RECYCLABLE MATERIALS AND THEIR POTENTIAL OF USING IN THE FIELD OF AGRICULTURAL BUILDINGS

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Abstract

Using recycled materials in construction is not only a gesture of solidarity with nature, but also a clever tactic that results in increasing their potential for reusing. The purpose of this paper is to identify and capitalize recyclable materials for classification and utilization in the agricultural buildings. Determining the potential for reuse of those can be done through proper management of each type of waste. Reintegrating them into materials cycle is essential for sustainable development. It will be identified and presented in this paper new materials developed by various researchers in order to increase their performance or at least to maintain them within acceptable limits to be exploited. This paper will present recyclables materials coming from industrial activities, such as burning solid fuels, steel production (ash, slag), auto-industry (tires) and polymeric industry. Synthetic materials generically called plastics are widely used in construction due to their durability and low weight. Common thermoplastics are polyethylene and polypropylene, have the advantage of being easily recyclable.

Key words: recyclable materials, agricultural buildings, waste

INTRODUCTION

Synthetic materials are widely used in construction because of their durability and low weight. PVC, for example, can help by recycling, to achieve a variety of products used in construction such as materials for external protection of buildings, floor finishes. PVC pipes are environmentally friendly and more efficient than concrete or metal alloys. The main advantages of PVC pipe are the life of a hundred years and low maintenance costs.

Recycled polystyrene may be used in combination with steel permanent shuttering used for the production of casting concrete walls. These casings have excellent thermal and sound insulating properties, other than the fact that they are resistant to wear. Also, the mixture of cement recycled polystyrene may be used as a basic material in the production of concrete, in order to achieve the construction of walls. These structures are energy efficient, fire resistant and sound absorbent.

Recycled paper is used to obtain products such as plaster board walls or the manufacture of cellulose insulation.

Wood chips embedded in cement under pressure, giving rise to the mixture used to make the formwork panels, structures that are non-toxic and recycled to them. Moreover, waste wood can be used for the development of systems for manufacturing floor or roof structure elements or even the arrangement of roofs "green". Clearly, the use of recycled wood products for doors, windows or structures of timber, wood instead of new is beneficial both in terms of saving energy and resources.

Waste brick and terracotta tiles are an economic alternative embodiment of building facades, provided that it be used for lime mortar. Recycled concrete may be used in the manufacture of concrete slabs used for foundations. As structural materials may be used lightweight concrete blocks made from cement, sand and lime, which can add clay coal combustion products

For the manufacture of asphalt, one of the components used can be recycled rubber. Artificial stone resulting from concrete and gravel mixture, is typically used as a material for building facades.

The fly-ash finds extensive application in the manufacturing of building components and materials such as bricks, hollow bricks and structural concretes (Raut S. P., et all 2011). The

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by-products and residues from industry are managed using several approaches including land filling, incineration, use in cement plant and brickworks, agricultural use and composting, anaerobic treatment, recycling and others (Huet R. J., 1982).

Figure 1 **Waste from construction and demolition**

Waste from construction and demolition offers a substantial source of raw material for construction works and others. The materials can be capitalized on construction sites, such as wood, plastic, paper, cardboard, metals, cables, solutions and varnishes, rubber. Construction waste must be collected separately, taking into account the degree of pollution by harmful substances. Likewise, demolition materials such as stone, cement, tiles, bricks, concrete, plaster, wood, metal, glass or excavated materials and remaining after road construction sand, gravel, clay, rocks, pavement bitumen (Beral E. and Zapan M., 1997).

Figure 2 **The surface deposit of fly-ash solid residue**

The fly ash - a solid residue, consisting of non-volatile inorganic components, resulting from oxidation processes by complete combustion of solid fuels (coal). Resulting from the burning of coal ash content varies between 2-40% by mass of coal. Its basic components are oxides of aluminum, silicon, iron, calcium and magnesium, it being approx. 95% of the total weight of the ash. The fly ash is a waste with a strong environmental impact because of the resulting large quantities and whose storage is a big problem. In Romania, lower fuel combustion generated and still generates huge amounts of ash, which are landfilled. These surface deposits removed from economic use large areas of land which is permanently lost for future generations. Also, ash dumps are important sources of environmental pollution.

The present study aims is to calculate the three recipes concrete composition which to find, in addition to the usual components (aggregates, cement, water) and additives consisting of demolition waste and fly ash. The concrete will be used for agricultural construction without noticeable load (light structures

The overall objective of this research project was to investigate the feasibility of incorporating recycled aggregates, either old concrete or old asphalt planning, as replacements for virgin aggregates in structural concrete and, to determine the mechanical and environmental performance of concrete containing these aggregates.

MATERIAL AND METHOD

The production of conventional building materials such as cement, bricks and steel consume a lot of thermal and electrical energy and in turn pollute air, water and land.

