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Polymer Nanocomposites and Related Legal Issues: An Overview

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Manipulation of engineered nanomaterials (ENMs) to develop different consumer and industrial products are preferred choice in modern day industrial productions due to their unprecedented but diversified promises and prospects. Burgeoning research have been being carried out in almost every corner of the world to explore and exploit the prospects of ENMs. Application of nanoparticles (NPs) into polymer matrix materials are also tested and dramatic changes in the mechanical, thermal, electrical and diffusion properties to the properties of the host polymers were observed. It was revealed that it promises a novel class of polymer matrix composite materials with superior properties and added functionalities.

Polymer nanocomposites (PNCs) are preferred over the neat polymer or traditional polymer composites as these are stronger, harder, lighter, durable, more dimensionally stable and less permeable. All these features make this suitable and desirable to be widely used in large quantities in consumer and industrial products ranging from aerospace, automobile manufacturing, medical devices and sporting goods, textiles, building materials, electrical and electronics goods etc.

With all these promises, there are some concerns as to the long term behavior of different ENMs in human health and different media of the environment i.e. air, land and water. Some of these ENMs are also popularly used to develop PNCs. Based on some laboratory findings, the scientists and policy makers have predicted that some of the nanomaterials may have adverse effect on the environmental components and human health and safety. Even though it is not yet the right time to draw a precise conclusion as to the human health and environmental implications of ENMs, the world market for the PNCs is expanding dramatically. Before 2015, its global market was of more than USD 3,000 billion, in 2015 it reached to USD 5,276 billion with projection to grow at compound annual growth rate (CAGR) of 10.9% during 2016-2022.

As some Chapters of this Book have already covered the applications and prospects of the PNCs and possible challenges involved in the applications, the primary aim of this Chapter is to predict and highlight the possible legal and regulatory issues. To do so, this Chapter attempts to review some of the existing international legal provisions and assesses the adequacy of these provisions in terms of oversight, monitor and implementation. As there is no internationally authoritative body and the main legal developments are seen in the European Union (EU) level, discussions on EU will be covered most in this regard. Some of the possible challenges faced by the regulators in implementing these legal provisions will also be highlighted. The chapter will further endeavor to share how the international and municipal community have been working to overcome these challenges.

Of all the published literature on nanotechnologies or ENMs, only 5-7% studies are relating to the human health and environmental implications on ENMs. Unfortunately, most of these studies do not share any clear statement on the safety of ENMs, and most of them are either self-contradictory or arrive at completely erroneous conclusions. Thus, it can be presumed that all the precise legal issues arising in relation to the PNCs is not possible to paint in this short canvass, rather it may be wise to highlight some parts only. Taking into account the product cradle-to-grave life cycle approach, this Chapter is divided into five parts apart from the introduction and conclusion. It is obvious that for the purpose of this Chapter, as the production stage of ENMs substances is not directly relevant and the definition of 'nanomaterials' does not cover nanocomposite materials including the PNCs,¹ the discussion should highlight other areas of legal concerns i.e. occupational health and safety, consumer protection and product liabilities arising out of defective products, and finally environment protection. Accordingly, Part II of this Chapter will briefly introduce PNCs, their applications and some legal concerns during their life cycle. Part III will deal with occupational health and safety concerns, Part IV will cover consumer protection issues, whereas Part V shall include discussions on liabilities arising out of defective products and the importance of updated and precise Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS). Part VI will shed focus on environmental issues and will argue that the popular environmental law principle i.e. precautionary principle should be followed during every stage of the product life cycle. Finally, this Chapter will stress that it should be made compulsory to develop an authoritative nano-enabled product inventory so that the precautionary principle can be applied to avoid any prospective serious damage to human health and environmental components.