



NOVEL ECOFRIENDLY WATER THINNABLE PAINT BASED ON LINSEED OIL

P. P. Chahande

Department of Chemistry, Sevadal Mahila Mahavidyalaya, Nagpur (M.S.)

priyadarshinichahande@gmail.com

Abstract

A novel chain stoppered alkyd with 17.5 percent oil length has been synthesized using benzoic acid and rosin as chain stoppers. The heating schedule was over a range of temperatures 170-245° C for 8 to 11.5 hours. The order of addition and procedural details has been worked out. Alkyd emulsion pastes containing this novel resin, poly vinyl alcohol, water and small quantity of organic solvents have been formulated. These emulsion pastes have storage stability of six months. The above emulsion pastes was used for the formulations of finishing paints. The prepared compositions are on par or sometimes better than commercial samples. They are economical, technically sound and ecofriendly..

Keywords: Alkyd resin, emulsion pastes, finishing paints.

Introduction

Today human race is looking forward to increase longevity with a desire to live long and enjoy the life at its best and the solution for that is preservice of health. Among the various factors essential for preservice of health, pollution free environment stands at top. This pollution free environment is possible only when we conserve the nature. The demand for ecofriendly products is growing continuously in the last two decades. Polymeric materials play a prominent role in everyday life and have been essential to a variety of industries. Now a days most commercially available polymers are derived from non renewable resources and account for approximately 7% of worldwide oil and gas fuel. Considering the continuous depletion of fossil feed stock, dramatic fluctuations in the oil price and environmental issue, academic and industrial researches are devoting increasing attention and efforts to the utilization of renewable resources as raw material for the production of polymeric material. The most widely used renewable raw material include polysaccharides, wood, proteins and plant oils. Among these, vegetable oils are the most widely used renewable resources due to their low toxicity, inherent biodegradability, ready availability and relatively low price. Rosin is a residual obtained from the distillation of pine exudates. It is also abundantly available and widely used in large number of industrial products like paints, detergents, cosmetics and pharmaceuticals.

In the present research work we wish to synthesize very short oil chain stoppered alkyds which use higher proportions of rosin and raw materials of vegetable origin. The idea is to use a binder system that can take up water and ethanol instead of mineral turpentine and

xylene. In our laboratory we are concentrating on novel resin synthesis and develop binders which can take atleast 50 % water as a substitute for organic solvents¹²³⁴⁵ The reaction conditions have been established so as to make the alkyd synthesis safe, simple and easy to control on commercial scale. We have used rosin and benzoic acid as chain stoppers and controlled the reaction without much difficulty.

EXPERIMENTAL**Synthesis of Alkyd Resin⁶**

Linseed oil, rosin, all the ingredients except phthalic anhydride are taken initially in a standard glass reactor of two litres capacity fitted with tafflon stirrer, thermometer and temperature control arrangement $\pm 2^{\circ}\text{C}$. Xylene and 1-butanol (3:1) were used as solvents. Details of heating schedule and order of addition of reactants are given in Table 1.

Preparation of Alkyd Emulsion.

The alkyd phase was warmed to 800°c and to this water phase containing PVA and ammonia is added which is separately heated to 800°c. The slow addition of water phase is continued for half an hour and stirred continuously for the next thirty minutes. The emulsion paste was withdrawn and stored in stoppered bottles.

Formulation of water thinnable paint.

The paint was formulated in a attritor milling machine for 1-3 hours till the desired fineness of grind was achieved

Paint testing.

The physicochemical properties of paint samples like viscosity, Adhesion, hiding power have been determined as per standard methods. The film properties like drying, scratch hardness, and resistance to water solvents have been measured as per Indian and ASTM standards⁷⁸⁹

Table-1: Composition and Heating Schedule of Novel Polymer

Ingredients	% by weight	Order of addition of reactants	Time of heating in Hrs: Mins
Linseed oil	17.0	Linseed oil, rosin, glycerol, catalyst, maleic anhydride, benzoic acid.	
Rosin	34.0	Heat at 170°C	1:00
Glycerol	25.0	Heating at 24°C	2:10
Maleic anhydride	5.0	Cool to 230°C	0:20
Phthalic anhydride	14.0	Slowly cool to 80°C	1:00
Benzoic acid	3.0	Stage B:-Add phthalic anhydride and 5% solvents (3:1) Xylene: Butanol. Heat to 225	1:00
Sodium bisulphate	1.5	Continue reaction further at 225°C	4:00
Sodium bisulphite	0.5	Cool to 80°C and remove the product	
% Yield	93	Total time in Hrs:mins	9:30

Note:-The alkyd resin have desired viscosity and acid value 29.3

Table-2: Composition of Alkyd emulsion paste

Ingredients	Composition % by weight
Alkyd	45.6
Poly vinyl alcohol	3.4
Ammonia	2.3
Pine oil	14
Xylene	1.7
Butanol	0.6
Water	45.0

Table 3: Analysis of alkyd emulsion paste.

