How sustainable is cellulose acetate?

The answer might surprise you . . .

In the mid-twentieth century, the tobacco industry coalesced around cellulose acetate as the standard filter material of choice, given its superior function and performance. For more than 50 years, consumers have shown a strong preference for these cigarette filters.

Today, concerns over single-use plastics have led the industry to consider alternatives, but various publications confirm that paper filters bring trade-offs. That is why it is important to dive deeper into four common misconceptions about the materials.

But first, what is cellulose acetate?

Cellulose acetate (CA) is a man-made cellulose fiber (MMCF) derived from a renewable resource, wood. Eastman's biobased cellulose acetate is produced from sustainably sourced wood pulp in a closed-loop process where solvents are safely recycled back into the system for reuse. The manufacture of Eastman CA is optimized for a low environmental impact with a low tree-to-fiber carbon and water footprint.

Our cellulose acetate fibers are used in a variety of sustainable products, including filter tow, apparel and home textiles, medical tape, and hygiene products. Like other sustainable fibers, cellulose acetate offers a variety of sustainability features to end-use applications without compromising performance.

Let's investigate a few misconceptions about cellulose acetate . . .

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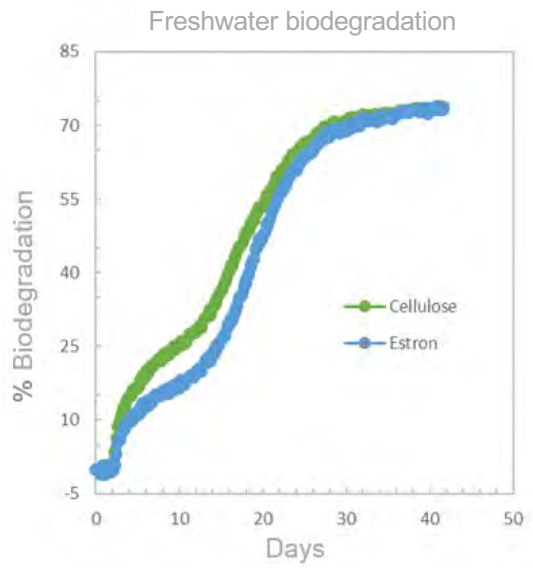
Myth 1: Paper is biodegradable and cellulose acetate is not.

Fact: Cellulose acetate is indeed biodegradable, and although the rate in which it biodegrades differs from paper, we believe the difference is not significant enough to change the perception of cigarette filter litter.

For example, during water biodegradation certification testing conducted by OWS, an Eastman Estron™ acetate tow sample achieved a biodegradation rate higher than 90% of the positive cellulose control in less than the maximum timeframe of 56 days (see graph to the right).



Myth 2: Cellulose acetate adds microplastics to the world's oceans.

Fact: Eastman Estron cellulose acetate tow is biodegradable in seawater.* Cellulose acetate has been assessed in many forms for marine disintegration and has been found to biodegrade in seawater orders of magnitude faster (months) than previously reported (decades).

In a recent study conducted by the Woods Hole Oceanographic Institution (WHOI) on the biodegradation of cellulose acetate, Eastman received further scientific evidence that our cellulose diacetate-based materials disintegrate in as little as 13 weeks and biodegrade in the ocean within months. Read more.

**As defined by 'OK biodegradable' marine certification scheme of TÜV Austria. Click the document to access the Eastman Estron OWS letter indicating the details*


OWS

LETTER OF OPINION

Marine aerobic biodegradation test on Estron™ from Eastman Chemical Company in line with ASTM D6691 (2017)

Access OWS Letter

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Myth 3: Switching from CA to paper filters will eliminate concerns over single-use plastics.

Fact: The perception of cigarette filter litter will remain even if paper filters are widely adopted. And if consumers believe paper filters are more biodegradable, they may feel even more inclined to litter.

Given that, any improvement in the biodegradation rate of paper over cellulose acetate is nearly indistinguishable given the environments in which litter is present.

When considering the use of paper filters as a sustainable option, providers should also consider the trade-offs to using paper.

CA biodegrades in nature and has the potential to reduce the use of virgin material and address the global waste crisis by incorporating recycled waste material diverted from landfills, incinerators, and other undesired end-of-life options for a more enhanced sustainability story.

Myth 4: Paper has a better sustainability story than cellulose acetate.

Fact: Our understanding of sustainability continues to change over time, and popular opinions of what make material sustainable should be reexamined. Both paper and cellulose acetate are biobased, biodegradable, and can be produced from recycled waste material. However, if we look at some of the greatest challenges that face the overall health and well-being of our environments, waste and pollution from landfills is a top concern.

