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SYSTEMIC ANALYZE BY LIFE CYCLE INVENTORY OF THE HYDROPHOBIZATION UNIT PROCESSES FOR TEXTILES

AILENI Raluca Maria[1], RADULESCU Razvan[2], CHIRIAC Laura[3], SUBTIRICA Adriana[4], SURDU Lilioara[5]

[1, 2, 3, 4, 5]National Research & Development Institute for Textiles and Leather, Department of Advanced Material Investigation, 030508, Bucharest, Romania

Corresponding author: Aileni, Raluca Maria, E-mail: raluca.aileni@certex.ro

Abstract: *This paper presents aspects regarding life cycle inventory (LCI) of the classical hydrophobization process used in textiles finishing. According to the ISO 14040-14044 stardards used for determine the framework for conducting an LCA (life cycle assessment), there are 4 steps for obtaining an LCA – scope definition, LCI, LCA impact, LC (life cycle) interpretation. In our work, we analized warming impact generated by gases, water footprint and energy impact. For analyzed sample (bbc 100%), treated with NUVATTC (based on fluorocarbon) for obtaining hydrophobic effect, was analyzed the LCI and the process tree. The goal was to obtain the environment impact level for classical hydrophobization based on fluorocarbon. The research methodology consisted in collecting technical input and output data and using the SimaPro software for generating the LCI. We obtained the input data (raw material, energy, chemical substances and water consumption) by direct measurements on machinery, device logs and specifications of the equipment (technical books) and processes. The output data (waste energy, water and chemicals were obtained using statistics, internet databases and SimaPro software. The environmental impact categories identification (carginogenic, inorganic compounds upon the breath, climate change, radiation, ozone layer, Eco-toxicity, land use, minerals and fossil fuels) was done by using the method ECO indicator 99. This study shows that the process of classic hydrophobization has a negative impact on significantly on climate change, fossil fuels, ozone layer and effects of inorganic compounds upon the respiration, and all this is the consequence of the chemicals, based on fluorocarbon, use.*

Key words: *life cycle inventory, textiles, hydrophobic, impact, environment*.

1. INTRODUCTION

The analysis of life cycle inventory involves procedures for collection and calculation of data on the system-product for hydrophobic textile that will be included in the life cycle inventory, for quantifying inputs of materials, energy or chemical substances and the materials output such as energy, products, the discharges into the air, water, soil - which are relevant to the system-product [1].

The analysis of the life cycle inventory (LCI) for a system - textile hydrophobic product represents the collection of inputs and outputs during the life cycle. To generate the LCI are necessary a large amount of data about the process or the production of the hydrophobic textile materials. The inputs (raw materials, energy, ratio between the main product and co-products and production rate) and output (discharged waste into the ambient environment). There are numerous methods for the generation of LCI and among the most used but cost expensive is the use of commercial software applications (commercial off the shelf –COTS) such as GABI or SimaPro, which reward allow quick access to data online updated. Another possibility is to achieve the study LCI directly from the source data (technical books of machinery or equipment, national statistics, technical journals, direct measurements on machinery, logs, and reports of the specific data from textile industry, the results of laboratory tests, governmental documents, reports, databases, scientific articles, books and patent, the specifications of the equipment or processes) [1].

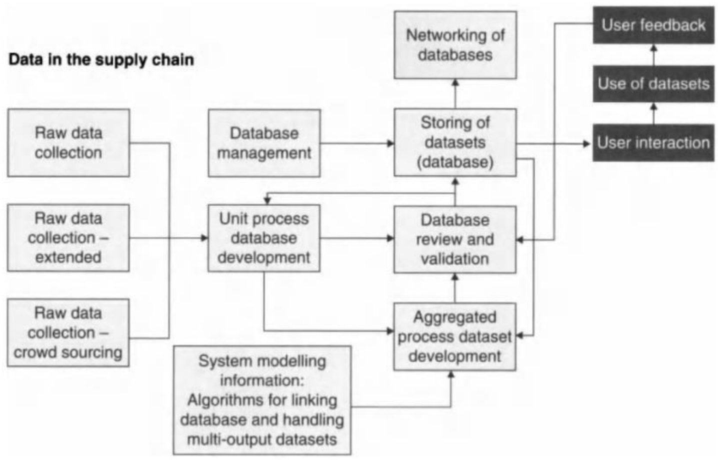

Fig. 1: *Raw data stream – LCI with feeback [2]*

2. EXPERIMENTAL PART

The experimental part consisted in LCI for data collected from classical textile hydrophobization process. Data, collected from industrial technological process and from indirect sources such as internet database and speciality scientific literature, were used for establish the LCI [3, 4].

