THE BENEFITS OF WASTE PROPYLENE USAGE IN ARCHITECTURAL STRUCTURES AND OTHER ENGINEERING APPLICATIONS

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Abstract - The concrete is made with wastes which are eco-friendly is called as Green concrete, and this paper gives information aboutthe aspect on how to use a material such as Polypropylene (PP) fiber withcement as a construction material and benefit also in gaining a detailed flexibility in the architectural design. Polypropylene is the world's second-most widely produced synthetic plastic, after polyethylene (PP). PP is normally tough and flexible with low density, this allows polypropylene to be used as an engineering plastic,, with a Young's modulus between 1300 and 1800 N/mm².The study presents the ability of the using a construction material by product materials like (PP). The use of PP contributes the reduction of greenhouse emissions with negative impacts on the economy. It had been observed that 0.9 tons of CO2 is produced per ton of cement production procedure. Also, the composition of cement is 10% by weight in a cubic yard of concrete. However, by the use of green concrete it is possible to reduce the CO2 emission in atmosphere and achieve an eco-friendly construction technique. Over and above (PP) has greater strength, fatigue resistance, and durability than the normal concrete.

Keywords - Polypropylene, Eco-Friendly Construction Material, Enhancing design capability, Green buildings.

I. INTRODUCTION

According to the contemporary engineering principles choosing the materials of construction can affect not only the way any structure would be designed, but also it can affect the environment in different ways, and that is why a lot of searches are done and developed to determine how different materials can cause different energy consumption, and the energy associated with materials has become an important aspect of the energy science. Plastic is a destructive material for the ecosystem due to its non-dissociation property in nature [1]. The plastic materials have no recyclable value and are disposed by public directly.

Administrations from all over the world have taken a serious addendum of polypropylene materials and even banned plastic below 50 µm. It is necessary to have mechanism in place for regulating its use, recycling and disposal instead of forbidding usage of plastics to detach the plastics from the environment [2,3]. Recycling and combustion process make new product which is less valuable compared to the materials form by some different methods called pyrolysis.

In addition to this, the construction materials industry is significant because of its impact on the environment in terms of resource use, energy consumption and CO2 emissions. The regulations for choosing specific construction materials, and this paper is concerned in studying Polypropylene (PP) fiber with cement as a way of reducing the negative impact on the environment [4].

II. METHODOLOGY

Life-cycle assessment LCA is a technique used to quantify the environmental impact of products during their entire life cycle. The different parts of the life cycle are examined from raw material extraction, manufacture, transport and use through to waste processing. For each stage an inventory is made of the energy and material consumption and of any emissions to the environment. This makes it possible to identify components where improvement can be made to benefit the environment. This type of investigation of products may bring economic advantages, as often material and energy consumption are reduced. Environmentally friendly products also have a marketing advantage, as consumers are becoming increasingly aware of ‘green’ issues.In addition, legislation is being introduced across the world to enforce environmentally friendly practices. The concept of product responsibility is commonplace and manufacturers and end-users must now consider the cradle to grave pathway of each product.In this paper allthe calculation and flows will bedone by using GABI program .

III. CONDUCTINGLIFE CYCLE ASSESSMENTUSINGGABI PROGRAM

Life Cycle Assessments are conducted according to the ISO 14040 and ISO 14044 standards. LCAs consist of four steps:

- Aim and Scope Definition
- Inventory Analysis
- Impact Assessment
- Interpretation

3.1 Aim and Scope Definition

The aim of the study is to compare between two cases the first is building a dome with a specific dimension using normal concrete, the second is building the same dome with same dimensions but this time using Polypropylene (PP) fiber concrete and how each case would affect the environment, and this study includes studying the Life Cycle Assessment LCA of each material. To determine the flows of the concrete material building the dome model. To determine the flows of the Polypropylene (PP) fiber concrete material building the same model. To compare the difference in flows and emissions produced using these different materials (Fig. 1).

