CHARACTERIZATION OF ACTIVATED CARBON FROM AUTOMOTIVE PAINT SLUDGE VIA MICROWAVE ASSISTED PYROLYSIS

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ABSTRACT

Industrial wastes such as automotive paint sludge has been an environmental problem for quite some time. With methods such as microwave assisted pyrolysis, it is possible to reduce the waste to be put to better use. Due to the high moisture content of the sludge, pyrolysis with the aid of microwave radiation is an added advantage, as it will act as the heating medium. From this process, the automotive paint sludge is reduced to a solid char, liquid oil and gas. This research focuses on the solid form with prior chemical activation. Being a carbonaceous material, one of the main objective was to determine whether it can be applied in supercapactior usage by characterizing the end product apart from determining the effects of radiation time and power level on the activated carbon produced from the automotive paint sludge. The chemical used for both chemical activation and washing were potassium hydroxide and sulphuric acid respectively. Radiation time and microwave power level were the parameters being applied in this research ranging from 300 W to 1000 W at 20 min to 40 min. The sample at 1000 W and 40 min had the highest potential being able to shed off most of the impurities within the sample leaving behind a 56.5 % yield with a surface area 1.6489 m^2/g. However, it was concluded that through this method, the samples produced very low surface areas and is not suitable in producing activated carbon to be used in the application of supercapacitors. This is because the minimum requirements for the surface area of the activated carbon should be at least 500 m^2/g to be able to function properly.

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CHAPTER ONE

INTRODUCTION

1.1 SUMMARY

This research is to study the potential of automotive paint sludge to be chemically pre-treated before converting it into an activated carbon to determine its potential to be applied in supercapacitors. The research focuses on the specific waste produced by the automotive industry and how it leads to some difficulties along the way and our objective to curb the problem arising. It relies on microwave pyrolysis to produce the desired product and characterized using a Surface Area Analyzer BET (Brunauer-Emmett-Teller), 3Flex Micromeritics and a Scanning Electron Microscope (SEM).

1.2 RESEARCH BACKGROUND

Every year, millions of vehicles be it land, air or sea, are built all over the world. It is a known fact that this industry keeps on increasing in size every year due to the high and increasing demand for vehicles worldwide. For the purpose of this research, the automotive industries are focused on. These are the industries that focus on the manufacturing of cars and its processes. Shown in Figure 1.1, the growth of global car sales almost doubled since the 90's. With billion dollar revenues every year, it is not surprising that the amount of cars sold in the distant future will keep on increasing.

In this industry, the manufacturing of cars undergoes various processes with tweaks and fixes before being put out on the market. One of the process that relates to the topic is the painting process of the car as the finishing touches once the car has been fully manufactured. The results of this procedure are production of waste which are referred to as automotive paint sludge (APS). The sludge formed is very viscous and becomes problematic in handling the waste. Since the production of vehicles increase every year, it is inevitable that the sludge increases accordingly as well.