resistance .

Water resistance ：Excellent .

(a) Immerse ink films printed on treated polyethylene films in tap water for 16 hours, and then remove water to conduct Scotch Tape Test.

(b) Immerse ink films printed on treated polyethylene films in tap water for 16 hours, When wrinkle test was conducted using "Face-to Face" printed on the treated polyethylene films, and NO.s of wrinkle ; 20 times.

10：Formulations to enhance adhesion onto untreated polyolefin films

Example of formulation to enhance adhesion onto polyolefin (polyethylene and polypropylene, etc.,) films is as follow, although no adhesion is generally believed when polyamide resins are employed onto untreated films.

Example of formulation：

KINGMIDE 550	20 parts
Organic pigment	10
Dammargum	7
Palmitic acid amide wax	1
Toluene	54
Isopropylalcohol(IPA)	8
Anti-oxidant (B.H.T)	0.1
Anti-oxidant (D.L.T.P)	0.1
Total	100.2 parts