BIODEGRADABLE PRODUCTS INSTITUTE

Review of Publicly Available Field Testing Results and Programs

Introduction

In early 2021, BPI and BioCycle Magazine hosted a workshop series with composters, municipalities, foodservice operators, and compostable packaging manufacturers to:

1. Identify and confirm the top barriers to the acceptance and successful processing of certified compostable products.
2. Build consensus for a single set of acceptability criteria so that compostable products can be accepted and successfully processed by a broader set of composters processing food scraps.

The workshop culminated in a report containing a Roadmap and Action plan detailing 6 barriers to the acceptance and successful processing of compostable products, along with future state definitions and initial project scoping for how to overcome them. One of those 6 barriers was "Compostability Standards", defined as "products meeting ASTM standards not breaking down quickly enough in real world environments". The desired future state for this barrier was articulated as follows,

> "Composters have enough information on real world performance to trust that products meeting ASTM standards will break down in facilities designed to accept food scraps and packaging."

Workshop attendees expressed support or non-support for proposed action items, including a "collaborative program designed to generate comprehensive data on the performance of certified products in composting facility systems", which received 100% support from all responding attendees, making it the most supported proposed action item of the entire workshop.

With consensus established, a "Field Validation Program" project was identified with the following draft scope of work:

> "Launch a field validation program to integrate with existing data sets on the performance of compostable products in a diverse mix of real world environments, making data available to composters and others through an online portal and annual reports."

The starting point for this program was to identify and consolidate all of the publicly available data BPI could find on the performance of compostable products in real world composting environments, which is what is presented in the remainder of this document. The conclusions and opinions of this report are solely those of BPI and are not endorsed by CMA or other sources of the data.

AUGUST, 2021

Review of Publicly Available Field Testing Results and Programs

Overview

In reviewing publicly available field testing data, it is clear that a significant amount of work has already been done. A few active organizations have conducted thousands of tests, funded by over a hundred companies looking to better understand how certified items break down in the real world. This establishes a firm foundation to work from.

The majority of categories that BPI certifies today are represented in this data, showing some initial indication that the lab testing called for by ASTM/EN/ISO standards may be sufficiently conservative for determining whether or not items will break down in full scale composting conditions, as was the original intent of the standards. This includes items made from potentially challenging materials like crystallized PLA (CPLA), with high crystallinity to withstand heat.

The data re-published here, however, does not include failed field tests or information on test conditions beyond process time. Operating conditions such as temperature, moisture, C:N ratio, and pH were not reported. As a result, the existing data alone does not provide a complete picture. All of these variables are important for understanding whether the field test was representative. A controlled field test is required to validate that a specific test correlates to full-scale composting processes.

Findings

The data provided here demonstrate that certified products have been shown to successfully disintegrate in existing composting processes, despite not reflecting documented controls for these processes. Most of the products successfully passed 49-day field tests, including 16 categories of bioplastics and coated paper products. These products represent the majority of physical forms and material composition of certified products currently in the market today. Molded fiber products are a notable exception to this and are not represented in the data.

About the Collected Data

• All products tested are certified to ASTM, EN, or ISO standards.

There are 1071 data points included from approximately 1,000 field tests.

