

Polyvinyl Alcohol (PVA)

Applications and Environmental Considerations

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Executive Summary

Polyvinyl alcohol (PVA), also commonly abbreviated PVOH and PVAI, is a synthetic water-soluble polymer used in a wide range of applications, including the dissolvable films surrounding some laundry and dishwasher pods and as a structural or binding material in certain detergent sheets.¹

Because PVA films can dissolve during washing, products containing them are sometimes marketed as alternatives to conventional plastic packaging.

Water solubility, however, is not the same as biodegradability. When PVA dissolves, it disperses into the water, but biodegradation requires the polymer to be broken down further by biological processes into substances such as carbon dioxide, water, and biomass.²

Current evidence suggests that how PVA behaves in the environment depends on the specific type of PVA and the conditions it encounters. Some PVA grades used in detergent films have demonstrated biodegradation in lab studies; however, degradation is slower and less consistent under “real-world” environmental conditions.^{2, 4, 5, 6, 7}

For this reason, neither the disappearance of a PVA film in water nor a general claim that PVA is “biodegradable” is sufficient by itself to demonstrate its environmental impact. Product selection should consider the specific PVA material, evidence-backed biodegradation claims, intended use and disposal, and ways to reduce unnecessary use of synthetic polymers.

Purpose and Scope

This report examines the use of polyvinyl alcohol in laundry and dishwashing products, with particular focus on the distinction between dissolution and biodegradation, the fate of PVA during wastewater treatment, and claims commonly made about dissolvable detergent formats.

It is intended to provide a science-informed guide for evaluating PVA-containing products while recognizing that PVA represents a family of polymers whose environmental properties may vary.

What Is PVA?

PVA is a synthetic polymer produced by converting polyvinyl acetate into polyvinyl alcohol through hydrolysis. The resulting material can have different molecular weights and degrees of hydrolysis, which influence characteristics including water solubility and biodegradation.²

PVA has been used in adhesives, coatings, textiles, paper products, pharmaceuticals, packaging, and numerous other applications. Water-soluble grades are also commonly used to manufacture films for single-dose laundry and dishwasher detergents.²

Dissolution is Not Biodegradation

A dissolvable film does not simply cease to exist when placed in water. Dissolution disperses the polymer into the surrounding water, while biodegradation requires the subsequent biological processes that break the polymer down further.

This distinction is important because a product may be water-soluble without necessarily being rapidly or completely biodegradable under every environmental condition. Conversely, the fact that a polymer remains present after dissolution does not mean that it will necessarily persist indefinitely.

Research demonstrates that PVA can undergo microbial biodegradation, but the rate and extent depend on both the characteristics of the polymer and the environment into which it is released.^{4, 5, 6, 7}

PVA and Wastewater Treatment

PVA is not a single uniform material, and its environmental behavior can vary depending on factors such as degree of hydrolysis, molecular weight, polymer structure, formulation, additives, and environmental conditions.^{2, 7} Because of this variability, environmental claims should focus on the specific type being used rather than PVA as a whole.

Laundry and dishwasher products containing PVA are primarily disposed of down the drain. After dissolution during use, the polymer typically enters a sewer or septic system along with the wash water.

A 2021 study by Rolsky and Kelkar modeled the fate of PVA from laundry and dishwasher pods in US wastewater systems. The authors estimated that approximately 77% of the PVA reaching wastewater treatment could ultimately enter the environment through treated sewage sludge.³ This estimate formed the basis of common claims that approximately three-quarters of PVA from detergent pods passes through wastewater treatment without being degraded.¹

Subsequent research has suggested that some forms of PVA may biodegrade more readily than earlier studies indicated. In 2023, the US Environmental Protection Agency (EPA) found that the earlier Rolsky and Kelkar study may not fully reflect the specific PVA grades used in laundry detergent films and noted that other biodegradation studies may be more relevant to understanding how these materials behave in wastewater treatment.² These findings were also supported by later studies,

which found that some PVA materials used in detergent applications can biodegrade to a greater extent than earlier estimates suggested.^{5, 6}

These findings are promising and suggest that some detergent-grade PVA may biodegrade more extensively than previously thought. However, the biodegradation occurs under very specific test conditions, and does not indicate that all PVA formulations behave the same way or that PVA is without environmental concern. Given remaining questions around its environmental fate and potential ecological effects, avoiding PVA when possible remains the safest choice.⁸

Detergent Pods, Sheets, and Environmental Claims

Single-dose detergent formats can provide convenience and controlled dosing, but the environmental profile of the product should be considered beyond whether its film or sheet fully dissolves during washing. Terms such as “dissolvable,” “biodegradable,” “eco-friendly,” and “plastic-free” can describe different properties and should not be treated as interchangeable.

A dissolvable claim describes what happens when the material contacts water. A biodegradability claim should be supported by evidence demonstrating biological degradation under defined conditions. Neither term by itself provides a full picture of PVA’s environmental impact.

