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SOME CHARACTERISTICS OF A NEW INSULATION STRUCTURE FROM RECYCLED APPAREL CUTTING WASTE

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Abstract: Recycled textile waste can be used as a raw material for insulation structures. Theoretically, 97% of textile waste can be recycled. Recycling textile waste has an ecological benefit as well as the economical, making it more popular in the past decades. Recycled textile waste has already found commercial application as insulation material but so far only waste that is easy to open down to fibers has been used. Commercialized products of this kind in Europe are Inno-Therm and Mettise that are obtained by mechanical recycling of post-consumer cotton. Standard mechanical recycling is not an option when it comes to textile waste from polyester woven fabrics, as it requires opening the fabric. The assessment of insulation materials is an issue which needs to be analyzed from different aspects: the physical properties of the material, their effect on people and the environment, installation difficulty and price.

In this paper thermal insulation, sound insulation, biodegradability and fire resistance of a new structure from polyester cutting waste are investigated. The samples are made from polyester cutting waste of three different fabrics with different structural characteristics.

Measuring of coefficient of thermal conductivity was conducted following ASTM C518 and ISO 8301 standards. The obtained values of thermal conductivity ranged from 0.0520 to 0.0601 W/mK, while the values of thermal insulation ranged from 1.658 to 1.924 m²/W, comparable to the values of the commercial insulation material.

The procedure for measuring coefficient of sound absorption used a sound generator (KYE Systems Corp Multimedia hi fi speaker system sp-diameter), microphone (A4 mi-10), Gold Wave computer software for sound recording and filtering, and Origin software for analyzing the recorded sound. The values of NRC (noise reduction coefficient) were in the range of 54.71% to 74.77%, therefore similar to those of commercial insulating materials. The samples of a new insulation structure showed absorption features typical of fibrous materials with maximum of absorption between 1000-2000 Hz.

Methodology for testing aging and biodegradation of apparel waste was based on ISO 11721:2001. The loss of mass by which the degree of biodegradation was evaluated, was within the range of 0 to 0.3%, i.e. there was practically no loss of mass what is a confirmation of the well-known fact that polyester is a biologically non-degradable material. In comparison with commercially used recycled insulators polyester insulation does not require treatment against fungi and insects.

In order to investigate fire resistance of a new insulation structure BS 4790: 1987 (Hot metal nut test was used). The results indicate that polyester is convenient for use in internal insulation structures as it is not conductive of flame.

A new structure has overall physical properties appropriate for application as insulation material in buildings for internal insulation and roofing. To achieve thermal and sound insulation values similar to commercial products the new structure has significantly higher density, i.e. a greater amount of material is needed. However, due to the cheap and readily available material competitive price can be achieved. The research demonstrates a way to decrease environmental pollution by using polyester apparel cuttings waste for insulation purposes in roof construction and internal walls.

Key words: polyester cutting waste, thermal insulation, sound insulation, biodegradability, fire resistance