

Recycling and Testing of Waste Cigarette Butts

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Abstract - Cigarette butts are commonly found litter worldwide. These littered butts are potential sources for environmental contamination. Environmental hazards may arise in areas where there is considerable amount of cigarette litter. This is due to leaching of chemicals from filters and smoked tobacco. According to a survey, there are over 200,000,000 pounds of discarded cigarette butts in the United States each year. Each butt can take eight to ten years to biodegrade. Smoke from each cigarette gives out more than 4500 chemicals which can cause irritation and butts also contain toxic, mutagenic and carcinogenic substances in it which act as pollutants to the environment. Cigarette smoking also releases heavy metal contaminants which are a major hazards for human and environmental health. This mainly includes the traces of lead, tin copper, iron etc. The main aim of this paper is to propose a solution to recycle these cigarette butts into cellulose acetate fibers and to understand graphically and evaluate the physical parameters like strength of the recycled cellulose acetate fibers thereby to understand the effectiveness of the recycling process.

Key Words: Cigarette Butt, Leaching, Carcinogenic, Cellulose Acetate.

1. INTRODUCTION

Cigarette filters consists of about 12,000 strands-like fibers. The core of most cigarette filters is actually a form of plastic called cellulose acetate. By itself, cellulose acetate is very slow to degrade in our environment. It can take 2-10 years for the fibers to decay into a plastic powder. Cellulose acetate is a photodegradable polymer. The nicotine inside 200 of these used filters is sufficient to kill an adult human. The chemicals left behind in a cigarette butt can leak into water and sewer systems. In addition, Cellulose acetate fiber has an acetate group on approximately 2-2.5 of every three Hydroxyls and it is used in a variety of domestic products textiles, plastics, films etc. [6]

1.1 QUICK STATS AND EFFECTS OF CIGARETTE BUTTS ON ENVIRONMENT

Annually there are about 5.6trillion cigarette butts littered every year. This constitutes about 38% of collected litter across the globe. In India there are 120million smokers who comprise of 12% of the smokers in the world. Cigarette smoking causes environmental pollution by releasing toxic air pollutants into the atmosphere. The cigarette butts release toxic chemicals in the remains seep into soils and waterways therefore causing soil and water pollution respectively. Animals and plants that come into

contact or absorb the toxic substances from the cigarette residues are affected as well. The common diseases caused by smoking are cancer, type 2 diabetes, heart attack, stroke etc. Washing away of these butts into water bodies is a major threat to aquatic life. [7]

2. PRE-PROCESS EXTRACT PREPARATION

Initially 10g of cigarette butt containing 2.6g of cigarette constituent is suspended in 100ml of distilled water for 24 hours. After this the entire solution undergoes centrifugation and the supernatant was poured out. The pH and conductivity of the sample was found to be 5.1 and 38mS.cm⁻¹.

The images corresponding to this step is given below and shows the amount of leaching which has taken place.



Toxins leached into water in just under 3 min of contact with filters

Fig-1: Leaching in 3 minutes



Toxins leached into water in just 24 hrs. of contact with filters

Fig-2: Leaching after 24 hours

3. METHODOLOGY

Firstly the cigarette butts undergo acid or alkaline pulping. Further the sample is hydrolyzed to get cellulose acetate. Tobacco also contains lignin which is removed thereby liberating cellulose. This solution also contains dissolved ash and chemicals. Further process gives out cellulose pulp and dark liquor. The acquired product i.e the cellulose pulp has fine mechanical properties. The byproducts i.e dark liquor can be reused in the pulping process after acid precipitation with HCl. This methodology is clearly depicted in the flow chart. The product obtained after this process is also shown at a later stage. [2]

