

EASTMAN

Supporting your confidence

*with product stewardship and
product safety studies*

Eastman **TRITAN™**
copolyester



Confidence is a key ingredient

in Eastman Tritan™ copolyester

Confidence is important throughout the value chain

Consumers have questions about the safety of the products in their lives. This leads to a stronger desire for reliable information about what goes into the products they purchase and use. Brand owners and manufacturers who provide the information needed to cultivate consumer confidence can tap into a growing demand for assurance that products are safe and reliable.

As a leader in technology and innovation, Eastman takes the relationship between understanding and confidence very seriously. This includes conducting extensive internal and third-party studies that help customers and the public understand and address potential health concerns.

The results of independent third-party testing are summarized in this brochure. These studies confirm that Eastman Tritan™ copolyester is free from bisphenol A (BPA). In addition, separate studies show that Tritan is estrogenic and androgenic activity free.



Product stewardship is critical throughout the production stream

Customer confidence in an innovative polymer like Eastman Tritan™ copolyester is the result of ongoing product stewardship. To Eastman, this means applying world-class product development and production processes to ensure the safety of its employees and customers.

Eastman's commitment to product stewardship is evidenced by its compliance with regulatory requirements and ISO standards in its manufacture of Eastman Tritan™ copolyester. This commitment is especially evident in Eastman's newest plant in Kingsport, Tennessee, which is dedicated exclusively to the production of Tritan. Additional examples of Eastman's product stewardship can be found in this brochure in the following sections: "Testing certifies BPA is not present" and "Eastman supports your confidence."

Eastman understands that an informed consumer can be a more confident consumer—and a more satisfied customer. Therefore, a critical part of the responsible stewardship of Eastman Tritan™ copolyester is conducting and publishing rigorous studies like those summarized in this brochure to help brand owners maintain the confidence of their employees, investors, and end users.

Definition of terms

- Endocrine disrupting chemicals (EDCs)—chemicals that are known to activate or inhibit estrogenic and/or androgenic (testosterone) responses in various species and ultimately lead to adverse health effects.
 - Estrogenic activity (EA)—compounds that specifically mimic the naturally occurring hormone estrogen.
 - Androgenic activity (AA)—compounds that specifically mimic the naturally occurring hormone testosterone.
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Comprehensive safety testing supports confidence

A comprehensive body of testing conducted by various reputable third-party research labs, using well-recognized test methods, evaluated monomers of and/or potential migrants of Eastman Tritan™ copolyester based on three complementary approaches:

- 1.** Structural evaluation of monomers of Tritan compared with estrogenic compounds
- 2.** In vitro testing of monomers and extracts to determine whether any compounds with endocrine disrupting potential migrate from Tritan copolyester
- 3.** In vivo testing to evaluate the potential of Tritan monomers to induce or mimic EA and AA in a living animal

Based on results from this battery of tests, Eastman Tritan™ copolyester is free of EA and AA. More details on these tests follow.

Structural evaluation of monomers

EDCs mimic naturally occurring estrogen and testosterone present in the body to such an extent that they induce adverse biological effects. This occurs because EDCs can bind to estrogen and androgen receptors found within cells, similar to a lock and key. The monomers used to manufacture Tritan were assessed for their ability to bind to these receptors. This was accomplished using computerized Quantitative Structural Activity Relationship (QSAR) modeling programs. QSAR modeling compares the structural and chemical characteristics of the monomers against compounds with known estrogenic or androgenic activity.



Results of this research, conducted by the UMDNJ-Robert Wood Johnson Medical School,¹ indicate that monomers used to manufacture Eastman Tritan™ copolyester have *negligible binding affinity with estrogen and androgen receptors*.

In vitro testing of monomers and potential migrants

Despite an extremely low likelihood for Tritan copolyester monomers to bind to receptors based on their structure and the computer modeling studies, additional laboratories assessed the EA and AA of both the monomers and concentrated extracts of Tritan.^{2,3}

Using tests known as the Relative Binding Assay and the Receptor Transactivation Assay, the functionality of any binding that may result from exposure to Tritan copolyester monomers or extracts was evaluated. Plastic migrants were obtained from several grades of Tritan using rigorous extraction techniques and conditions consistent with use in baby-bottle and food contact applications.

Migrants were then incubated in a bioluminescent yeast assay that responds to the presence of estrogenic and androgenic compounds.

Results of this in vitro testing *showed no estrogenic or androgenic response*.