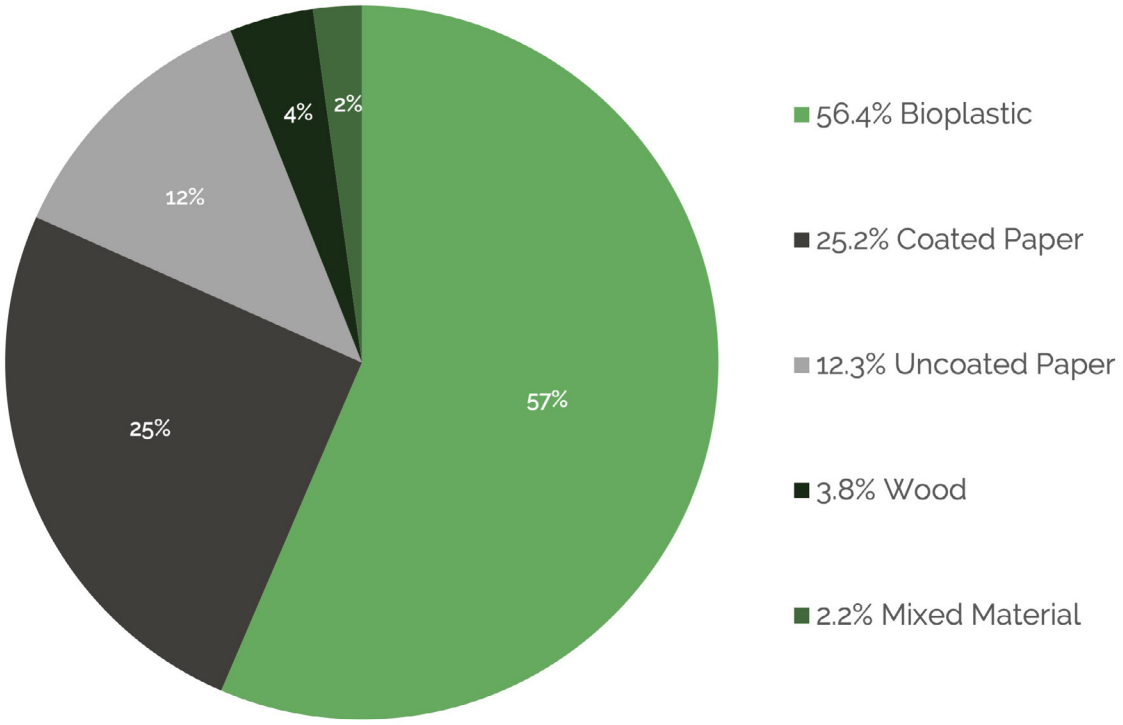
• The data was collected in April 2021 from information shared either publicly or directly by the Compost Manufacturing Alliance (United States), Cre (Ireland), and CIC (Italy).

• All products represented in the data passed either a 49-day or 90-day field test requirement.

• Products are organized by field testing time frame, material type, and product category to provide different ways of understanding the scope and breadth of what has been tested and approved to date.

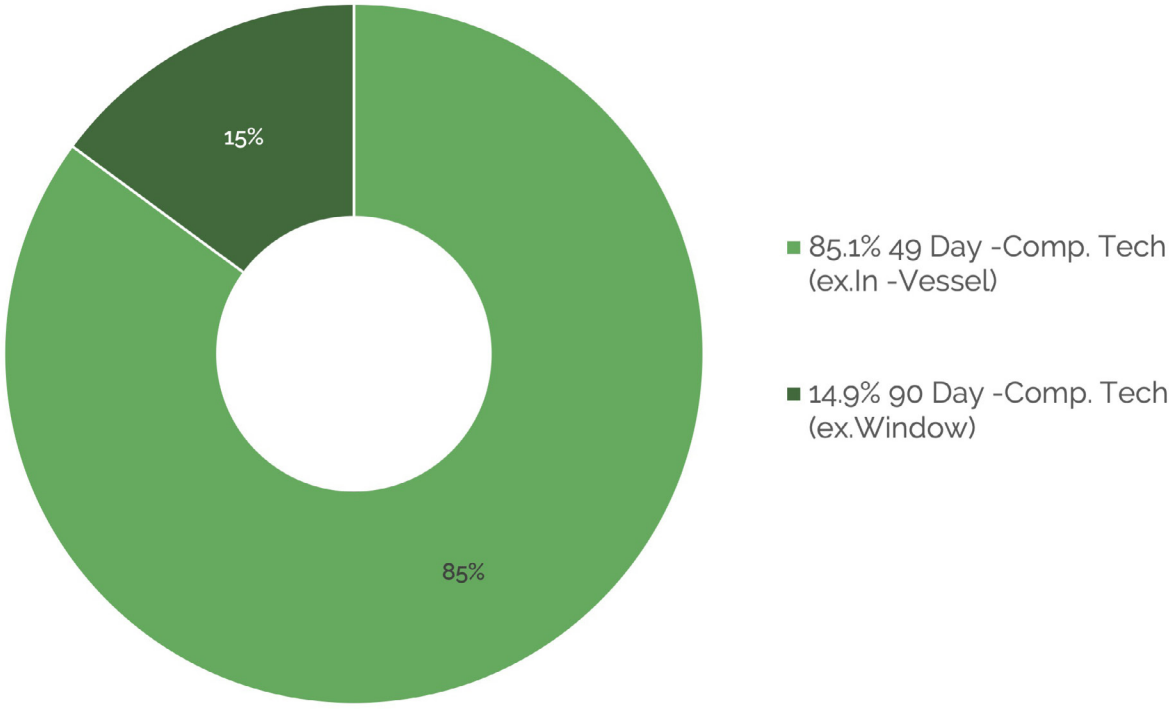
• The reporting is intended to provide some initial correlation, but is not based on an independent review of raw data.