Similarly, consumers seeking to reduce their use of synthetic polymers should be aware that a detergent sheet or pod may contain PVA even when there is no conventional plastic bottle or wrapper remaining after use. Regulators have begun drawing similar distinctions. For example, the European Union’s microplastics restriction excludes polymers that meet certain water-solubility criteria, recognizing that water solubility is different from biodegradability or environmental safety.⁹

Selection Considerations

Topic	What to Look For	What to Avoid
Product format	Powders or liquids that do not require dissolvable PVA films.	Assuming pods or sheets are PVA-free because the film disappears in water.
PVA disclosure	Clear identification of polyvinyl alcohol, PVA, PVAI, or PVOH.	Relying on appearance or marketing claims to determine whether PVA is present.
Biodegradability claims	Evidence-backed claims regarding biodegradability of the specific PVA material.	Assuming “water-soluble” automatically means “biodegradable”.
Environmental claims	Clear, specific information explaining environmental claims.	Broad claims such as “eco-friendly,” “green,” or “plastic-free” without supporting information.
Packaging	Concentrated products that reduce packaging and unnecessary materials.	Assuming one delivery format is more sustainable based on packaging alone.

Table 1. Considerations when evaluating PVA-containing detergent products.

Reducing PVA Use

There are a multitude of options on the market for consumers who prefer to minimize their use of PVA-containing products. Powder and liquid laundry or dishwasher detergents can provide the same

basic function without requiring a PVA film. Concentrated products can also reduce packaging and transportation impacts when appropriately packaged.

When comparing products, look beyond the format itself. Ingredient composition, packaging materials, product performance, and disposal channel all contribute to overall environmental impact.

Reducing unnecessary material use remains an important component of addressing the major issue surrounding plastic and polymer pollution. Global plastic waste reached approximately 353 million metric tons in 2019, while only about 9% was ultimately recycled.¹⁰ Although PVA behaves differently from many common plastics, minimizing use can still help lower overall material use and environmental impact.

Visit MADEWORKS.com for certified products without harmful PVA.

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We are building a bridge to a safer, more sustainable future for all. Using the MADE Ecosystem Approach, MADEWORKS Intelligence generates insights that support better product development and advance systemic change. By bringing together science, industry leadership, and informed consumer choice, we help turn meaningful information into action, transforming the marketplace for a healthier world.

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References

1. US Environmental Protection Agency. *“Polyvinyl Alcohol (PVA); TSCA Section 21 Petition for Rulemaking; Reasons for Agency Response; Denial of Requested Rulemaking.”* Federal Register 88 (April 27, 2023): 25590–25610.
<https://www.govinfo.gov/content/pkg/FR-2023-04-27/pdf/FR-2023-04-27.pdf>
2. Rolsky, Charles, and Varun Kelkar. *“Degradation of Polyvinyl Alcohol in US Wastewater Treatment Plants and Subsequent Nationwide Emission Estimate.”* International Journal of Environmental Research and Public Health 18, no. 11 (2021): 6027.
<https://doi.org/10.3390/ijerph18116027>
3. Byrne, Dominic, Geert Boeije, Ian Croft, Gerd Hüttmann, Gerard Luijckx, Frank Meier, Yash Parulekar, and Gerard Stijntjes. *“Biodegradability of Polyvinyl Alcohol Based Film Used for Liquid Detergent Capsules.”* Tenside Surfactants Detergents 58, no. 2 (2021): 88–96.
<https://doi.org/10.1515/tsd-2020-2326>
4. Menzies, Jennifer, Ashley Wilcox, Kenneth Casteel, and Kathleen McDonough. *“Water Soluble Polymer Biodegradation Evaluation Using Standard and Experimental Methods.”* Science of the Total Environment 858 (2023): 160006. <https://doi.org/10.1016/j.scitotenv.2022.160006>
5. McDonough, Kathleen, Maura J. Hall, Ashley Wilcox, Jennifer Menzies, Jessica Brill, Brian Morris, and Kristin Connors. *“Application of Standardized Methods to Evaluate the*

Environmental Safety of Polyvinyl Alcohol Disposed of Down the Drain.” Integrated

Environmental Assessment and Management 20, no. 5 (2024): 1693–1705.

<https://doi.org/10.1002/ieam.4929>

6. Chiellini, Emo, Andrea Corti, Salvatore D’Antone, and Roberto Solaro. “*Biodegradation of Poly(vinyl alcohol) Based Materials.*” Progress in Polymer Science 28, no. 6 (2003): 963–1014.
[https://doi.org/10.1016/S0079-6700\(02\)00149-1](https://doi.org/10.1016/S0079-6700(02)00149-1)
7. Mondellini, Simona, Matthias Schott, Martin G. J. Löder, Seema Agarwal, Andreas Greiner, and Christian Laforsch. “*Beyond Microplastics: Water Soluble Synthetic Polymers Exert Sublethal Adverse Effects in the Freshwater Cladoceran Daphnia magna.*” Science of the Total Environment 847 (2022): 157608. <https://doi.org/10.1016/j.scitotenv.2022.157608>
8. European Chemicals Agency. “*Microplastics.*” Information on the EU restriction of intentionally added synthetic polymer microparticles.
<https://echa.europa.eu/hot-topics/microplastics>
9. Organisation for Economic Co-operation and Development. *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options.* 2022.
https://www.oecd.org/en/publications/global-plastics-outlook_de747aef-en.html