

Characterization of Post-Pyrolysis Tyre Char as a Pigment in Aqueous Ink-Jet Printing Inks: Using Different Analytical and Spectroscopy Techniques

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Abstract

This work studies the characterization of post pyrolysis tyre char as a pigment in aqueous ink jet printing inks, using different analytical and spectroscopy technique. Samples of the post pyrolysis char were collected in special containers, the determination of ash content used to quantify the amount of nonorganic mineral matter present in a sample. The results ash content shows the post pyrolysis (CBp) has a substantially higher ash content than the two commercial carbon black grades (CB01) and (CB02) that are currently available for inkjet applications and lower carbon content. The major contaminants found in CBp are the elements Si, S, Fe, Ca and Zn. The carbon contents was calculated by difference, giving around 85%. The result of waste tyres pyrolysis one may obtain valuable chemical semi-products or fuels. The full utilization of the waste tyres products is possible after their further processing.

Keywords: carbon black grades (CB01), post pyrolysis (CBp),

1. Introduction

Increasing numbers of used tyres have become a problem. The most common way of dealing with them is recycling, which entails great economic losses and environmental pollution [1]. Recent data show that in the European Union, 2.5 million tons of used tyres appear each year, equivalent to 80% of new tyres are made up of different materials: organic ones of a polymeric type, such as natural or synthetic rubber, inorganic ones, and metals. This complex structure makes recycling difficult [2]. A possible solution to treat used tyres not as waste, but as an energy resource [3]. Carbon Black is a particular form of industrial carbon produced by thermal cracking or decomposition of a hydrocarbon raw material. More than 90% of carbon black is produced using the oil furnace process, which involves injecting an aromatic petroleum distillate into preheated closed furnace and then cooling and collecting the carbon aggregates that have been formed. By controlled manipulation of reactor conditions it is possible to vary particle size, aggregate size, and surface chemistry to create a broad range of carbon black properties to be used in a wide range of applications [4]. The recovery of carbon black product is different in structure, morphology and chemical composition in comparison with virgin carbon blacks. Typically carbon black properties that best describe the high performance level of both automotive tyres and pigment based inkjet inks include [5]. The post-pyrolysis car tyre (CBp) (obtained from coalite, Debyshire, UK) is carrying out recovery of used car tyres, based on the separation of the polymeric and metal contents. In this case of used car tyres, the company has set up a pilot pyrolysis plant where used tyres are subjected to thermal

decomposition into two fractions, solid and gas, both of which can be used as fuel for generating energy.

2. Experimental

Samples of the Post pyrolysis char were collected in special containers, the determination of ash content used to quantify the amount of non-organic mineral matter present in a sample, Ball mill with assorted milling balls, Laboratory furnace, crucible, measuring cylinder, Semi-quantitative XRF, Ash content, Chemicals and reagents. Qemscan is the most powerful process mineralogical tool currently employed in the mineral industry for quantitative evaluation of minerals and inorganic substances. The samples were analysed using the partial mineral analysis mode. This was where the electron beam is rastered over individual particles at a pre-determined beam stepping interval (pixel spacing) and a mineralogical map of each particle was obtained.

3. Results and Discussion

Ash content in this figure (1) show that CBp has a substantially higher ash content than the two commercial carbon black grades (CB01 and CB02) that are currently available for inkjet applications. The results in Figure (2) show that CBp has a substantially lower carbon content than the two commercial carbon black grades (CB01 and CB02) that are currently available for inkjet applications. The proximate analysis of CBp, and two commercial grades of carbon black designed specially for inkjet printing.

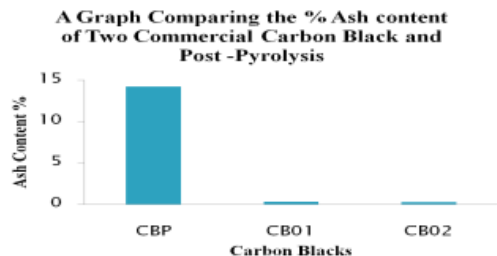


Fig. 1

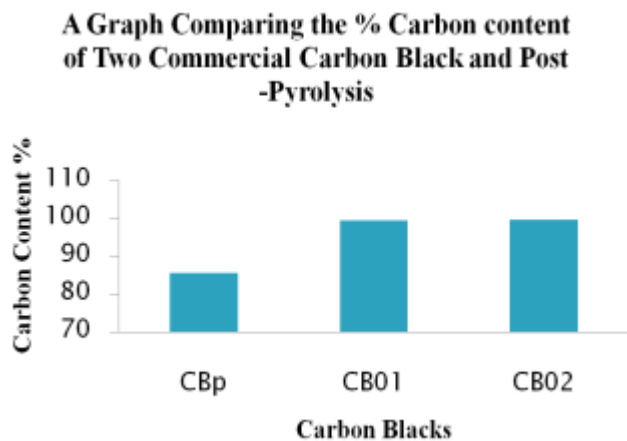


Fig. 2

Semi-quantitative XRF

The results in the table below show that the major contaminants found in CBp are the elements Si,S,Fe,Ca and Zn. The carbon content was calculated by difference, giving around 85%.

The results in Figure (3) below show the main contaminants are elements silica, Sulfur and Zinc, whilst carbon content is calculated around 85%. identified by GC-MS chromatograms in Figs. 4, 5, and 6.

