

# Minimization and Utilization of Byproduct

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**Abstract** - Negative effects arising from the presence of waste materials on the environment is a major problem worldwide, requiring emphasizing of the recycling processes and reuse processes. In this context, the objective of the research was based on finding of a for a sustainable development. To date, for a higher recovery of waste rubber is necessary to transform them into reclaimed rubber involving the use of polluting technologies. Thus, through the proposed technology, respectively through the grinding with tools activated in an ultrasonic field, has been possible to decrease rubber particle size and there was obtained a crumb rubber with a particle size of 100–150  $\mu\text{m}$ . It can replace a large proportion of reclaimed rubber from the composition of a type of analyzed rubber, and the obtained results demonstrate changes in the physico- mechanical rubber properties thus produced with effects on the growth of the life of rubber products and reduce environmental pollution. Also, by applying new technology there is a clear improvement of sustainable development indicator (SDI) defined and analyzed in the paper. Currently, worldwide it is put increasing emphasis on ensuring sustainable development through innovation or, in accordance with the European Commission, on eco-innovation (represented by any innovation which may determine economic development and has a positive impact on the environment). Thus, eco-innovation is considered, “key” to competitiveness”, given that the manufacturing sector is stimulated to shift from methods such as “end-of-pipe” to the “closed- loop”, with positive effects on consumption of raw materials and energy (European Commission).

These clarifications were the basis of research conducted in the field of waste rubber regeneration, problem solved now by various methods, but that involving many technological operations, that, in turn, determine some environmental

pollution.

**Keywords:** Rubber Waste, Pollution , Recycling.

## 1. INTRODUCTION

The economic models specific to market economy that rely on consumer satisfaction and getting of profit, have generated major imbalances and pollution, determining an unsustainable growth. Thus the problem of raw materials and energy crisis, depletion of natural resources, excessive environmental pollution and the damage to human health are just some aspects of a general crisis that threatens all humanity, in the context of challenges generated by their application. Therefore, applying the principles of sustainable development has become a necessity, imposing the replacement of the “homo economics” behavior type with the type “rational homo”. Moving from technology to ecotechnology may be the key to ensure sustainable development. But what is sustainable development?



*Figure No.1 Rubber Waste*

Sustainable development is a concept extremely debated in recent years, though, can be identified a concern for its requirements with decades ago. Thus, the paper "Limits to Growth" (Meadows et al., 1972) is an important point in starting the debate on the rational use of resources. The bio-economy theory founded by Georgescu - Roegen contributed decisively to identify the correlation between technical progress and environmental protection. The theory of sustainable development is still under development and has generated numerous debates on environmental protection. In this regard, we can mention the Stockholm Conference, the Rio Conference (1992, Rio +5, Rio + 10, Rio +20) etc. An important document, in which it is presented a definition of the concept of sustainable development, is the "Report of the World Commission on Environment and Development: Our Common Future" by approach perspectives. Thus, the authors of this report have an interesting opinion regarding the influences on sustainable development. In this context, the sustainable development "is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs". (WCED report, 1987). In accordance with this point of view, it is obvious that between innovation and sustainable development there is a strong link. Innovation is, incontestably, an engine of sustainable economic growth, no matter the domain where it is realised. At the same time, sustainable development is a source of innovation, more and more companies allot significant resources to research and to identify new solutions.

Currently, worldwide it is put increasing emphasis on ensuring sustainable development through innovation or, in accordance with the European Commission, on eco-innovation (represented by any innovation which may determine economic development and has a positive impact on the environment). Thus, eco-innovation is considered, "key" to competitiveness", given that the manufacturing sector is stimulated to shift from methods such as "end-of-pipe" to the "closed- loop", with positive effects on consumption of raw materials and energy (European Commission).

These clarifications were the basis of research conducted in the field of waste rubber regeneration, problem solved now by various methods, but that involving many technological operations, that, in turn, determine some environmental pollution.

## II -LITERATURE REVIEW :

The rubber from waste can be recycled normally by the grinding to produce fine powders with a wide domain of the specific surface. Until now, there could be produced powder in a wide range of specific surface using only grinding processes "at heat", whose efficiency of the particle with granulometry ranging between 400 and 600  $\mu\text{m}$  is quite low (Torretta et al., 2015). In order to increase the efficiency of recycling waste made of rubber the upside of the fineness of the rubber particle .

### I. DEFECTS AND SOLUTION :

**DEFECTS** : Negative effects arising from the presence of rubber waste materials on the environment is a major problem worldwide.

### SOULUTION :

The research has aimed to identify a new technology enabling a higher recovery of wasterubber.

Superior grinding of waste rubber and reusing in the mills with ultrasonic activation leads to a crumb of rubber with a very good particle sizedistribution and particle sizes in the range of 100–150  $\mu\text{m}$ .

Crumb rubber obtained can be used in this state in the rubber composition of the various types of rubber mostly replacing the reclaimed rubber

## II. CHARACTERISTICS AND PROPERTIES OF ADDITIVES IN RUBBER

### 1. ZnO:

Characteristic - Catalytic properties

Uses- Used as baking agent ,colourant, skinprotectant.

### 2. Steric Acid :

Characteristic - Odourless in nature ,wax like

Uses- Used as lubricating agent food additive used in making insulators

### 3. N550 carbon black :

Characteristic -Exist in powder form and odourless, high melting and boiling point.

Uses- Used in car cases ,inner tube ,gasket and plastic compounds.

