Polyurethanes in Perspective

**OIL USAGE (WEST EUROPE)**

Over the past fifty years, the oil and chemical industry has converted selected oil products of the oil refining process into polymers. These valuable resources have contributed greatly to our quality of life. The amount of oil diverted to polymer production is 4%. Compared to the 86% which is used to generate energy in one form or another, this is a small amount for a product which makes such a large contribution to our daily lives. (Figure 1).

![Figure 1: Oil usage in West Europe (Source: APME)](image)

**THERMOPLASTIC AND THERMOSET POLYMERS (WEST EUROPE)**

The annual consumption of polymers in West Europe is about 39 million tons (1998) and falls into two categories (Figure 2):

1. Thermoplastics - materials such as polyethylene, polypropylene and polystyrene
2. Thermosets - materials such as polyurethanes and epoxy resins

Of thermosets, polyurethanes represent about 30% and of all polymers, about 5%.
Polyurethanes exist in many forms and have increasingly been used during the past thirty years. Key to their growing success and increased usage has been their ability to fulfil the high consumer expectations: comfort, value for money, energy saving insulation products, improved safety and environmentally sound products. One of the remarkable features is their durability, which contributes significantly to the long lifetimes of many products which contain them. The extension of product lifetime - and resource conservation - are important environmental considerations which favour the selection of polyurethanes (Figure 3).

The long lifetimes of polyurethane-containing products, sometimes exceeding 30 years, means that the return of these products as post-consumer waste materials is a slow process.

Indeed, in the construction industry, which uses rigid foam panels and laminates, waste has yet to reach 50% of production and in the automotive industry, waste products account for only two thirds of consumption.

Similarly, PU accounts only for about 3% of plastics in municipal solid waste, while it represents about 5% of consumption (APME).

CONTRIBUTION OF PLASTICS WASTE TO MUNICIPAL SOLID WASTE (WEST EUROPE)

Polyurethanes make up around 5% of all plastic waste. This should be seen in the context of the overall contribution of plastics to solid waste - less than 1% (0.6% by weight) - and as a constituent of municipal solid waste 7%, with an equivalent of 30% of the energy of the MSW (Figure 4).

The use of readily accessible trim foam from the manufacturing process into rebonded foams has been an established practice for the last three decades and increasingly, new activities in the area of post-consumer polyurethane foam waste are emerging: e.g. grinding and re-use, particle bonding, energy recovery and others. After its useful life, most polyurethane post-consumer waste in the European Community finds its way, if uncollectable or unidentifiable, into the municipal solid waste (MSW) stream. Until now this MSW was either landfilled or incinerated with or without energy recovery.
The greatest environmental benefit will result from a planned, integrated approach to polyurethanes waste management, based on:

- avoidance of unnecessary waste
- environmental product design
- recycling, as product, on an economic and resource-efficient basis
- feedstock recovery where chemistry and economics favour it (e.g. mixed plastics waste streams)
- energy recovery, as part of the MSW, or with plastics as a fuel
- controlled landfill as a last resort.

Some schemes to recover post-consumer waste have been in use for some years now; others are increasingly being developed. The experience gained over the last few years is a basis for sound resource integration plans for each type of polyurethane in the different application areas. Current practice with the re-use of regrind flexible foams, recovery of rigid polyurethane foams from appliances and construction demolition waste only form a few examples of the approach to improved recovery of polyurethanes resources.
ISOPA has produced a brochure and a series of fact sheets on polyurethane recycling options. The following are now available:

- Recycling Polyurethanes (Brochure)
- PU in Perspective
- Densification/Grinding
- Re-use of Particles
- Rebonded Flexible Foam
- Adhesive Pressing/Particle Bonding
- Regrind/Powdering
- Compression Moulding
- Chemolysis
- Feedstock Recovery
- Energy Recovery
- Energy Recovery from Flexible PU Foams
- Recovery of Rigid Polyurethane Foam from Demolition Waste
- Options in Practice

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ISOPA - the European Isocyanates Producers’ Association - is an affiliated organisation within the European Chemical Industry Council (CEFIC).

Since the original polyurethane material has not been designed for use in articles in contact with food, relevant EU (such as Directives 90/128/EEC) and national legislations need to be consulted, if and when recycled materials are used to manufacture articles and goods for possible direct and indirect food contact.

The information contained in this publication is, to the best of our knowledge, true and accurate, but any recommendation or suggestions which may be made are without guarantee, since the conditions of use and the composition of source materials are beyond our control. Furthermore, nothing contained herein shall be construed as a recommendation to use any product in conflict with existing patents covering any material or its use.

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