

SUSTAINABLE AND ENVIRONMENTALLY BENIGN POLYMERS: CHALLENGES AND OPPORTUNITIES FOR RESEARCH AND INDUSTRY

S. Sivaram,
CSIR Bhatnagar Fellow,
Polymers and Advanced Materials Laboratory,
CSIR-National Chemical Laboratory,
Pune-411 008, INDIA.

Tel : 0091 20 2590 2614
Fax : 0091 20 2590 2615
Email : s.sivaram@ncl.res.in
Website : www.ncl-india.org

ABSTRACT

Polymer materials were the products of post war renaissance in chemical industry driven by the promise of inexpensive hydrocarbon feed-stocks. The fifties and sixties saw the introduction of many polymers that changed the face of human civilization. From early curiosities, polymer became an indispensable part of our daily living and so ubiquitous that we no longer realize how addicted we are to polymer materials!

The key question that we will address in this presentation is the nature of challenges faced by polymeric materials in terms of sustainability of, both, resources and environment.

Polymer materials consume <10% by weight of earth's hydrocarbon resources (fossil fuels) and produce >250 million tons of polymers that fuel our economy. In this sense, polymers can hardly be termed as inefficient use of scarce fossil hydrocarbon resources.

The manufacture of polymers from chemical building blocks, are largely clean technologies, energy efficient, having by and large low carbon and water footprints and very little waste generation. Advances in catalysis science and reactor engineering have ensured that large scale manufacturing processes for polymers are inherently safe and environmentally benign.

Consequently, both, from the point of view of resource utilization and manufacturing, polymers are quintessential examples of "Green Chemistry and Engineering".

So, where does the challenge lie? We need to address two issues, one real and the other, largely of perception. The real issue is the matter of handling post consumer use polymer waste, especially, those resulting from short life cycle applications of polymers.

Second, is managing the perception of the consumer, who seeks “greener” products, preferably bio-based, which can be disposed off in composting pits and reduced use of fossil fuels in products of every day consumption.

This has resulted in renewed focus on use of biomass derived building blocks for polymers (bio-based) and bio-degradable (compostable) polymers from feed stocks derived from starch, sugars and lingo cellulosic biomass.

We will assess how much of these new initiatives offer real solutions to post consumer waste disposal of polymers and resource substitution of fossil fuels by bio-derived resources. Issues such as cost, scalability and impact of solutions will be discussed. Future opportunities in this area for, both, research and applications, will be presented based on optimal use of bio-derived resources.