### 4. DOP (dioctyl phthalate) :

Characteristic - Flexibility, coldresistant, electrical insulation.

Uses- Used as plasticiser.

### 5. TMTD (tetramethyl thiuram disulphide):

Uses- Used in processing of rubber and in blending of

lubricant oil.

6. Crude rubber :

Characteristic - High level of wear and heat resistant, high strength High compressible.

1. Filler :

Characteristic - Improve particle packing and give the fresh concentrate and even to reduce amount of cement in concrete without losin

2. Softner :

Characteristic - It is an finishing agent it gives pleasing touch to product.

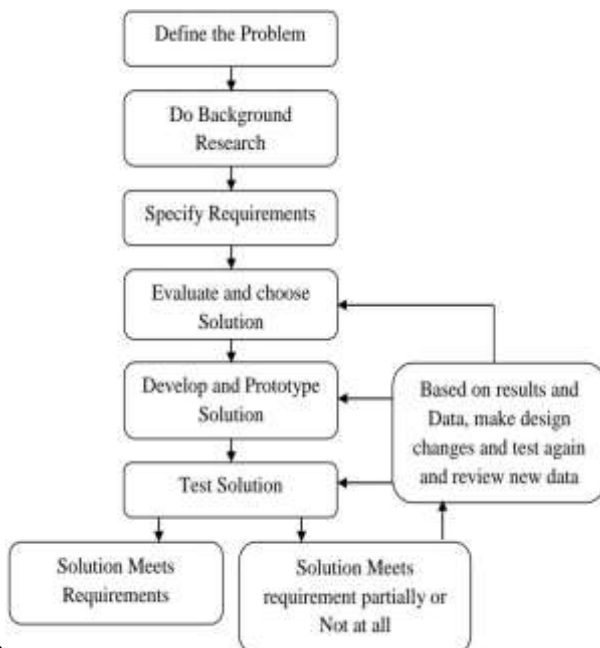
3. Antioxidant :

Uses- Mainly used to prevent thermal and oxygen ageing and could effectively prevent copper damage used in light coloured and transparent rubber products and in foam latex products.



Figure No 2. Additives

**DESIGN METHODOLOGY**



In this step we are going to implement our information gathered and try to make a prototype solution. We already know the effect of temperature on rubber and properties of natural rubber and properties of byproducts.

We are going to add a specific amount in 1 kg of raw material in presence and absence of cork oil. Then we are going to measure the effects on product hardness is it constant, increased or decreased. We are going to find out if there is presence of cracks on the product and we are concluding if our requirement is fulfilled or not fulfilled.

Amount of material added in every 1 kg	Presence of oil (Cork)	Effect on Hardness	Cracks	Requirement is fulfilled
0	Absent	No Effect	Absent	Yes
5	Absent	No Effect	Absent	Yes
10	Absent	Increased	Present	No
10	Present	No Effect	Absent	Yes
20	Present	No Effect	Absent	Yes
30	Present	No Effect	Absent	Yes
40	Present	No Effect	Absent	Yes
50	Present	No Effect	Absent	Yes
60	Present	No Effect	Absent	Yes
70	Present	Increased	Present	No
67	Present	Increased	Present	No
65	Present	Increased	Absent	No
62	Present	No Effect	Absent	Yes

- 1) Define the Problem:- In this step we define our problem or objectives of project.
- 2) Background Research:- In this step we do analysis of products required in our project and the materials in what quantity involved in the manufacturing what are effect on product by the process.
- 3) Specify Requirements:- In this we are specifying our requirements of project i.e. we need to utilities and reuse byproduct without changing product characteristics.
- 4) Evaluate and Choose Solution:- In this step we choose proper solution by conducting Solution financial and available resources.
- 5) Prototype Solution:- Now we are developing a prototype solution to test is our process is working or not if it is not working or not giving required results then we again go to step

number 4.

6) Testing:- Here we are doing test on actual or full scale model.

7) Solution not meeting requirement :- In this step we check is our solution is meeting or not meeting our requirements then we decide is we need to go again doing process from step number 4 or finish our project.

### III. CONCLUSION

The research has aimed to identify a new technology enabling a higher recovery of waste rubber. Thus the investigations, the following conclusions can be synthesized:

- superior grinding of waste rubber in the mills with ultrasonic activation leads to a crumb of rubber with a very good particle size distribution and particle sizes in the range of 100–150  $\mu\text{m}$ .
- crumb rubber obtained can be used in this state in the rubber composition of the various types of rubber mostly replacing the reclaimed rubber.

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### REFERENCES

- [1] Morton, M.: "Rubber Technology", VanNostrand Reinhold, New York, 1987
- [2] Donnet, J., A. Voet: "Carbon Black—Physics, Chemistry, and Elastomer Reinforcement", Marcel Dekker, New York, 1976.
- [3] Eirich, F. R., and A. Y. Coran: —Science and Technology of Rubber, Academic Press, New York, 1994.
- [4] Long, H.: —Basic Compounding and Processing of Rubber, Lancaster Press, Lancaster, Pa., 1985.
- [5] Brown, R. P.: —Physical Testing of Rubber, Elsevier Applied Science Publishers, New York, 1986.
- [6] Figure No 1, MEKODEXIM CO., LTD, available at <https://uqC3oEuhJQbEQJmD8>
- [7] Figure No 2, Seien Gum Industrial, <https://j2P2WqmZbZhnzv538>
- [8] Figure No 3, lantor labs available at <http://lanotr.com>