It is not an exaggeration to say that concrete produced with Portland cement is so far the most popular construction material in today's world due to its relatively inexpensive cost and versatility. Concrete is adaptable to a wide variety of civil engineering projects: from high-rise buildings to road pavements, from bridges to water supply schemes, from retaining walls to railway sleepers. Therefore, the role of concrete in promoting society's development will, without doubt, continue to play a crucial role in the fore see able future.

Therefore, there is an urgent need to find and supply suitable substitutes for natural aggregates (Rajput D., 2012). According to Sani et al (Alami A. H., 2010), a well-known example of alternative supply of aggregate is the use of construction and demolition(C&D) waste to manufacture recycled aggregates. Waste coming from construction and demolition (C&D) represents one of European Union's (EU's) largest waste streams. Recycled aggregates have been used in non-structural concrete applications or used as sub-base for roads (Savas¸ E and Marva A., 2013).

Portland Cement Cem IIA 32.5 conforming to Romanian Normative was used to produce all concrete mixes in this experimental study. Naturals and constituted the fine aggregate for concrete mixtures made with recycled aggregate as well as concrete made with conventional aggregate (SR EN 197-1/2004). The two types of natural coarse aggregates will be used here in were crushed limestone from Quarries.

The shape of limestone particles was primarily angular and the texture was rough, while the aggregate consisted of smooth and rounded particles. Similarly, two sources of recycled aggregates were used to totally replace the natural coarse aggregates; one coming from the precast concrete waste of demolition and the other coming from.

The shape of the aggregate particles from recycled asphalt was irregular, whereas that of precast concrete was angular.

Ground granulated blast furnace slag, which is a by product from the making of iron, was used in concrete mixes as a partial replacement of Portland cement.

Table 1

Mixing formula 1 - Concrete C12/15 – the calculation is made per 1square meter

Basic (initial)	Modified (with the addition of waste)
- cement: 320 kg - sand 0-3mm: 647 kg - sand 3-7mm: 339 kg - gravel 7-16mm: 429 kg - gravel 16-31mm: 588 kg - water: 190 l	10% by weight of the substituted material - cement: 288 kg - fly ash: 32 kg - sand 0-3mm: 647 kg - sand 3-7mm: 339 kg - gravel 7-16mm: 429 kg - gravel 16-31mm: 530 kg - waste (crushed): 58 kg - water: 190 l

Table 2

Mixing formula 2 - Concrete C12/15 – the calculation is made per 1square meter

Basic (initial)	Modified (with the addition of waste)
- cement: 320 kg - sand 0-3mm: 647 kg - sand 3-7mm: 339 kg - gravel 7-16mm: 429 kg - gravel 16-31mm: 588 kg - water: 190 l	15% by weight of the substituted material - cement: 272 kg - fly ash: 48 kg - sand 0-3mm: 647 kg - sand 3-7mm: 339 kg - gravel 7-16mm: 429 kg - gravel 16-31mm: 500 kg - waste (crushed): 88 kg - water: 190 l

Table 3

Mixing formula 3 - Concrete C12/15 – the calculation is made per 1square meter

Basic (initial)	Modified (with the addition of waste)
- cement: 320 kg - sand 0-3mm: 647 kg - sand 3-7mm: 339 kg - gravel 7-16mm: 429 kg - gravel 16-31mm: 588 kg - water: 190 l	20% by weight of the substituted material - cement: 256 kg - fly ash: 64 kg - sand 0-3mm: 647 kg - sand 3-7mm: 339 kg - gravel 7-16mm: 429 kg - gravel 16-31mm: 470 kg - waste (crushed): 118 kg - water: 190 l

RESULTS AND DISCUSSIONS

The calculation of a concrete mixing formula is a complex issue, since it must simultaneously fulfill three conditions: workability, strength and durability. The calculation involves several steps mandatory, following which it will determine the exact quantities needed of each material. It will determine the quantities, in kg, aggregates (plus construction waste, sieved to know the exact size distribution), sand, cement (some of it will be replaced by fly ash) and water.

CONCLUSIONS

The three concrete mixing formulas will be implemented in the near future. After its preparation and making specimens, will make mechanical tests such as compressive strength, tensile strength, gelivity and permeability. Thus we can show the influence of additions of recyclable materials and changing parameters (resistances, for example).

It is intended that, based on the results of mechanical tests, to realize a statistical analysis with the purpose to optimize those properties depending on the considered parameters which influent the result of this analysis.

Usually, statistical analysis performed on different variants suggested mixing formulas outlined that there are the real possibility of improving them.

If the test results are satisfactory, then we can increase the percentage of waste contained in concrete. The recycling of materials that can cause future problems is essential to reduce the pollution in the long term and vital for human health and the planet.

Recycling of such wastes by incorporating them into building materials is a practical solution to the pollution problem. The needs to conserve traditional building materials that are facing depletion have obliged engineers to look for alternative materials.

Various physico-mechanical and chemical properties of concrete incorporating different waste materials are studied in accordance with the reviewed literature and the standards.

The study could be useful for various resource persons involved in using industrial or agricultural waste material to develop sustainable construction material.

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