DEVELOPMENT OF URETHANE AND ACRYLATE MODIFIED OIL EPOXY BASED CORROSION PROTECTIVE COATINGS FROM SUSTAINABLE RESOURCE

A THESIS
SUBMITTED TO JAMIA MILLIA ISLAMIA
IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

CHEMISTRY

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APRIL, 2006

ABSTRACT

The industrial scenario in India is on the threshold of change. Industrial growth is witnessing a shift like never before. Efforts are being made to conserve energy and maintain infrastructure to ensure enhanced productivity. In this regard, control and mitigation of corrosion related problems play an important role. Paints and coatings provide the most important, often the most cost effective and sometimes the only important method to check corrosion. Vegetable seeds oils have been used for paints and surface coating applications since the days of cave paintings. Of late, a number of seeds oils based monomeric/oligomeric/polymeric resins viz. fatty amides, alkyds, polyesteramides, epoxies, polyurethanes and polyetheramides have been developed to be used in coatings and paints. Literature reveals that about 90% of these resins have been synthesized by reactions at carboxyl functionalities of oils. Transformations at carbon-carbon double bonds such as hydrogenation, dimerization and metathesis are becoming increasingly important these days. One such reaction is epoxidation.

Aliphatic epoxy resins derived from seeds oils are characterized by high flexibility and good corrosion resistance particularly against moisture and chemicals owing to their long hydrophobic chains. They hold promise to improve physico-chemical (viscosity), physico-mechanical properties and hydrophobicity of paints. However, *the drawbacks associated with epoxidized oils are their poor load bearing ability and hardness coupled with their sluggish curing rate due to internal epoxide rings.* In the present research program an attempt has been made to overcome the aforementioned drawbacks of oil epoxies. In this respect, Linseed and Pongamia glabra seeds oils were selected for epoxidation and trans hydroxylation. The modified epoxy polyols (HLOE) were treated with TDI to develop epoxy polyurethane coatings curable at ambient temperature by a simple curing route with a reasonably short curing time. Further modifications were accomplished

by grafting acrylic monomers such as acrylonitrile, methylmethacrylate as well as by the incorporation of transition metals (Mn,Cu,Zn) in epoxy polyol backbone to improve their physico-mechanical properties, chemical resistance as well as thermal behaviour. The acrylic and metal incorporated hydroxylated derivatives or epoxy polyols were subsequently treated with TDI to develop polyurethane coatings with improved properties.

A lot of work has been carried out on epoxy polyols and polyurethanes. However, *acrylic grafted and metal incorporated hydroxylated derivatives of oil epoxies or epoxy polyols have not been reported. They hold scope to serve as important building blocks of polyurethane coatings. In the present scenario, interestingly, when the technologists moot considerable efforts to substitute sustainable resources to their petro-based counterparts there is scanty literature available on the development of metal based polymers from sustainable resources. Oil epoxies in this respect remain completely unexplored.*

India is an agricultural country. It has an abundant stock of oilseed bearing trees. *The attempt is directed towards the utilization of these non-depletable, domestically abundant, non-toxic and cost effective sources of energy that are non-edible, non-medicinal and go as waste thus adding value to a natural waste material.* Indian coatings industry is, to a great extent, reliant on its imports for its raw materials. Substituting oilbearing seeds-biofactories of nature, to fossil fuels may save the amount spent on import of oil taking India to the road of self-reliance, creating employment opportunities, in near future. In the long run, greater utilization of aforementioned resins may also cut off the cost incurred on corrosion and its mitigation. Keeping in mind the importance of vegetable seeds oils and their monomerc/oligomeric/polymeric resins, the work in the thesis has been carried out related to the development of oil epoxies and their modification.