4. FLOWCHART

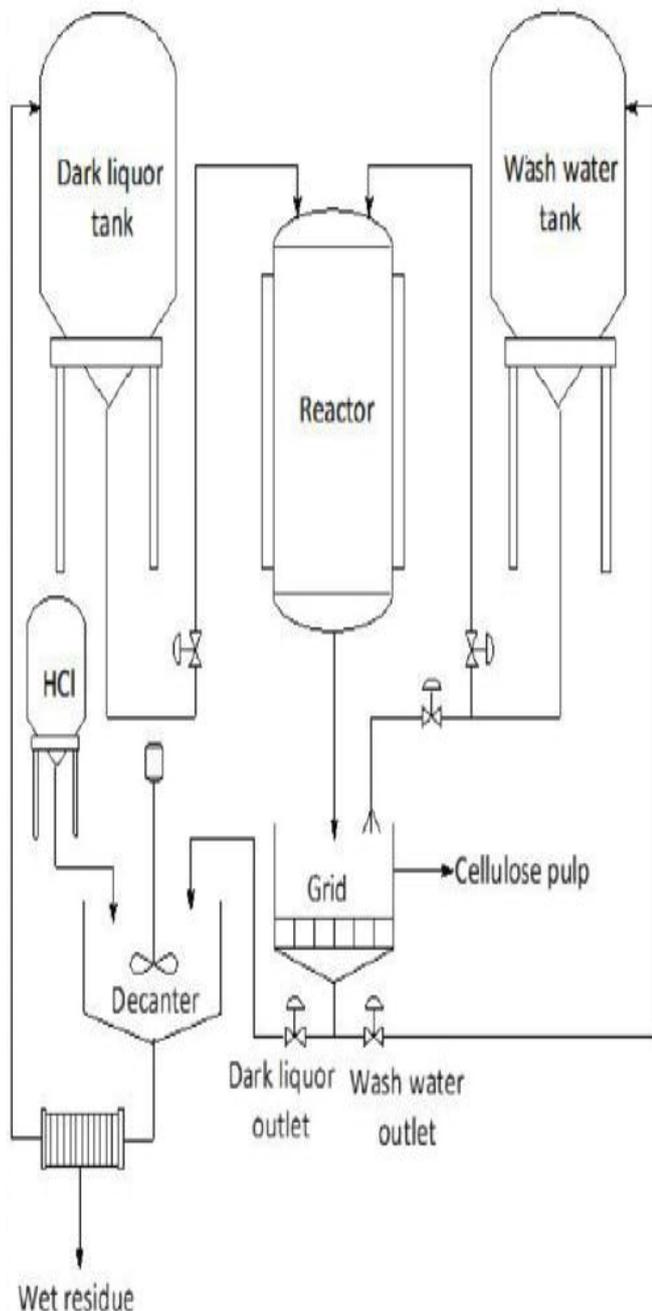


Fig-3: Flow of Processes

5. TESTING AND ANALYSIS

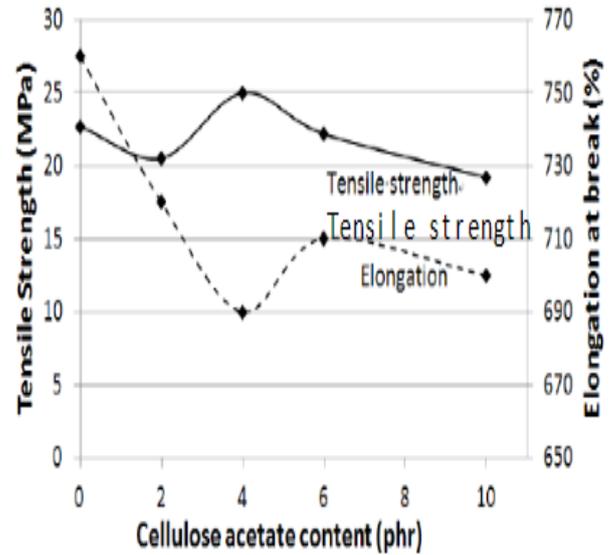


Chart-1: Based on Tensile Strength

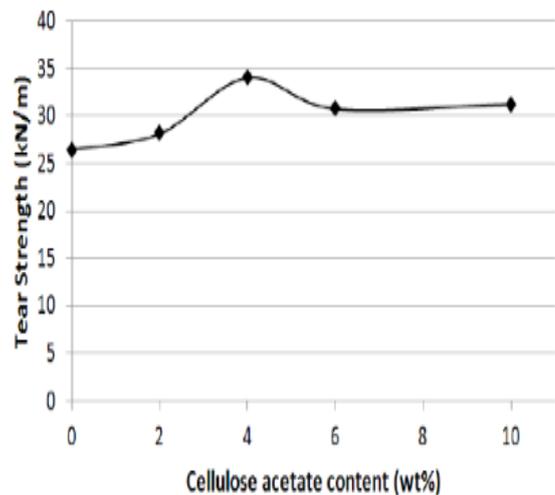


Chart-2: Based on Tear Strength

On testing the above samples, we have plotted the tensile strength and tear strength to the cellulose acetate content. The results are clearly shown in the graphs. This proves that the sample thus obtained has fairly good mechanical properties and can further be used in many applications.

6. RESULTS

After the testing and analysis now it is evident that the recycled sample has good mechanical properties. On a note on its visual appearance, the recycled sample is predominantly a whitish cotton like material with traces of yellow color. This yellow color depicts the presence cellulose acetate in the sample.



Cellulose acetate after the recycling process, ready to be used to produce other finished products.

Fig-4: Recycled Sample



Fig-5: Sample with traces of cellulose acetate

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7. FUTURE SCOPE

This research can further be continued with a series of chemical analysis to check out the presence of heavy metals in the recycled sample. On completion of the chemical analysis, these materials can be used to make various domestic products like door mats, pillows etc

8. CONCLUSION

Waste cigarette butts are an environmental menace and cause harm to every ecosystem. So it is highly recommended and important to recycle these into harmless substances. In this research, we have used a chemical method to recycle cigarette butts. We have tested these samples for physical parameters like tensile strength and tear strength and the results are depicted graphically. The tensile strength of the sample signifies and indicates the potential of waste cigarette butts as a useful raw material to make various products thereby reducing or eliminating an environment pollutant.