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DICYCLOPENTADIENE (DCPD) AND POLYDICYCLOPENTADIENE (PDCPD): PRODUCTION, MARKET AND FORECAST IN RUSSIA

Sample PDF

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Annotation

The **purpose of this research** is an analysis of the Russian market of dicyclopentadiene (DCPD) and polydicyclopentadiene (PDCPD) and raw materials for their production.

The **objects of the study** are DCPD and PDCPD.

This work is a **desk research**. As **information sources**, data of Federal Service of State Statistics of Russia (Rosstat), the Russian customs statistics, and the databases of "InfoMine" were used. Also the materials of the industrial and regional press, annual and quarterly reports of companies, web-sites of companies-producers and consumers of DCPD and PDCPD, as well as the scientific and technical literature were employed. In addition, interviews were conducted with representatives of the market participants.

The **chronological scope of the study**: 2011-2014; a forecast is up to 2020.

The **geography of research**: Russian Federation.

The **volume of research**: the report consists of 7 chapters, contains 55 pages, including 16 Tables, 6 Figures and 3 Appendices.

The **first chapter** is devoted to the description of the production technology of DCPD and PDCPD.

The **second chapter** analyzes the raw material base for their release. In particular, it lists the enterprises-manufacturers of liquid pyrolysis products, which are formed as by-products of the ethylene-propylene technological process. Also the chapter describes the fractions of liquid pyrolysis products manufactured by various companies.

The **third chapter** is devoted to the production of DCPD in Russia in 2011-2014. It describes the capacities and production volumes, and analyzes the current state and development prospects of the largest enterprises-producers.

The **fourth chapter** presents data on foreign trade in DCPD and PDCPD in Russia in 2011-2014. It considers the amounts, directions and the structure of export-import supplies.

The **fifth chapter** presents the export-import prices on DCPD of varying quality and destinations.

The **sixth chapter** is devoted to consumption of DCPD and PDCPD in Russia during the reporting period. It presents the supply-demand balance of DCPD/PDCPD, estimates a sectoral pattern of their consumption, and describes the largest Russian companies, which manufacturer products made of PDCPD.

The **seventh chapter** presents a forecast of development of the Russian market of DCPD/PDCPD for the period up to 2020

The **appendices** give the specifications for the fractions of liquid pyrolysis products, released by the various Russian companies, and the addresses and contact information of enterprises producing liquid pyrolysis products and DCPD, as well as products from PDCPD.

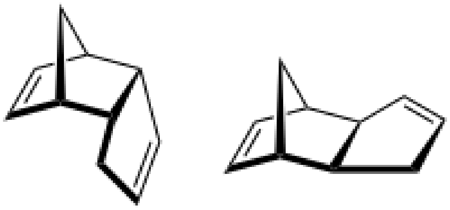
The target audience of the research:

- Participants of the market of dicyclopentadiene and polydicyclopentadiene - producers, consumers, and traders;
- Potential investors.

The proposed study claims the role of a reference for marketing services and professionals, who make managerial decisions in the oil market.

Introduction

Dicyclopentadiene (DCPD), the chemical name tricyclo [5.2.1.02,6]dodeca-3,8-diene (biscyclopentadiene), cyclopentadiene dimer, is a chemical compound with the formula $C_{10}H_{12}$. Its structural formula is as follows:



By its physical properties DCPD is a colorless crystalline substance with a pungent odor. It is soluble in hydrocarbons, carbon tetrachloride, diethyl ether, acetone, and acetic acid. It has a negligible solubility in water.

Dicyclopentadiene exists as *endo*- and *exo*-isomers. For an *endo*-isomer m.p. = 33°C, the boiling point = 65°C at a pressure of 50 mm Hg; for an *exo*-isomer m.p. = 19°C.

DCPD easily bonds with H_2, H_2O, halogens, halides, carboxylic acids, etc., and the reaction preferably takes place through a more active norbornane bond (C_8-C_9).

An industrial importance has the *endo*-isomer resulting from the dimerization of cyclopentadiene at 0-130°C (the Diels-Alder reaction). The reaction is reversible, and at higher temperatures DCPD begins to decompose with a release of cyclopentadiene.

DCPD is flammable, so that should not be allowed to mix with air. It irritates mucous membranes of the eyes, and its MPC is 1 mg/m^3.

The *endo*-isomer of DCPD is used in the production of metallocene polymerization catalysts, insecticides, and other agricultural chemicals, flame retardants, ethylene-propylene-diene rubbers, resins and modified oils, and other organic products.

One of the most efficient high-tech ways of using DCPD, developed over the last decade in the world, is its metathesis polymerization with obtaining as a result of polydicyclopentadiene (PDCPD) - a polymer with unique consumer properties: a low density, a high strength, a stability at high and low temperatures, and a resistance to chemicals.

PDCPD is an environmentally degradable plastic, its combustion does not release toxic products. Its mechanical and chemical processing, the secondary recycling, including that with obtaining materials for the oil collection, are possible.

For the synthesis of PDCPD the monomer with a purity of not less than 98% is used. Currently in Russia DCPD of the indicated purity is not produced.

1. Technology for producing dicyclopentadiene (DCPD) and polydicyclopentadiene (PDCPD)

1.1. Dicyclopentadiene

Dicyclopentadiene is one of the byproducts of the production of ethylene and propylene by a high temperature pyrolysis of petroleum fractions. In addition, dicyclopentadiene can also be released from the products of the stone-coal tar processing.

On an industrial scale for the first time cyclopentadiene and DCPD were obtained exactly in the coking industry, by releasing them from the benzene fractions produced during the coal processing.

The technology of producing DCPD from coke is quite simple. The head fraction of the benzene distillation, containing more than 28% of carbon disulfide, about 45% of benzene and about 22% of cyclopentadiene and DCPD, is first subjected to a neutralization with an alkali solution.

After settling, the neutralized fraction is fed to the thermal dimerization, which is carried out in tubular reactors at temperature of 110-125^{o}C for 30 hours. The dimerized fraction at an atmospheric pressure is separated by distillation into a carbon disulfide and a dicyclopentadiene fraction. The dicyclopentadiene fraction is subjected to distillation under vacuum.

DCPD obtained from coal has a 90-96% purity. The coking of 1 million tons of coal produced only about 50 tons of cyclopentadiene.

Over time, the resources of DCPD obtained from coal proved insufficient, which led to the research on the separation of DCPD from liquid products of pyrolysis of petroleum fractions - the richest potential source of DCPD.

The first information on separation of DCPD from liquid products of pyrolysis, obtained in the production of ethylene, appeared in 1962.

The *liquid products of pyrolysis (LPP)* is a mixture of various hydrocarbons, especially aromatic ones - benzene, toluene, xylenes, C_9-C_8 alkylbenzenes, naphthalene, alkylnaphthalenes, indene, diphenyl, acenaphthene, fluorene, phenanthrene, anthracene and their methyl derivatives, and other condensed aromatic hydrocarbons.

In addition, the liquid products of pyrolysis contain cyclic and alicyclic dienes (isoprene, ***cyclopentadiene***, piperylene, etc.), olefins, vinyl aromatic hydrocarbons (styrene, methyl styrenes), as well as paraffins and naphthenes impurities.

LPP C_5 and above are sometimes called a resin of pyrolysis, a pyrocondensate or a pyrolysate.

A composition of liquid products of pyrolysis depends not only on the mode of pyrolysis, but also on the type of raw materialused - gas, straight run gasoline, or atmospheric gas oil.