In vivo testing for EA and AA

Even though the in vitro tests found no EA or AA, a third series of tests were conducted to evaluate the potential of Tritan copolyester monomers to elicit an estrogenic or androgenic response in biological systems.⁴

These in vivo tests included the Uterotrophic assay and Hershberger assays for assessing potential to elicit EA or AA, respectively. These tests are regarded by the scientific

community to be very sensitive in their ability to detect compounds that possess EA or AA and are considered the “gold standard” for assessing the endocrine disrupting potential of a compound. Furthermore, these methods are accepted tests in the Tier I Endocrine Disruption Screening Program of the U.S. Environmental Protection Agency (EPA).

Monomers used in Eastman Tritan™ copolyester were given orally as a mixture and encompassed a wide range of doses. EA and AA were assessed by examination of reproductive organs and other tissues for any change in weight or appearance. Results from these tests showed no evidence of estrogenic or androgenic effects in any of the measured tissue parameters.

Third-party results demonstrate that Eastman Tritan™ copolyester is free of EA and AA. The monomers and potential migrants of Tritan do not demonstrate an affinity to bind to hormone receptors or a potential to induce endocrine disrupting effects. The results of the monomer studies assessing endocrine activity and a detailed explanation of the scientific approach have been published in *Food and Chemical Toxicology*, Vol. 5, Issue 2, pages 2196–2205 (2012).

¹Conducted by Dr. William Welsh, Department of Pharmacology, UMDNJ-Robert Wood Johnson Medical School, Piscataway, N.J.

²Conducted by CeeTox Inc., Kalamazoo, Michigan

³Conducted by the Center for Environmental Biotechnology, University of Tennessee, Knoxville, Tenn.

⁴Conducted by WIL Research Laboratories, LLC, Ashland, Ohio



Testing certifies BPA is not present

in Eastman Tritan™ copolyester

In response to market demand for a BPA-free alternative, many brand owners and molders are looking to Eastman Tritan™ copolyester as a high-performance solution. To increase customer confidence in the decision to use Tritan, Eastman has gone the extra step of rigorously analyzing this innovative polymer—and making test results available to customers.

BPA is not and has never been an ingredient or by-product of the production of Eastman Tritan™ copolyester. *Validation that Tritan is BPA free is supported by robust internal testing and independent third-party testing by accredited laboratories.*⁵ Third-party tests were conducted with a range of sensitivity. The results shown in Table 1 indicate that Tritan, as supplied by Eastman, has been found to be free of BPA.

Table 1

Validation: Eastman Tritan™ copolyester is BPA free

Polymer	Standard test 5 ppm LOD*	High-sensitivity test 0.1 ppm LOD
Eastman Tritan™ copolyester TX1000	Not detected	Not detected
Eastman Tritan™ copolyester TX1001	Not detected	Not detected

*LOD, limit of detection



⁵Intertek, www.intertek.com.

Eastman supports your confidence

Eastman's ongoing commitment to product stewardship supports customer confidence in our product research and development and technical support.

Commitment to product stewardship at all levels within Eastman promotes sustainable production of polymer solutions. Eastman's commitment is demonstrated throughout our company:

- Eastman was one of the founding members of Responsible Care® more than 20 years ago. We continue to implement and advance its programs for protection of the environment and the health and safety of employees, communities, and people who handle our products.
- Named a 2012 and 2013 ENERGY STAR® Partner of the Year, becoming the only chemical company to ever receive the recognition more than once
- 2012 Company of the Year by *Chemical and Engineering News*
- Ranked in the *Bloomberg Businessweek* Top 50, a listing of the S&P 500 companies with the best recent performance and outlook for the future
- Honored as Silver Level Stevie® Award Winner in the 2012 American Business Awards
- Received chemical safety excellence awards for outstanding performance in 2011 in its shipping of chemical products from three major U.S. railroad companies: Burlington Northern Santa Fe, Norfolk Southern Corporation, and Union Pacific Railroad
- Received Responsible Care® Energy Efficiency Awards from the American Chemistry Council for the 19th consecutive year
- During 2012, Eastman reduced its overall energy intensity by 2.5% compared to 2011 (7% overall since 2008).
- Eastman realized 2012 energy savings equivalent to \$8 million and 340 million pounds of GHG emissions (equal to emissions from 28,000 cars).
- During the years 2005–2011, the company reduced VOC emissions by almost 33%; SO₂ emissions by almost 8%; NO_x emissions by almost 16%; and TRI emissions by 26%.
- To date, the company has completed cradle-to-gate life cycle assessments (LCAs) on approximately 75% of its top-grossing product lines comprising 80% of revenues.
- Eastman ranked fourth out of 34 U.S. companies in the Materials Sector of *Newsweek's* 2012 Green Rankings.

From product development and production to programs that help ensure safe and responsible manufacture, sale, shipment, use, recycling, and disposal of our products, customers find a world of reasons to be confident in using products from Eastman.



For more information about Tritan copolyester product stewardship and safety studies, contact your Eastman representative today.



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