Ash Content (%)

Generally, it has been suggested that the pyrolysis of used tyres may be successful new recycling method. when tyres are no longer suitable for their original applications. that are usually dumped in landfill sites, burnt in cement kilns, or turned to tyre crumb. It has been suggested that pyrolysis of used car tyres may be successful new recycling method. When tyres are no longer suitable for their original application. The results from this study show that the CBp recovered from tyre pyrolysis has a carbon content around 85%, which is much lower than that of most commercial grades of carbon black used in the printing industry. The ash

content of the CBp was determined to be higher than that of the commercial grades.

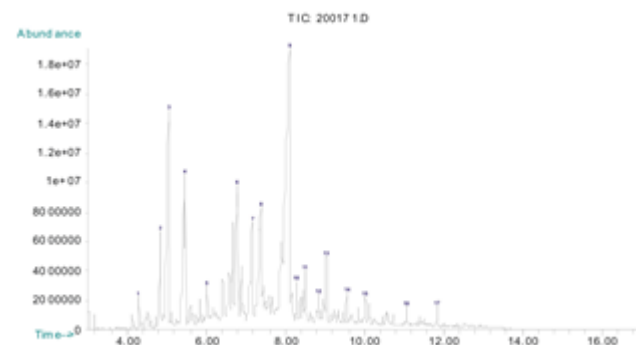
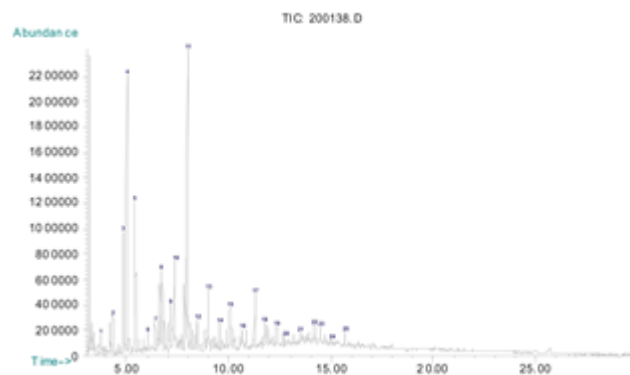


Figure 4 GC-MS Chromatogram for carbon black char at 500 °C

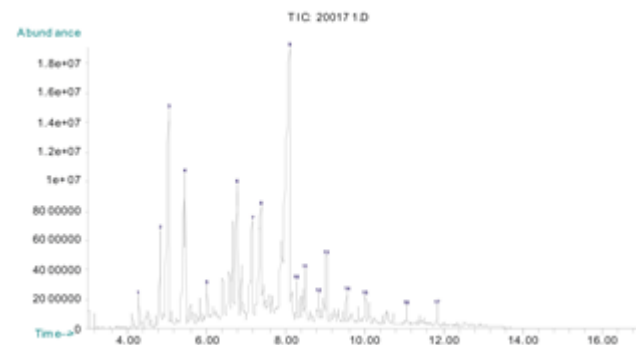


Figure 5 GC-MS Chromatogram for commercial carbon black 01 at 400 °C

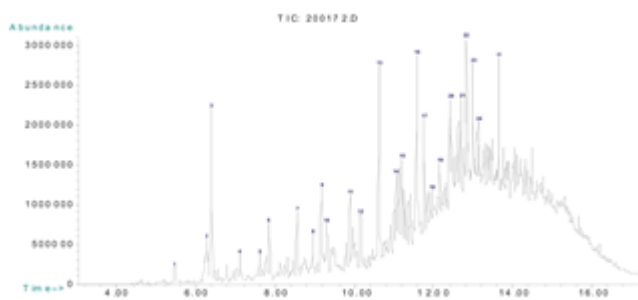


Figure 5

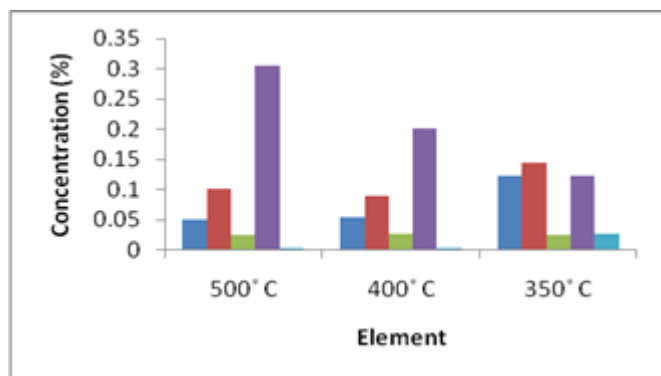


Figure 6 GC-MS Chromatogram for commercial carbon black 02at 350 °C

4. Conclusions

The pyrolysis of used car tyres has been thoroughly researched during the preceding 20 years on a small laboratory scale. Initial results from tyre pyrolysis were deemed sufficiently promising to lead to scale up. This current project had access to samples from a pilot plant obtained at different temperatures. Pyrolysis may be an interesting option of waste tyres recycling. There are many technological variants of the process. As a result of waste tyres pyrolysis one may obtain valuable chemical semi-products or fuels. The full utilization of the waste tyres pyrolysis products is possible after their further processing.

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