The study is one type of Cradle-to Gate that approaches the production phase (after the collection of the raw materials to the development of the product). By using the method Eco-Indicator 99 was identified the following categories of environmental impact : carcinogenic, organic compounds and inorganic upon the breath, climate change, radiation, the ozone layer, Eco-toxicity, acidification /eutrophication, land use, minerals and fossil fuels. The impact types obtained by SimaPro are presented in the following diagrams:

-Specification diagram (Fig. 2);
-Normal diagram (Fig. 3);
-Weighted diagram (Fig. 4);
-Single Score diagram (fig. 5).

In Fig. 2 can be identified the resources with the most significant environmental impacts, such as heat supplied by natural gas, the consumption of fluorocarbon dioxide (of the substance for hydrophobization NUVA TTC) and consumption of electrical energy for the operation of the hydrophobic coating. We can remark that the volume of water (74 l) consumed in the classical hydrophobization process for 100 kg BBC material, has a minor impact on the environment. The same thing can be said about the consumption of acetic acid (37 ml/ 100 kg BBC). The program

SimaPro7 has the possibility of the evaluation of the impact on the environment through diagrams of the following approaches: normalization and weighting.

The normalisation is a procedure required to show the extent to which a category of impact has a significant contribution to the general problem of the environment, and is done by means of the division of the category indicator of impact by a value of "Normal". There is a procedure whereby each category of impact is related to the relative importance of these [5, 6, 7].

The weighting method has as its objective the quantitative aggregation of the results of using the weighting factors. This kind of approach has impact on categories reported between these categories. Each category of impact is multiplied by a weight, the date of seminificatia that category the impact of general [7, 8].

It is also noted that the natural gas (14%), tetrafluoretilene (78%) and the electrical energy used (6%) have a negative effect on climate change (Fig.3). The procedure for the classic hydrophobization contributes to global warming through the greenhouse effect caused by fluorocarbons presence. Natural gas used in the process (10%), tetrafluoretilena (43%) and the electrical energy consumed (47%) have a negative effect on the environment, in the form of radiation emitted into the atmosphere. In Fig. 4 it is presented the semnificativ impact of fossil fuels, climate change and inorganic upon the respiration. In Fig. 3 and 4 is presented the signifiant impact of the finishing based on fluorocarbon (tetrafluorethilene) and heat necessary in this process, for fossil fluel, ozone layer and climate change.

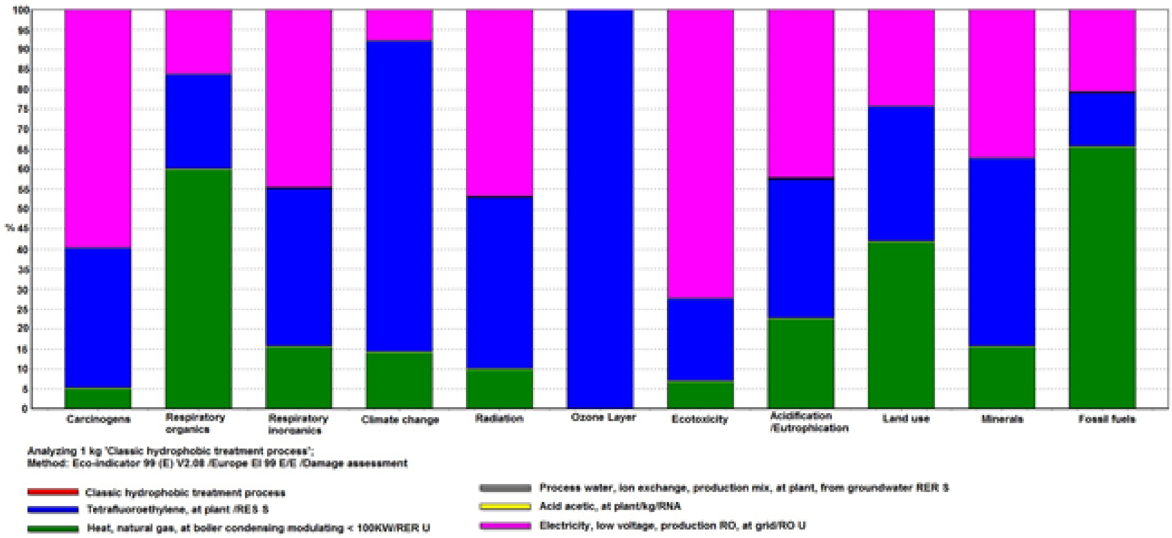

Fig. 2: *Specification diagram for 100% bbc sample hydrophobizated by classical process*