Unlike paper, cellulose acetate has the capability to incorporate hard-to-recycle waste plastics diverted from landfills and incinerators as a feedstock using molecular recycling via Eastman's patented carbon renewal technology.

This allows plastics to be broken down into basic building blocks and reused to make new fibers with zero trade-offs on quality and sustainability.

To learn more about the potential for Eastman recycled filter tow, stayed tuned for our next newsletter issue.

Study shows rapid disintegration and biodegradation of cellulose acetate

Eastman has received further scientific evidence that our cellulose diacetate (CDA)-based material, used to produce Naia™ cellulosic fiber, **disintegrates and biodegrades in the ocean within months.**

Recently, Eastman participated in a marine biodegradability study with researchers from Woods Hole Oceanographic Institution (WHOI), the world's leading, independent nonprofit organization dedicated to ocean research, exploration, and education. The study was published in December of 2021 and demonstrated that "CDA-based materials disintegrate and biodegrade in the ocean orders of magnitude faster (months) than previously reported (decades)."

CDA is largely derived from wood pulp, making it biobased, and is responsibly sourced from sustainably managed forests.

"These materials are breaking down on timescales of months. This challenges the perception that they persist for decades," said coauthor Collin Ward, assistant scientist in the Marine Chemistry and Geochemistry Department at WHOI.

The study was conducted using Eastman Naia™ cellulosic fiber and shows great results for the breakdown of CDA in marine environments, challenging the belief that CDA-based materials persist in the ocean for decades.*

Eastman Estron, also a cellulose diacetate fiber, is certified biodegradable in soil and freshwater environments and compostable in home and industrial settings.

You can access the WHOI CDA biodegradation study press release and the ACS publication "*Rapid Degradation of Cellulose Diacetate by Marine Microbes*" through the hyperlinks.

Figures: Time-lapse photography showing visual disintegration of Naia™ CDA materials (CDA and positive controls) and not others (negative controls) over a 25-week incubation in a continuous flow seawater mesocosm. To review the disintegration and biodegradation of other fibers in the study, click the link to the ACS publication.

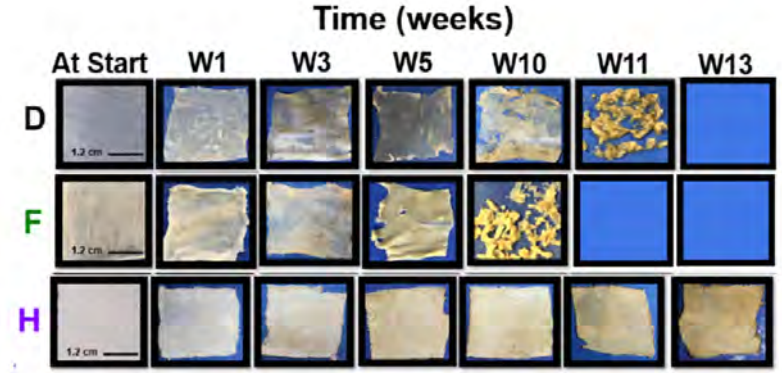

Figure 1. Time-lapse photography showing visual disintegration of certain materials (CDA and positive controls) and not others (negative controls) over a 25-week incubation in a continuous flow seawater mesocosm (week 25 photographs in Figure S2). Blue-filled boxes represent complete disintegration. Legend: (A) 25 μm CDA film (no plasticizer), (B) 25 μm CDA film (triacetin), (C) 510 μm CDA foam, (D) 97 g/m^2 CDA fabric, (E) 100 μm Kraft paper, (F) 91 g/m^2 cotton fabric, (G) 25 μm LDPE film, and (H) 126 g/m^2 PETE fabric.

Michael G. Mazzotta, Christopher M. Reddy, and Collin P. Ward
Environmental Science & Technology Letters 2022 9 (1), 37-41
DOI: 10.1021/acs.estlett.1c00843

**Eastman supports proper disposal of waste; however, we understand that, unfortunately, products end up in the environment due to leakage.*

Looking for a sustainable solution?

Contact your Eastman representative to learn how we can collaborate.

CONTACT US

Q1 2022 Filter Products Newsletter Resources

[WHOI CDA biodegradation study press release]

Rapid Degradation of Cellulose Diacetate by Marine Microbes. Michael G. Mazzotta, Christopher M. Reddy, and Collin P. Ward Environmental Science & Technology Letters 2022 9 (1), 37-41 DOI: 10.1021/acs.estlett.1c00843.
https://pubs.acs.org/doi/10.1021/acs.estlett.1c00843

[Eastman Estron™ OWS Letter of Opinion]