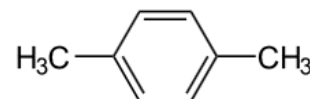




VIRENT BioForm PX[®] Paraxylene



Overview

The BioForming[®] process converts plant-derived feedstocks into a BioFormate[®] product that is analogous to petroleum reformat. Similarly to conventional petroleum reformat, Virent's Bioreformat product can be used as a gasoline blendstock or processed to high purity aromatic chemicals using conventional aromatics processing technology. Virent's products are indistinguishable from the petrochemical analogs, except for C-14 dating for bio-content. Using conventional aromatics processing Virent has produced renewable paraxylene, mixed xylenes, toluene, benzene and Aromatic 100.

Key Properties

Composition

BioForm PX paraxylene fully meets the ASTM speciation for high purity paraxylene. Common impurities are present at levels at or below those in conventional petrochemical paraxylene.

Interchangeable

BioForm PX is a direct drop-in replacement for petrochemical paraxylene, meeting typical industrial specifications for high purity paraxylene.

Green House Gas (GHG) Reduction

BioForm PX helps meet sustainability goals. Depending on the feedstock used to produce BioForm PX, it will reduce the GHG up 70% versus petrochemical paraxylene. Independent radio carbon dating confirms the carbon content of BioForm PX is bio-based.

TSCA Listing

BioForm PX is TSCA listed. Product registrations in other regions, including REACH, will be obtained prior to commercialization. Consult the SDS for additional information.

Applications

Nearly all paraxylene is consumed in the production of terephthalic acid (TPA). TPA is a key building block in the production of polyesters for bottles, fiber, film and other applications. Bio-TPA produced from bio-paraxylene can be combined with the bio-based glycols, ethylene glycol (EG), propanediol and butanediol to produce 100% bio-based polyethylene terephthalate (PET), polytrimethylene terephthalate (PTT) and polybutylene terephthalate (PBT).

Demonstrated Conversion to PET

Several leading PET manufacturers have oxidized BioForm PX paraxylene to TPA and subsequently copolymerized the TPA with bio-EG to bio-PET. The PET has been successfully converted to bio-based beverage bottles with the same properties, including clarity as conventional PET.



Produced from BioForm PX

Property	Method	HP <i>p</i> -xylene ASTM D5136-09	VIRENT	
			Specification	Typical ⁽²⁾
<i>p</i> -xylene	ASTM D3798 ⁽¹⁾	≥ 99.7 wt%	≥ 99.7 wt%	99.86 wt%
<i>o</i> -xylene	ASTM D3798 ⁽¹⁾	≤ 0.1 wt%	≤ 0.1 wt%	0.040 wt%
<i>m</i> -xylene	ASTM D3798 ⁽¹⁾	≤ 0.2 wt%	≤ 0.2 wt%	0.096 wt%
Ethylbenzene	ASTM D3798 ⁽¹⁾	≤ 0.2 wt%	≤ 0.2 wt%	< 0.01%
Nonaromatic hydrocarbon	ASTM D3798 ⁽¹⁾	≤ 0.2 wt%	≤ 0.2 wt%	0.003 wt%
Sulfur	ASTM D7183	< 1 ppm	< 1 ppm	0.5 ppm
Appearance	ASTM D2090	Clear and sediment-free	Clear and sediment-free	Pass
Color, maximum	ASTM D1209	10	10	5
Mean Biobased Content	C-14	N/A	>99%	100% ⁽³⁾

(1) Method modification available upon request
(2) Production Lot C0101D
(3) Beta Analytic Radiocarbon Dating

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