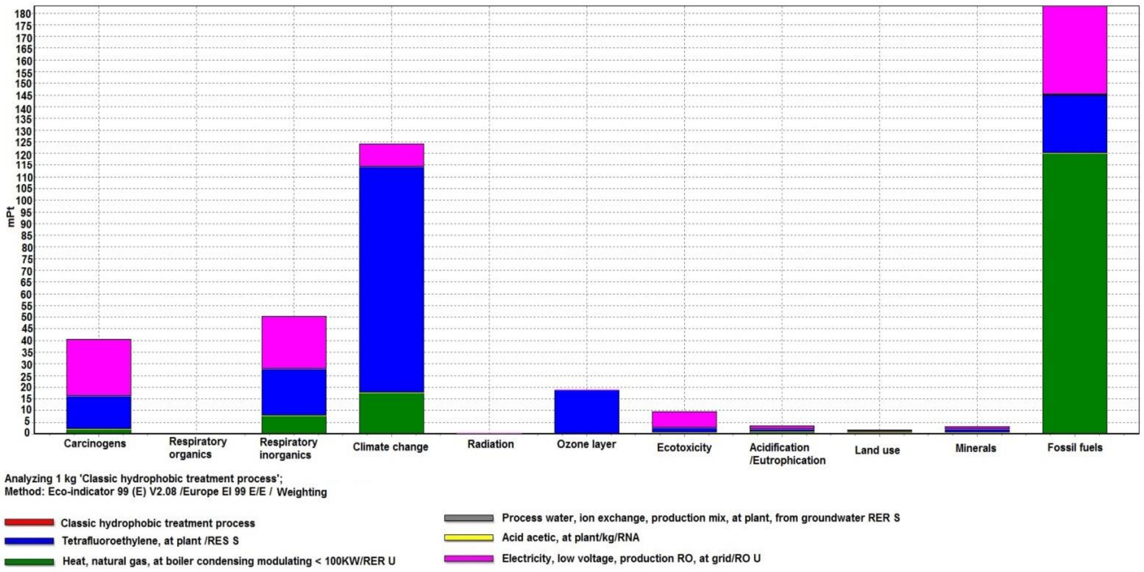

Fig. 3:*LCI evaluation by normalized method*

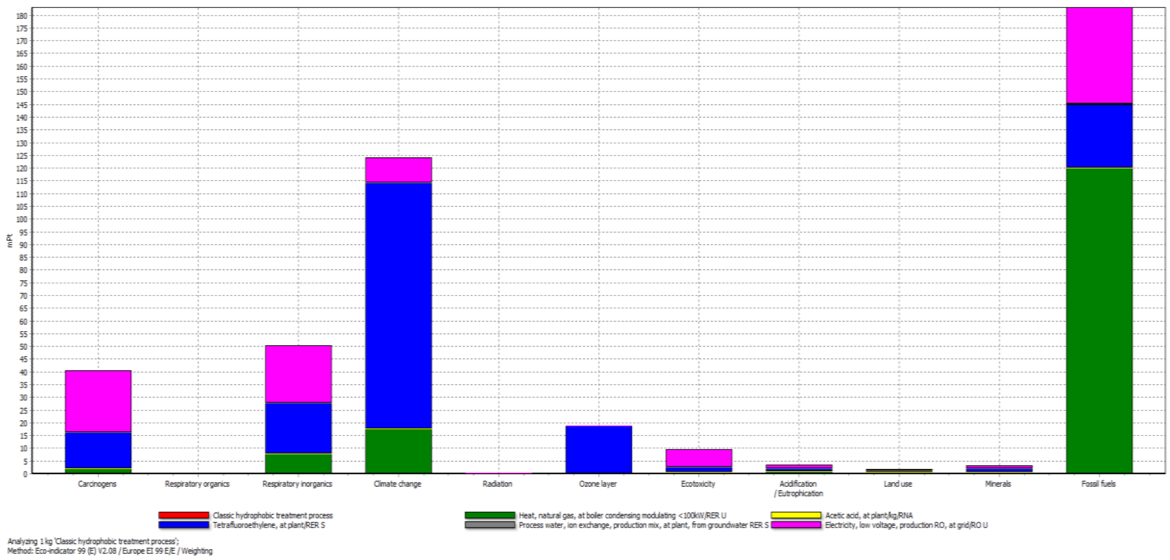

Fig. 4: *LCI evaluation by weighting method*

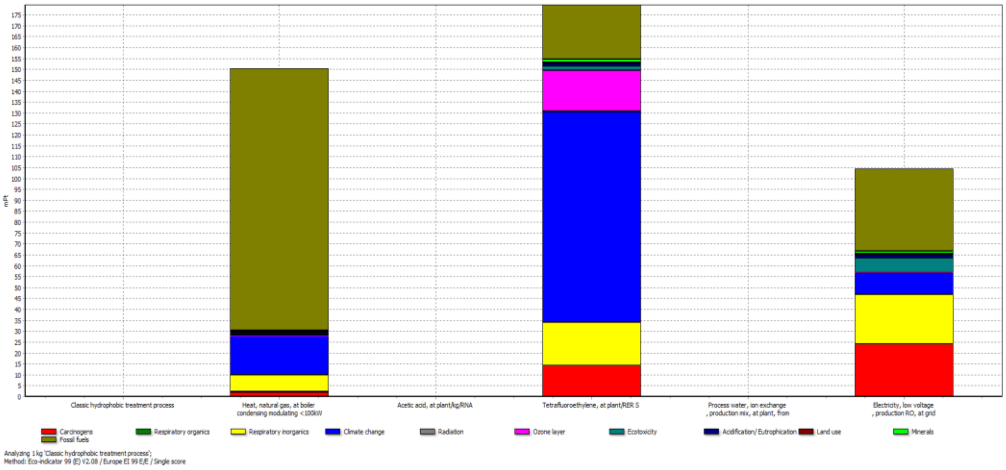

Fig. 5: *LCI evaluation by single score method*

3. DISCUSSIONS

For textile sample treated with NUVATTC, was carried out the inventory of the life cycle (ICV) using the software SimaPro and have determined the process tree for classical hydrophobisation (Fig. 6) and the effect on the environment on the impact categories. In the program was used ECO-Indicator 99 [9], which provides for the quantification of the following categories of impact : carcinogenic substances, organic compounds and inorganic with negative