

RECOVERY, RECYCLING, RE-INTEGRATION OF RIGID AND FLEXIBLE POLYURETHANE WASTE

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ABSTRACT:

The Recuperating, Recycling and Re-integration of the polyurethane foams is under continuous development; due to increasing number of companies which manufacture heat insulating products, and being a source of bulky waste, it aims to recuperate and reintegrate it. Today, there are mechanical and chemical technologies to Recovery, Recycling, Re-integration flexible and rigid polyurethane foam waste. Combustion is not an economical process.

The polyurethanes are produced by the polyaddition reaction of polyols and di-isocyanates, becoming consumption goods and heat insulating products, used in buildings as plates, shells, in situ manufactured foam, cast by spraying, etc. The attention manifest towards the recycling of polyurethane foams is justified by the huge quantities produced every year. Due to the low density, between 20 – 80 Kg/m³, these foams occupy a huge storage space.

There are several possibilities of reuse or energetical recuperation of the polyurethane waste:

- burning the waste as a fuel – harmful for the ecological balance and with a low economical efficiency;

- recuperating the raw materials, the polyol, by means of an adequate chemical technology, which consist in the alkoxylation of the polyurethane waste under the addition, in three subsequent stages, of primary amines, ethylene and propylene oxide at 180-220⁰C.

- mechanical – chemical technology for the recuperation flexible poliurethane foam waste and gluing it with polyol. The final products may have the shape of plates or mattress, and are used as sports hall floorings, because of their flexibility. They are also used in industrial halls for vibration attenuation under large equipement.

- mechanical – chemical recuperation of rigid polyurethane foam waste is now under testing in INCERC and consists in:

- * grinding the rigid polyurethane waste in large peaces, with dimensions between 20 – 50 mm,
- * mixing for ten seconds the new polyurethane components, with the ratio Polyol: Isocyanate 1:1,
- * laying the broken polyurethan waste, uniformly in a mould,
- * casting the mixed PU components over the broken polyurethane waste in a ratio:
Broken PU waste : new PU mixing components 15-50 : 100
- * pressing the mould with a minimal load of 60 Kg/sqm .

In this way, it is possible to obtain not very homogeneous plates but adequate for termoinsulation of walls, floors, basement cealings in buildings.

The characteristics of the plates manufactured by this procedure are presented inthe Table below:

Characteristics	Unit.	PU new	PU with % waste			
			15	30	40	50
Density	Kg/cm ³	40	40-45	35-40	39	39
Compression resistance at a 10 % deformation	N/mm ²	0,35	0,006	0,07	0,008	0,003
50 % deformation		-	0,018	0,020	0,19	0,13
Tensile strength	N/cm ²	0,25	0,17	0,20	0,15	0,15

The advantages of the procedures of recuperation the flexible and rigide polyurethane waste are:

- for the chemical tehcnology – obtaining of polyols;
- for the mechanical tehcnology – the recuperation of poliurethane waste in percent up to 50 % in the new final products;
- the big dimensions of broken waste;

- the possibility to improve with low costs the heat comfort in buildings;
- raw materials economies;
energy economies;
- reducing of waste storing spaces;
- benefic enviromental effects;
- attenuation of shock and wibrations and fireproofing properties tresses from flexible polyurethan waste.

As advantages of the procedure may be mentioned: obtaining of polyols; the recuperation of polyurethane waste in percent up to 30% in the new final product; a gross breaking of waste; the improvement of the heat comfort of the buildings; raw materials economies; energy economies; reducing of storing waste spaces; benefic environment effects.

The Recuperation the flexible polyurethane waste, consist in grinding the flexible polyurethane waste and gluing it with polyols. The final product like plates-mattress, were used at sports hall floors and for attenuation of vibrations.

Mechanical – chemical recuperation of rigid polyurethane waste consists in recycling the polyurethane waste by its mechanical grinding and these gluing with polyol and isocianat of the obtained particles in form of plates; the procedure is under testing in INCERC.

Chemical recuperation of polyurethane waste consists in the alkoxylation with an admixture of primary amines. This process represents;

- a new and rapid process for the chemical recovery of polyurethane waste by simultaneously alkoxylation of ground waste – primary amine mixture was developed;
- the studied process is “authothermal” and needs no external heating;
- the resulted scission polyols were used successfully to obtain new polyurethane foams;
- due to high degree of aromatic, the resulted polyurethane foams have excellent physical-mechanical thermal and fire proofing properties.

For more informations you can ask at INCERC – BUILDING NATIONAL RESEARCH INSTITUTE, STAFF: HYDROTHERMAL ISOLATIONS OF POLYMER MATERIALS, Eng.E.Dabu, Eng.D.Stoica, Eng.C.Stamate and Gh.Radulescu - Laboratory for Using of Polymer Products in Buildings - 266,Pantelimon Street Bucharest, Phone: (401)2552250/233, Fax: (401)2550062, Email: dabu@cons.incerc.ro