	Alkyd Emulsion
Acid value	12.3
Consistency	Thick flowing homogeneous paste
% Solids	50.0
% Water	45.0
% Organic solvent	4.8

Table 4:-Composition of water thinnable paints

Ingredients	S1	S2	S3	S4
TiO ₂	31.2	30.9	31.3	31.3
ZnO	3.1	3.1	3.2	3.2
Talc	6.2	5.8	5.6	5.6
Aluminium stearate	2.1	1.9	2.1	2.1
Soyales-eithene	0.5	0.7	0.6	0.6
Alkyd	17.3	17.8	17.3	17.3
PVA	0.9	0.9	0.9	0.9
Ammonia	0.9	0.9	0.9	0.9
Pine Oil	0.5	0.6	0.6	0.6
Water	17.5	17.9	17.5	17.5
Xylene	16.6	11.5	8.2	4.9
Butanol	3.2	3.4	2.4	1.5
Alcohol	Nil	4.6	9.4	13.6

Table 5:-Physicochemical analysis and film properties of water thinnable paint

	S1	S2	S3	S4
Viscosity by ford cup No 4	85	85	85	85
Density	1.8	1.8	1.7	1.7
Hiding Power	13.8	11.1	15.2	14.9
% Solids	42.6	41.7	42.2	42.1
Finish	Gloss	Gloss	Gloss	Gloss
Surface dry(Mins)	10	10	10	10
Hard Dry(Mins)	20	20	20	20
Scratch hardness (In Grams)	>1000	>1000	>1000	>1000
Adhesion test	Excellent	Excellent	Excellent	Excellent
Stability test(3 Months)	Excellent	Excellent	Excellent	Excellent

Table 6 :- Resistance properties of water thinnable paints based on novel short oil alkyd resin

S. No	Paint samples	Water (2 days)	Boiling water (30 mins)	Alkali NaOH (30 mins)	Acid (48 Hrs)	Solvent (Xylene) 10 mins	Alcohol 15 mins
1	S1	Excellent	Good	Poor	Good	Excellent	Excellent
2	S2	Excellent	Good	Poor	Good	Excellent	Excellent
3	S3	Excellent	Good	Poor	Good	Excellent	Excellent
4	S4	Excellent	Good	Poor	Good	Excellent	Excellent

Results and Discussion

- 1) The cooking schedule and analysis of alkyd resin is given in table No 1
- 2) The composition of water thinnable paint is given in table No 4. The alkyd content is varying from 17.3 to 17.8. All samples can take up water upto 17.5. The compositions are free from driers. The paint can be thinned with water as well as organic solvent. These behavior can be advantageous in designing various finishes
- 3) .The special feature is use of industrial alcohol as a solvent. due to liberalization. alcohol is available from sugar industry at competitive price to mineral turpentine. The use of alcohol has not adversely affected the consistency flow and brushability characteristics of paint
- 4) The paints have very fast drying with excellent hiding power, drying time, scratch hardness, adhesion and stability.
- 5) The resistance of films to water ,boiling water, acids and alcohol in general are excellent.

Conclusion

The following conclusions stand confirm in the light of above experimental work

- 1) A chain stoppered alkyd has been prepared using benzoic acid and rosin as chain stoppers. The heating schedule is of 8 to 11 hours.
- 2) The resin samples have desired viscosity and acid value .
- 3) Stable alkyd emulsion pastes based on novel resin ,PVA,and small quantity of organic solvents have been successfully prepared. They have stability of 3 months.

- 4) The paints have dual thinnability in water and in organic solvents. These compositions are stable for a period of six months. The % of water will certainly make the paint ecofriendly and cheap.
- 5) The samples have excellent resistance to water and alcohol .

References:

1. Gogte B.B., Sathe P.D, European coatings 20127(Milano) 77(6) 75-77 (2001)
2. Gogte B.B, Anjekar M.A. Paint India 36(3), 41 (1996)
3. Gogte B.B. Mundhe B.N, Morey S.P. .Paint India 43 (3), 77 (1993)
4. Gogte B.B. Sharma, Assam. .Paint India 43 (2), 63 (1993)
5. Gogte B.B. Joshi J.R. Vaidyanathan, K.S. .Paint India 38 (7), 25 (1998)
6. Payne, H. F. Organic Coatings Technology, vol.1 (John Wiley & Sons, New York) 1961, 87-106
7. Indian standards specifications, IS.101 (for water resistance), 1991
8. ASTM Standards method , 6.01, d 1647-70 (For resistance of water and chemical dried films of varnish and paints) 1981
9. Indian Standard method .6.01, D 2792 -69 (For solvent and fuel resistance of paints), 1980.