

Confidential Report

Rubber Chemical Consultants



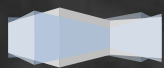
Waste Tire Pyrolysis

Producing Commercial Tire

Derived Carbon

CONTENTS

Page 1 of 39 (Full Report)	
Report Number:	RCCL086
Issue Date:	July 2014
Prepared For:	General Release





Report Scope

This market report covers the following items:

Rubber Chemical: This report focuses on tire derived carbon (TDC) and furnace carbon black.

Markets: Global and regional furnace carbon black markets.

Geographies: Global and regional furnace carbon black with a focus on North American tire derived carbon production.

Time Frame: Historic and projected market data for 2011 to 2030 with snapshot data for 2013/14.

Market Volumes: Global and regional for furnace carbon black.

Note: This report is primarily a technical report providing context for tire derived carbon production and markets by comparison with the furnace carbon black industry.

Report Objectives

To understand the competitive position of, and future outlook for, tire derived carbon produced from the pyrolysis of waste tires.

Report Contents

- 1 Contents
- 2 Introduction (3 Pages)
 - 2.1 Definitions, Abbreviations and Nomenclature
 - 2.2 Scope
 - 2.3 Objectives
 - 2.4 Information Sources
 - 2.5 Assumptions
- 3 Furnace Carbon Black Producers (9 Pages)
 - 3.1 Economics of Furnace Carbon Black Producers
 - 3.1.1 US Domestic
 - 3.1.2 Foreign Competition
 - 3.1.3 Market Regionalisation
 - 3.2 US Supply and Demand Forecast
 - 3.2.1 Demand Drivers
 - 3.2.2 US Pricing Forecast
 - 3.2.3 Size of US and International Market
- 4 Recycled Carbon Black from Tires (3 Pages)
 - 4.1 How to Get Customers
 - 4.2 Maintaining Customers



- 4.3 Benefits versus Virgin Furnace Carbon Black
- 4.4 Pricing Relative to Virgin Furnace Carbon Black
- 5 Tire Pyrolysis Technology to Produce Tire Derived Carbon (9 Pages)
 - 5.1 Leading Technologies
 - 5.2 Types of Process
 - 5.2.1 Fully Continuous
 - 5.2.2 Semi-Continuous
 - 5.2.3 Batch
 - 5.2.4 Other Technologies
 - 5.3 Commercial Production
 - 5.4 Summarising Leading Technologies
 - 5.5 Interesting Process Features
 - 5.6 Industry Landscape
 - 5.6.1 US Competitors
 - 5.7 Considerations for Back Integration or Technology Development
- 6 Value Chain Analysis (3 Pages)
 - 6.1 Crumb Rubber
 - 6.2 Pyrolysis
 - 6.3 Landfill
 - 6.4 Fuel
 - 6.5 Tire Pyrolysis Potential to Take Share from Other Markets
 - 6.6 Outlook on Availability of Waste Tires
- 7 Pollution Effects of Furnace Carbon Black Manufacture (6 Pages)
 - 7.1 Furnace Carbon Black Plant Emissions
 - 7.2 Emission Effects Compared Across Different Feedstocks
 - 7.3 Furnace Carbon Black versus Recycled Carbon Black
 - 7.4 Regulatory Environment
 - 7.4.1 Air Quality Standards
 - 7.5 Incremental Costs
 - 7.6 Carbon Trading Credits
- 8 Tire Technology Aspects (2 Pages)
 - 8.1 PAH Content
 - 8.2 Tire Labelling
 - 8.3 Sustainability
 - 8.4 Potential Impact on Tire Derived Carbons

Report Figures (4 Figures)

Figure 3.1 - Average Carbon Black Import Values, \$/MT

Figure 3.2 - Estimated Product Price Split from US Import Data

3



Figure 7.1 - Equivalent Mass Balance

Figure 8.1 - Future Construction and Material Effects on Pyrolysis Char Carbon Content

Report Tables (19 Tables)

Table 2.1 - Definitions, Abbreviations and Nomenclature

Table 3.1 - Selected Data from Annual Reports

Table 3.2 - Selected Data from Annual Reports

Table 3.3 - Furnace Carbon Black Production Cost Breakdown

Table 3.4 - Chinese Supply & Demand

Table 3.5 - European Supply & Demand

Table 3.6 - Indian Supply & Demand

Table 3.7 - North American Supply & Demand

Table 3.8 - Global Actual and Forward Consumption Volumes (Silica Adjusted)

Table 3.9 - North American Actual and Forward Consumptions (Silica Adjusted)

Table 4.1 - Range of TDC Estimated Market Values

Table 5.1 - Pyrolysis System Types for Current & Future Producers

Table 7.1 - Indicative Emissions for 100 kMTpa Furnace Carbon Black Plant using FCC Feedstock

Table 7.2 - Indicative Emissions for 100 kMTpa Furnace Carbon Black Plant using CT Feedstock

Table 7.3 - Typical Pyrolysis Output

Table 7.4 - Estimated On-Site Emissions from Gas Combustion for 100 kMTpa TDC

Table 7.5 - SO₂ Air Quality Standards

Table 7.6 - NO_x Air Quality Standards

Table 7.7 - Particulate Air Quality Standards