ABSTRACT

Due to the increasing car production, the problem of end-of-life tires utilization in the eco-friendly way is still growing. Tires are 100% recyclable. Steel in the tire (the content of 20% weight) despite the high-quality parameters, has not found any industrial application as a full-value raw material. The main objective of this work was to propose a solution to the global problem of using steel waste obtained during rubber recovery during the most commonly used ambient recycling method in reference to the requirements of sustainable development in construction. Fibre concrete was discovered as the likely application of the mentioned waste.

The work represents an interdisciplinary character and the proposed research program includes two fields of science: the technology of concrete and the ecology. Legislative requirements, sustainable development policy and methods of tire recycling are presented in the first part of work. Main research was preceded by a multi-stage preliminary tests. Preliminary research was aimed at the detailed comparative analysis of mechanical and physical features of the concrete composite with the addition of recycled steel fibers in relation to the fibre concrete commonly used for industrial floors. For testing, fibers from recycled tires (RSF) were used without any pre-treatment. RSF were coming from the recycling plant based on the KAHL's technology. A study was carried out on the recycled fibers using the microcomputer tomography and the scanning electron microscope to determine their characteristics, incl. the EDS spectrum. In order to designate the full characteristics of the physical and mechanical features of the proposed new composite, a wide range of tests was performed with particular emphasis on the determination of the tensile strength of the composite. This parameter was appointed by three different methods: tensile strength testing for splitting (Brazilian method), residual tensile strength test (3-point test) and testing of tensile strength by a wedge splitting (WST method). The last two methods allowed to determine the dependence of *strength-CMOD* for the tested samples. The obtained results were used to classify the strength of the proposed fibre concrete in accordance with the *fib Code 2010*. In addition, the indication of the fracture characteristics of the reinforced composite using the DIC method allowed to illustrate the map of deformation of the samples during WST. The designed concrete with RSF fibers was analyzed to ecological and economic impacts according to the assumptions of sustainable construction.

According to the obtained results, it has been proved that it is possible to replace industrial fibres with recycled tire fibres in concrete without deterioration of the strength parameters of the fibre concrete commonly used for industrial floors. The proposed solution may lead to economic benefits and clearly contribute to the reduction of pollution to the environment.

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