A STUDY OF THIXOTROPIC ALKYDS BASED ON "ARAM1DE CHEMISTRY"

Jain Anamika

Dept. of Chemistry, Govt. Girls P.G. College, Indore (MP),INDIA

***Available online at*: www.isca.in**
(Received 26th March 2011, revised 28th March 2011, accepted 5thApril 2011)

Abstract

Polyamides are reacted with alkyd resins to give thixotropic (nondrip) consistency. The Existing thixotropic technology often fails due to too weak structures. Also paints based on higher solid systems are more sensitive to tinting systems based on water, surfactants & other solvents, the thixotropic structure is hence not stable any more, also they lose their structure forming ability at temperatures above 45° C. This is due to poor association capability of H-bonding network of polyamide based modifiers.

So to get the desired rheological properties, if stabilizers are added in the final paint formulation, such paints could also become sensitive to changes in weather conditions and may not remain stable over a period of time. The answer to this problem is to incorporate the rheological properties into resin instead of paint formulation. So there is a need for stronger & more stable thixotropic structures. If a polymide resin based on aromatic amide moieties was reacted with a dimeric fatty acid, it could be used to develop alkyd resins which show superior gel forming properties. Thus a new family of thixotropic alkyd resins for decorative applications has been developed.)

Introduction

Polyamide modified alkyd resins are exclusively used in air drying decorative paints. They are used as blends with the unmodified alkyds or urethane modified alkyds to produce the thixotropic decorative paints.

In the growing market for higher solid systems for decorative paints, reduction in the amount of solvent while keeping paint performance on the higher level is the main goal.

To get HS paints, alkyds resins with lower molecular weight, longer oil length should be designed, A combination of thixotropic resins & rheology modifiers such as Bentones, Clays, aerosil or hydrogenated castor oils & waxes are used to get the right flow-sag balance, resulting in a stepwise formulation of a complex paint.

The incorporation of proper rheological properties into the resins is must to get the stable thixotropic structure. The 3 basic building blocks causing thixotropy are the amide, the urethane & the urea group.

A new family based on aramide chemistry exhibits a number of important features, which makes it suitable for use in high solid & high gloss decorative paints & stain applications. Such a paint shows superior properties when compared to traditional polyamide based types or those based on urethane or urea chemistry.

Objective: To study thixotropic alkyds based on "Aramide Chemistry". To find out the typical physical properties of different polyamide based on thixotropic alkyd resins.

Material and Methods

Table-1: Formulations for thixotropic alkyd

Soybean oil	29.45%
Pentaerythritol	6.43%
Phthalic anhydride	16.94%
Fumaric acid	0.19%
Xylene	1.92%
Resin	2.30%
White Spirit (Diluent)	42.77%
Lithium Hydroxide	0.008%

Process: Its manufacture involves:

Alcoholysis: Soybean oil & pentaerythritol are alcoholysed at 245°C using lithium hydroxide as alcoholysis catalyst. Once a tolerance of one part sample to 3 parts methanol (at 25°C) is obtained, the reactants are cooled to below 180°C & phthalic anhydride, fumaric acid, xylene are added.

Polycondensation : Reaction is carried out at 260°C, once an acid value of 16mg KOH/ gm has been achieved, xylene is removed & esterification is continued using a fusion process until an acid value below 12 mg KOH/gm & viscosity of 20-25 poise at 25°C is achieved..

Polyamide Reaction: The reactants are cooled to 210°C & resin is added. The reactor is held at 210°C, while the reaction between alkyd & resin occurs.
The course of reaction is studied by determination of clarity of a 10% solution in white spirit. When the resin sample is completely' clear, the reactants are cooled & diluted with white spirit. By taking 5 different thixotropic alkyds, Theological measurements were made in the white spirit. They all have a gel concentration of 25%.

Although the slope of graphs is equal showing equal recovery speed, the aramide based thixotropic alkyd appears more resistant to white spirit compared to polyamide, urea or urethane technology.

The dependence of temperature: The aramide based thixotropic alkyd shows a much stronger resistance against higher temperature. Polyamide loses its structure completely at higher temperature (above 45°C). The urea curve however, starting with low G' value at room temperature shows an increasing structure at elevated temperature, but it leads to handling problems in industrial use.

Result and Discussion

The rigid aromatic molecule has less freedom of torsion in aramide complex with respect to amide bonds. Hydrogen bonds in aromatic ring are stabilised by the mesomeric effects. When temperature is increased from 0°K to 300°K, H-bond bridges in aramide complex remain intact while in Butane diamide complex, molecule loses its structure on one side of the complex by increasing temperature. Hence due to lack of effective H-bond bridging & stabilizing groups aliphatic amide polymers lose their structure. So aramide based resin has the strongest ability due to efficient H-bridging.

Conclusion

The new thixotropic resin family has strong stabilising properties in polar solvents particularly at higher temperature compared to other well known systems. They are easy to handle & can be used to replace actual traditional resin mixtures. This resin also stabilises pigment pastes. The combination of strong association forces by hydrogen attraction & low [viscosity makes it possible to use this type of thixotropic resin in high ijoss paint systems. The paint manufacturing becomes easier, more accurate & more Economical.

References

1. Bridle, Pitture Vernici, **63 (2), (1987)**

2. Nae H. N., Am. Paint and coat, *J. Jan.* **(1993)**

3. Homer D., A. Wickers, 4th Asia - Pacific Conf. paper 26, Hoi Kong **(1994)**

4. Dent B.J. and Bernlmaier R., *Am. Paint J.* **76(26), (1991)**

5. Rees S., Pol. Paints, *Coirs J*., **185, (1995)**

6. Newton L., Paint and Resins, **(1982)**

7. Pauling L., *J. Amer. Chem. Soc.*, **(1947)**

8. Aerts J. and King G. S. D., *Bull. Chim. Belg.,* 106, **(1997)**

Table-2: Some typical physical properties of different polyamide based thixotropic alkyd resins

Resin	Thermos Tabel> 50^0C	Polar Solvent Resistance	For High Solvent	High gloss	Handling at 70^0C	Handle at 20^0C
Polyamide	No	No	No	No	Yes	Yes
Polyurea	Yes	Yes	Yes	Yes	No	No
Polyuretrhane	Yes	Yes	Yes	Yes	Yes	No
Polyaramide	Yes	Yes	Yes	Yes	Yes	Yes