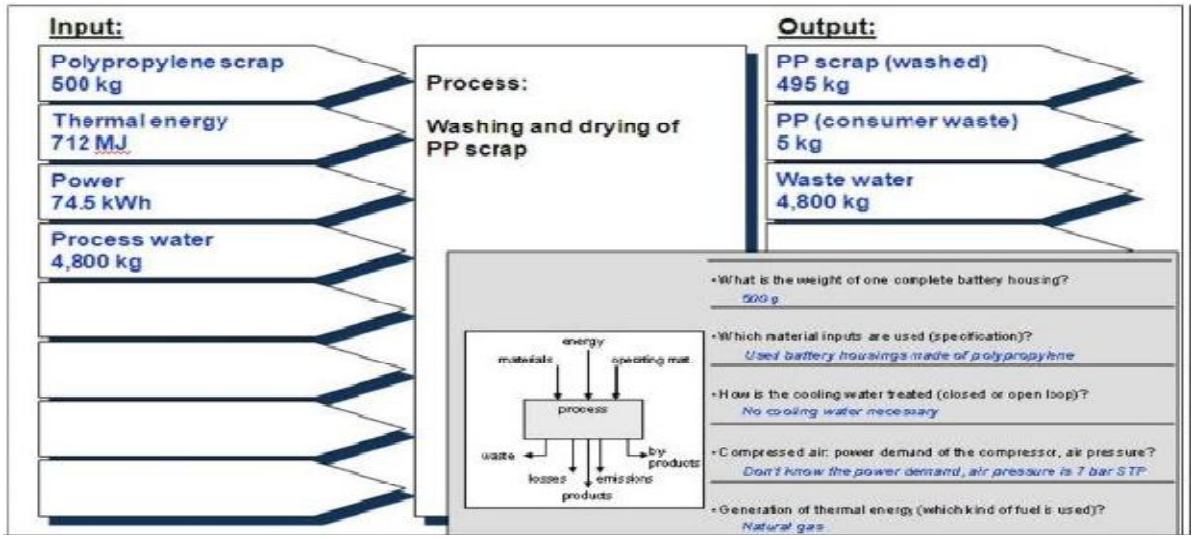


Figure 1. Determination of Gabi Input and Output Values

3.2 The Inventory Analysis

The inventory analysis is the LCA phase that involves the compilation and quantification of inputs and outputs for a Polypropylene throughout its life cycle or for single processes. The inventory analysis includes data collection and the compilation of the data in a Life Cycle Inventory (LCI) tableAbbreviations and Acronymsand the input used in this paper is taken from a previous study and has been inserted in the data of Gabi program.Witnessing various studies, there was one the studies called: Properties of Polypropylene Fiber Reinforced Concrete.

That paper includes experimental research investigation of the fresh and hardened material properties polypropylene fiber reinforced concrete is reported. Fiber lengths were1/2 and1/4, and volume fractions were 0. I, 0.3, and 0.5%. Fiber effects on concrete properties were assessed. Properties studied were slump, inverted slump cone time, air content, compressive and flexural behaviors, impact resistance and rapid chloride permeability, and volume percent of permeable voids.

An innovative method of characterizing the flexural behavior of polypropylene fiber concrete was proposed. The new method was dependent on the post-peak flexural resistance of concrete. For impact resistance and flexural behavior, it was concluded that ¾ in long fibers were more effective more than ½ in long fiber volumes of 0.3 percent or less, while H-in-long fibers were more effective for 0.5 percent volume [5].

The study in Gabi program considers that the system boundaries used is Cradle to Grave which includes the material and energy production chain and all processes from the raw material extraction through the production, transportation and use phase up to the product's end of life treatment. And this affect the type of process we should set for the project.

We should also determine our Allocation which is the partitioning and relating of inputs and outputs of a process to the relevant products and byproducts. The allocation to different products can be done according to one of the rules defined below [6].