effect on the respiration, climate change, radiation, the ozone layer, Eco-toxicity, acidification /eutrophication, land use, minerals and fossil fuels.

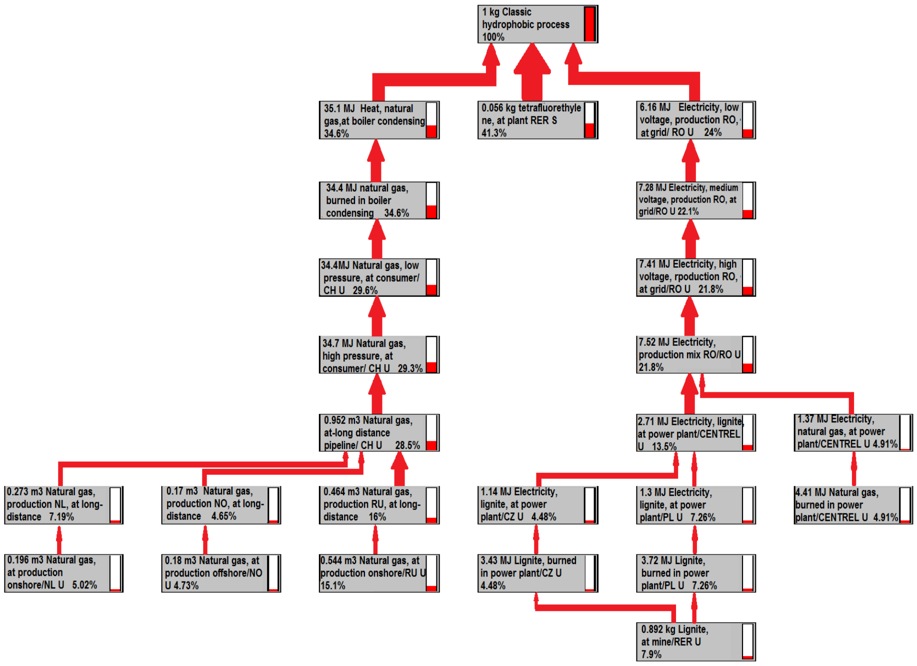

Fig. 6: *Process tree for classical hydrophobization*

5. CONCLUSIONS

The investigation of the process and the diagram for environment impact on different categories (Eco-Indicator Method 99) were prepared by weighting method. From all diagrams used in evaluation, we observed a significant impact of the classic hidrophobization on fossil fuels, climate change, ozone layer and effects of inorganic compounds upon the respiration, given in the main by fluorocarbon use.

6. ACKNOWLEDGMENTS

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