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ABSTRACT

Polymer chemistry is one of the most diverse fields of the present time. A wide variety of polymers are being synthesized and evaluated, on the basis of their structural analogy in various fields. In ages of depleting fossil oil reserves and an increasing emission of green house gases it is obvious that the utilization of renewable raw materials wherever and whenever possible is one necessary step towards a sustainable development. In particular, this can provide a constant raw material basis for daily life products and avoid further contribution to green house effects due to CO_2 emission minimization. Furthermore, the utilization of renewable raw materials, taking advantage of the synthetic potential of nature, can meet other principles of green chemistry, such as a built-in design for degradation or an expected lower toxicity of the resulting products. The growing demand for petroleum-based products and the resulting negative impact on the environment, plus the scarcity of non-renewable resources, are some of the many factors that have encouraged the chemical industry to begin using renewable resources as raw materials. Some of the most widely applied renewable raw materials in the chemical industry for non-fuel applications include plant oils, polysaccharides (mainly cellulose and starch), sugars, wood etc. Most of the current polymers are produced from fossil sources. Because of their broad use, polymers make a significant contribution to the increasing amount of solid waste. Moreover, efforts such as recycling and combustion in incinerating plants have to be considered carefully from economic and ecological perspectives. The renewable raw materials that are most important to the chemical industry are natural oils and fats because of their high availability and versatile applications. Vegetable oils constitute about 80% of the global oil and fat production, with 20% (and declining) being of animal origin. One of the recent and appealing trends in the field of polymer chemistry is the synthesis of biodegradable and bioactive polymers for their application in medicinal and food processing industry. Looking superficially this field seems to be exhausted however careful observation reveals the increasing drug resistance of bacteria and fungi towards the available drugs. This indeed is an alarming situation and calls for synthesis of new drugs to

combat this resistance. In view of these findings an attempt is made to synthesize some bioactive metal incorporated oil based polymers exhibiting antifungal activity.

The advent of microwave synthesis in chemistry has drastically changed the face of synthetic chemistry. Shorter reaction times and solvent free synthesis have made microwave a valuable and promising technique. Conventional reactions that took hours and even days to complete can now be completed within minutes and it also gives higher yield. Thus microwave synthesis is employed for the synthesis of polymers making it altogether a small contribution towards green chemistry.

Vegetable oils are one of the most easily available and cost effective natural resource. It is biodegradable and hence a non pollutant. They react easily and under milder conditions as well and thus are one of the valuable starting materials and easy to work upon. The availability of number of functionalities allows a chemist to modify the structure as per the requirement. Structural modification of vegetable oils is done to obtain donor sites for attachment of metals in order to obtain metal containing matrix.

Biological systems require metals for their proper functioning. Metals such as Iron, Zinc, Copper, Cobalt etc. are an integral part of biological systems. On one hand these are necessary for the functioning of living organisms while on the other hand these metals in combined form affect and even inhibit the growth of living organisms including micro-organisms as well. An attempt is made to take advantage of these properties of the used metals in order to synthesize biologically active polymers.

The synthesized metal containing polymers are subjected to various characterizations and biological evaluation. These include solubility tests, viscosity measurements, determination of iodine value, saponification value, hydroxyl value, elemental analysis, TG/DTA, AAS, FTIR and ^{1}HNMR. Substantial evidences are obtained by AAS, FTIR and ^{1}HNMR and the characterization data clearly indicates the attachment of metal in the polymeric matrix. The synthesized polymers are found to be thermally stable as shown by thermo-gravimetric analysis. Comparative studies are made between the synthesized polymer, monometallic polymers and bimetallic polymers. The MIC values and Proton efflux measurements in all the cases show that metal containing polymer is more active and gave better results in comparison to polymer alone. Furthermore the bimetallic polymers are more active than the monometallic ones.