• Allocation by Mass: The inputs and outputs of a process are assigned to all of its products proportionally to their mass.

• Allocation by Heating Value: The inputs and outputs of a process are assigned to all of its products according to their heating value. This allocation method is often used for production processes of fuels.

• Allocation by Market Value: The inputs and outputs of a process are assigned to all of its products according to their market value.

• Allocation by Other Rules: This can include exergy, substance content, etc.

3.3 Life Cycle Impact Assessment

The Life Cycle Impact Assessment (LCIA) identifies and evaluates the amount and significance of the potential environmental impacts arising from the LCI. The inputs and Conducting Life Cycle Assessments outputs are first assigned to impact categories and their potential impacts quantified according to characterization factors. Figure 2 shows the

conversion from emissions to impact potentials via classification and characterization [7].

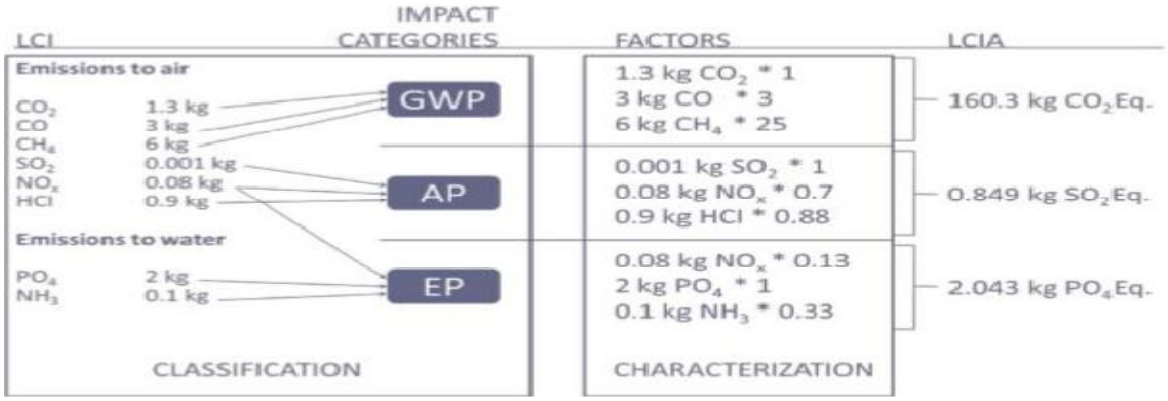


Figure 2. Classification and characterization factors

CONCLUSIONS

It is seen that the GaBi combines the world's leading Life Cycle Assessment (LCA) modelling and reporting software, content databases with intuitive data collection and reporting tools. The program allows LCA professionals to affect scientific results by helping to save money, reduce risk, communicate product benefits and increase revenue.

The program should be used to evaluate every raw material and process in every phase from extraction to end-of-life across your supply chain. In addition to these results, the below mentioned results should be drawn according to the studies indicated in Ref. 1 and Ref. 3:

1. Fibrillated polypropylene fibers have no detectable effect on the workability and air content of fresh concrete at volumes below 0.3 percent. An adverse effect on workability and an increase in air content of concrete resulted from the application of polypropylene fibers at 0.5 percent volume.
2. Fibrillated polypropylene fibers tended to increase the permeability of concrete. With l/2-in.-long fibers, the increase was relatively mild. With 3/4-in.-long fibers, the increase was significant.
3. Polypropylene fibers had a relatively small favorable effect on compressive strength of concrete when l/2-in-long fibers were used, and on compressive toughness when 3/4in.-long fibers were used.
4. It was proposed that the flexural behavior of polypropylene fiber concrete be characterized by the post-peak flexural resistance (load or stress). It was found that, for volumes equal to or less than 0.3 percent, 3/4-in.-long fibers were more favorable for enhancing the post-peak resistance. For 0.5 percent volume, l/Zin.-long fibers were more effective [3]. We just benefit from this study, to determine the inputs and parameters for Gabi program.

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