# ABSTRACT

In most of the countries of the world the industrial development has brought an increased pollution of the atmosphere due to emission of volatile substances. All organic solvents have adverse effects on human body, circulatory system, nervous system, lungs and liver. Solvent borne insulating varnishes represent a quite significant source of organic emissions. For these reasons, it is in the interest of all of us, we should concern ourselves with the development of low solvent and solvent free insulating varnishes. Thus in this research work, the objective was set to develop high performance water borne modified alkyd base insulating varnish for coating of high voltage electrical machines. The desired water borne varnish should contain low amount of auxiliary solvent and have good mechanical and dielectrical properties coupled with excellent thermal stability. The effect of tribasic acid anhydride on the physical, chemical, mechanical, electrical and thermal properties of the developed water borne insulating varnishes is also to be studied. For better dielectric properties and thermal stabilities at elevated temperatures, the water borne insulating varnishes will be modified with appropriate silicone resins.

The desired water borne varnishes were prepared following the procedure of alkyd manufacturing process by reacting a proprietary aromatic tribasic acid anhydride mixed with a diacid and polyols and linseed oil. Three types of recipes were developed (a) WSV-3 varnish : containing less amount of aromatic tribasic acid anhydride, (b) WSV-5 varnish : containing more aromatic tribasic acid anhydride, and (c) WSV-4 varnish : modified with silicones. The physical, chemical, mechanical, and electrical properties of all three varnishes were studied and the results were matched with conventional high thermal performance insulating varnishes available commercially.

The salient results of this investigation may be summarised as follows :

1. The formulation, process instruction and in process testing parameters for water borne insulating varnish were established. The physical, chemical, mechanical, electrical and thermal properties of these varnishes were studied in detail. The test results were compared with conventional high performance insulating varnishes. It was observed the properties of water borne varnishes have matched well with conventional varnishes.

2. The effect of proprietary tribasic anhydride, which imparting the water solubility, on physical, chemical, mechanical, electrical and thermal properties of water borne insulating varnish were also studied. It was observed the proprietary tribasic anhydride acid improves the water solubility, bond strength and thermal performance of varnish, whereas it has an adverse effect on alkali resistance, flexibility and electrical properties of water borne insulating varnish. That is, optimum quantities of tribasic acid to be used to balance the water solubility and insulating properties.

3. Silicone modification in water borne insulating varnish was done to improve dielectric properties and thermal performance. Silicone modification has also improved film flexibility. The dielectric strength, insulation resistance, dissipation factor and dielectric constant were improved and retention of these properties at elevated temperatures was also better. The high temperature stability of water base insulating varnish improved but water tolerability got reduced due to silicone modification.

The thin film drying of developed water borne insulating varnishes were slower than solvent base varnishes due to high latent heat of evaporation of water. Thus energy consumed on drying will be more, however the maintenance cost of heating system will be much less and hazards involved with solvents will be totally eliminated and thus the use of water borne varnishes will be beneficial. The shelf life of water borne varnishes depends on pH and cosolvent and thus storage tanks to be monitored carefully. The shelf life and tank stability of water borne varnishes was observed to be much less than those of solvent borne varnishes.