

Harmonization of plastics and the environment in the 21-st century

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Abstract:

The materials science is determining in a way the expected technical achievements of the upcoming 21-st century. The results of the technical development in the different industrial branches is depending very much on the new structural materials. Metals, ceramics and polymers - seemingly competing, - are rather cooperating and completing each other in the modern design of machinery, electronics, household appliances etc.

The relationship and production rate of the conventional metals and the new, synthetic structural materials, the plastics, has been changed significantly in the last two-three decades. In the most developed industrial regions of the world already 25 years ago the volume of the produced plastics surpassed the volume of the produced steel. The change has been even more dramatic in our country. Hungary in 1988 produced 4,5 Mtons of steel and 0,4 Mtons of synthetic polymers, while in the last year of 2003, 1,5 Mtons of steel and 1,1 Mtons of plastics has been made in our country. Actually the world is consuming yearly more than 200 Mtons of crude-oil based synthetic polymers.

The key questions arise: How long this growing polymer consumption can be harmonized with the ecology? Are the benefits of the new, high-strength, lightweight structural materials in balance with the exploitation of non-renewable raw materials? What can we do for the environmental acceptance, the biocompatibility and recyclability of our new polymer systems? Has the polymer a correct place in the sustainable development of the world? What kind of polymer structural material could we produce in a post-petroleum period of the world?

The crude oil consumption – as well as the plastics consumption, - is correlating to the GDP in most countries. The application rate of polymers in the modern IT appliances, transport machines, infrastructural installations or packaging is somehow directly related to the wealth of the nations. We cannot discuss the

right of the poorer regions of the world to the telecommunications, healthy infrastructure and other benefits of the civilization.

Although the modern plastics industry is converting mainly crude oil today, this conversion is still helping the eco-balance. This is because the main stream of the crude oil, - actually more than 80% of it, - is serving energetic purposes, such as fuel in transport machines (automobiles, airplanes, ships etc.) or simply as fuel in power plants. The plastics industry, using barely 7 – 8% of the crude oil as raw material – is still improving the efficiency of transport machines or even the whole power economy, by making the machines lighter, insulating the heat-conducting systems etc.

There is a lot to do in the field of environmental acceptance of the plastics. The material recycling, reuse and energetic recovery of polymers should be better organized and technologically developed in the future. The bio-compatibility, the bio-degradability of the materials must be harmonized with the ever-increasing engineering requirements.

There is an enormous potential in the biomass as raw material for (semi)synthetic polymer production. The biomass production of the world, as a yearly renewable resource of polymer materials in the agriculture, in the forestry, in the living world of flora and fauna, is actually three order of magnitude larger than the production of synthetic polymers. There is a direct way to use more natural fibrous polymers in our modern structural materials, mainly as composites. On the other hand, cellulose based polymers, as well as proteins and polylactides will serve as natural raw materials for modern polymers long after the depletion of crude oil in the world.

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