SYNTHESIS AND CHARACTERIZATION OF NOVEL ALKYD RESINS BASED ON KARAWILA SEED OIL

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Abstract

This research project mainly focused on developing air drying alkyds with 65% oil length which offer superior film properties using locally available a suitable fatty oil and also developing a mathematical model to predict the gel point acid value in manufacturing alkyd resins.

Analysis of seed oil of 'Karawila' MC43 indicated that it was a fatty oil rich in conjugated trienoic acids with moderate amount of saturated fatty acids. The oil content of seed of MC 43 was about 24% and the weights of dried seeds were in the range 2.98 -7.93 g with weight ratio of kernel to seed in dry basis of about 0.6. Acid value of the oil was 2.73 mg g'', saponification value was 190.70 mg g-l and iodine value was 115.96 cg g''. The seed oil of MC43 showed better drying properties compared to common drying oils. A simple mathematical model was developed to predict the iodine value of fatty oils based on the total number of pi-bonds in the fatty acid profile (π) as Iodine value equals 0.8683 x π

Since the acid value of seed oil of MC43 was comparatively low, monoglyceride process was selected in manufacturing alkyd resins. The optimum heating rate, mixing speed and the volume ratio were first established for the laboratory reactor used in the experiment. Better film properties could be obtained when a mixture of glycerol and pentaerythritol was used as polyols with excess OH. Film properties were compared by gradually increasing the pentaerythritol content while keeping oil length at 65% until the industrial specifications for film properties were obtained. Excellent film properties were obtained when the minimum ratio of pentaerythritol/glycerol was 0.33 and the *OHICOOH* ratio was in the range of 1.23 to 1.4. Satisfactory film properties were obtained when *OHICOOH* ratio was in between 1.23 to 1.48 with pentaerythritol / glycerol ratio within 0.23 to 0.33. When pentaerythritol / glycerol ratio was lower than 0.2, hardness was not acceptable.

The results of kinetic studies on polyesterification of monoglyceride mixture based on seed oil ofMC43 with pthalic anhydride suggested that the way of assigning order to the reaction based on correlation coefficient was unsatisfactory. This was mainly due to the simultaneous occurrence of several reaction mechanisms associated with steric hindrance of reacting molecules.

A new mathematical model was developed to predict the acid value at gel point based on the statistical approach of proposing the growth pattern of alkyd molecules during the polyesterification reaction. Proposed model was compared with the existing models using the actual data recorded in literature. The predicted acid values from the proposed model gave minimum deviation from actual data compared to existing models. However, the predicted acid values of alkyd resins based on MC43 seed oil deviated significantly from the experimental data due to the presence of conjugated trienoic acids in the fatty oil of MC43. Hence, a modification was introduced to incorporate the effects of dimerization reactions and the predicted results were then closely agreed with the actual data.