Notification No: COE/Ph.D/Notification/493/2021 Dated: 6/5/2021

Date of Award: 6/4/2021

Name of the Scholar: Mohammad Irfan Bakshi

Name of the Supervisor: Prof. Amir Azam

Name of the Department/Centre: Department of Chemistry, Faculty of Natural Sciences, JMI, New Delhi.

Topic of Research: ***Synthesis, Characterization and Properties of Modified Vegetable oil Based Anticorrosive Polymer Coatings.***

Findings

The thesis describes the synthesis, characterization with formulation of different oleo-polymers from Tung oil. The sustainable resource coatings provide solution to high cost, toxic, fossil fuel-based materials which will be unavailable in near future. The high triene-conjugation of tung oil-based coatings get cross-lined extensively and glossy, waterproof, rigid and tough polymer coatings are obtained with multifunctional applications. The oleo-polymer resins synthesized from tung oil include polyetheramide, polyesteramide, alkyd and epoxy nanocomposite systems which are prepared through In-situ, solventless and green approach using differ modified ceria, PPy-CeO_2, PPy-PSCeO_2 hybrid inorganic-organic nanofillers for suitable applications. The nanofillers occupy the interstitial voids and prevent the entry of corrosive ions into the substrate hence provide barrier protection. The curing of the oleo-polymers synthesized was carried out by TDI, and IPDI respectively. A non-isocyanate approach using DDS as a curing agent has been carried out during preparation of oleo-polymer nanocomposite coatings. The oleo-polymers have been characterized by spectroscopic (FTIR, NMR, XRD), morphological (SEM/EDX, TEM), DLS, optical, thermal, ASTM standards and other scientific procedures. The synthesized oleo-polymers exhibited increased physico-mechanical strength, adhesion, rigidity, hydrophobicity, flame retardancy, anti-icing and anticorrosive property while using oil as medium and solvent without releasing any VOC,

CFCs or toxic fumes into the environment. The mechanistic approach of the oleo-polymers displayed their inherent ability to provide potential surface barrier protection in acidic, basic, saline environments of different molar concentrations. The comparative study of the systems studied displays that oleo-alkyds showed more corrosion resistant protection compared to other oleo-polymeric resins under aggressive conditions.

Summary of Abstract

Synthesis, Characterization and Properties of Modified Vegetable oil Based Anticorrosive Polymer Coatings

ABSTRACT
of the Ph.D. Thesis

Submitted to
Jamia Millia Islamia
for the award of the Degree of Doctor of Philosophy

Submitted by
Mohammad Irfan Bakshi

Under the Supervision of

Prof. Amir Azam

Department of Chemistry
Faculty of Natural Sciences
Jamia Millia Islamia
New Delhi

Oct, 2020

Synthesis, Characterization and Properties of Modified Vegetable oil Based Anticorrosive Polymer Coatings

Keywords: Sustainable resource, tung oil, oleo-polymers, polymer coatings, nanofillers, nanocomposites, anticorrosive

Abstract

With the increase in petroleum prices depletion of fossil-based resources and release of toxic chemicals in the environment the coating and industrial technologists developed an alternative to meet the daily requirements using green approach. Renewable resources derived from nature like polysaccharides (chitosan, cellulose, starch etc) and vegetable oils (castor oil, linseed oil, soya oil, sunflower oil, jatropha oil, tung oil etc) have been used for the preparation of oleo-polymer materials. Due to the low cost, abundant availability, non-toxicity and the presence of active functionalities VOs serve as important precursors for synthesising oleo-polymers on a large scale for various applications like plascticizers, lubricants, inks paints, coatings etc. However, these polymers exhibit poor mechanical and thermal stabilities as compared those of commercial polymers. These drawbacks have been overcome through their modifications in the form of their blend, copolymers, composites and nanocomposites etc. Literature reveals that the dispersion of conducting organic nanofillers, inorganic metal oxides, nano-carbons (graphite, GO, CNT etc) and hybrid nanofillers in oleo-polymer matrix induces compactness, interlocking effect, enhanced hydrophobicity and adhesion at coating-metal interface which led to formation of their polymer nanocomposites. The vegetable oil-based nanocomposite coatings synthesized exhibit excellent physico-chemical, thermal and physico-mechanical properties Further, the oleo-polymer coatings formulated using tung oil have also displayed superior anticorrosive application under different aggressive environments. Further, these oleo-polymer coatings exhibited anti-icing and flame-retardant applications thus increasing the

dimensions of application with immense potential for industrial establishments, equipments, installations, devices, coatings and paintings etc.