BPD

Phosphorus Specialties

Technical Information Bulletin

BPD IN 3HPP - A FLAME RETARDANT FOR POLYESTER

Introduction

BPD (Benzene Phosphorus Dichloride) is a highly reactive, aryl phosphonus dichloride that is utilized as an intermediate in the manufacture of 3HPP (2-carboxyethyl(phenyl) phosphinic acid), a reactive phosphorus-based flame retardant for polyesters. The chemical composition, physical properties and high reactivity of the BPD molecule afford 3HPP manufacturers the opportunity to produce an economical and highly efficacious flame retardant product.

Physical and Chemical Properties

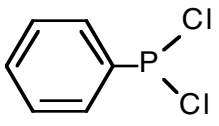
In its purified form at ambient conditions, BPD is a liquid product. The chemical structure, nomenclature, general characteristics and properties of the product are as follows:

Characteristics and Properties

Appearance	Colorless liquid with phosphine-like odor
Empirical Formula	$C_6H_5PCl_2$
Molecular Weight	178.99
Boiling Point	224.6ºC
Specific Gravity @ 25ºC	1.316-1.320
Vapor Pressure (mm Hg)	10 @ 98ºC
Viscosity @ 25ºC	1.3 cps
Autoignition Temperature	265ºC
Solubility	Soluble in most aprotic organic solvents. Decomposes in water and protic solvents.

Product Sales Specifications

Assay (GC)	99.0% minimum



(BPD)

Chemical Name: Benzene Phosphorus Dichloride or Phenylphosphonus Dichloride

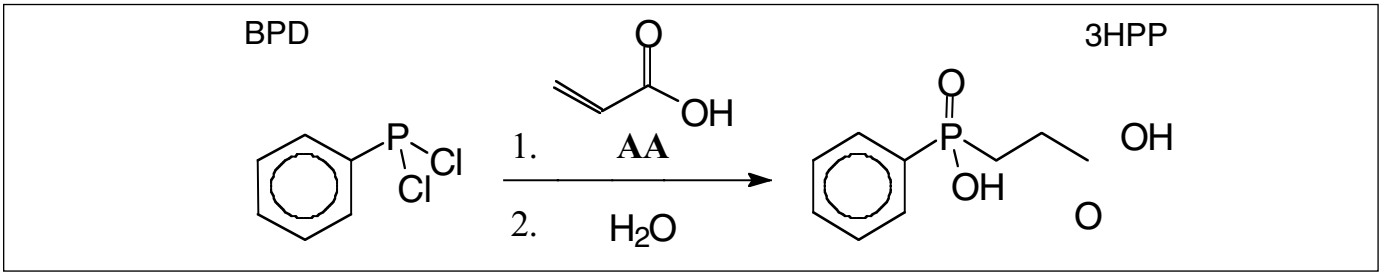
Technology

Increasingly, polyester fibers and moldings are being utilized in consumer, construction, electronics, hospitality, health care and transportation industries where flame retardant properties are desired or required. Polyester fiber applications requiring flame retardant properties include specialty clothing, flooring, furniture, bedding, upholstery and draperies. Computer and electronic housings, automotive and aviation parts and construction materials are representative polyester molding applications requiring flame retardant properties.

Traditionally, flame retardancy was imparted to polyesters through the application of topical coatings or the incorporation of migratory additives. This is still the practice in some areas today. However, topical coatings and migratory additives possess inherent limitations, in that they can be washed, rubbed or wiped off during the lifetime of the product. They also present problems with respect to impacting the chemical and physical properties of polyester and some even impact product safety and toxicity.

To overcome the limitations of the topical coatings and migratory flame retardants, technology has been developed to produce polyester products with permanent flame retardant properties. The current state of the art involves the incorporation of flame retardants into the backbone of the polyester resin through a chemical reaction. A product that currently finds application in the industry to achieve this effect is 3HPP (2-carboxyethyl(phenyl) phosphinic acid). 3HPP is a reactive phosphorus-based molecule that imparts permanent and excellent flame retardant properties to polyester. 3HPP also enhances polyester color stability and dyeability. Additionally, polyester chemical and physical properties are maintained.

Production of 3HPP is achieved through the reaction of BPD with acrylic acid (AA), and the subsequent hydrolysis of the intermediate to 3HPP. A simplified reaction mechanism is as follows:



Features and Benefits

The features and benefits of BPD with respect to the manufacture of 3HPP are as follows:

Features	Benefits
1. Highly reactive molecule	Readily reacts with acrylic acid to yield reactive intermediates that are subsequently hydrolized to 3HPP
2. Phosphorus atom in BPD molecule	Imparts flame retardant property to 3HPP, forming a protective char when polymer is exposed to flame and heat
3. Trivalent phosphorus in BPD	Readily oxidized to pentavalent phosphorus on conversion to 3HPP

Markets and Recommendations

Manufacturers of polyester flame retardants are encouraged to consider the evaluation of BPD as a starting raw material for the production of flame retardant products. It is also recommended that polyester producers interested in imparting flame retardant properties to their products consider BPD-based 3HPP flame retardant technology.

Safety and Toxicity Information

Please refer to the Material Safety Data Sheet for information on safety and toxicity.

Technical Service Information

Cytec's Phosphine & Phosphorus Specialties group provides technical service assistance for BPD and other products. Samples of BPD are available upon request.

IMPORTANT NOTICE

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