Field Verified Certified Products by Material Type



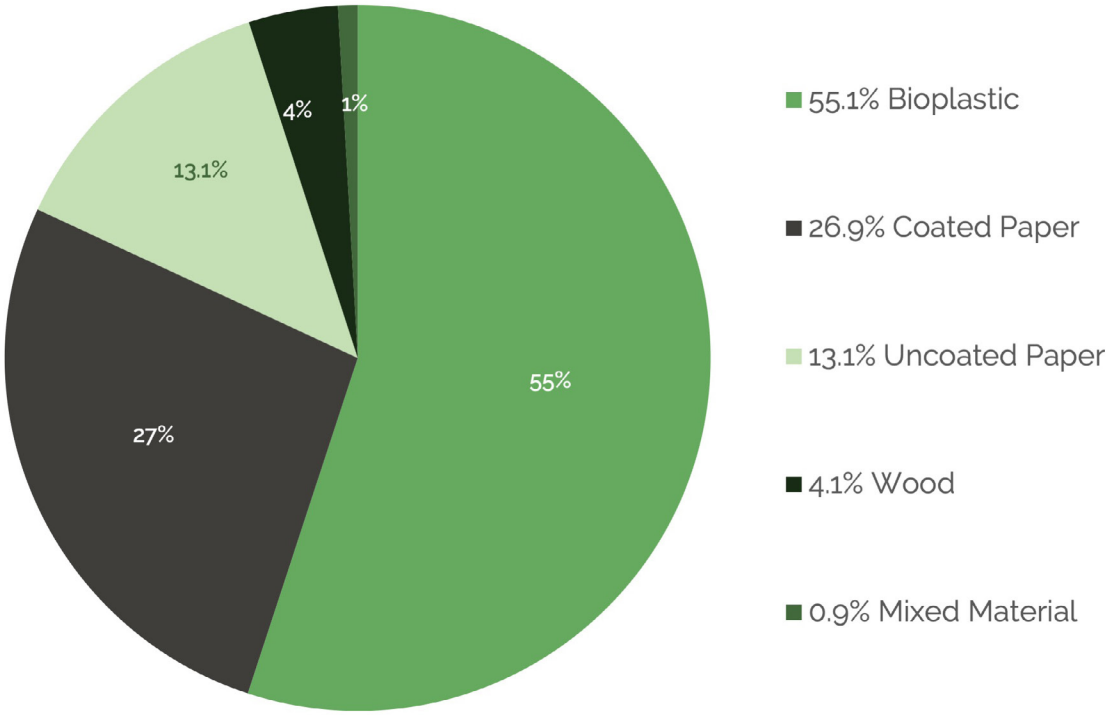
All products meet ASTM/EN/ISO compostability standards and have passed a third-party field test

Field Verified Certified Products By Timeframe / Technology



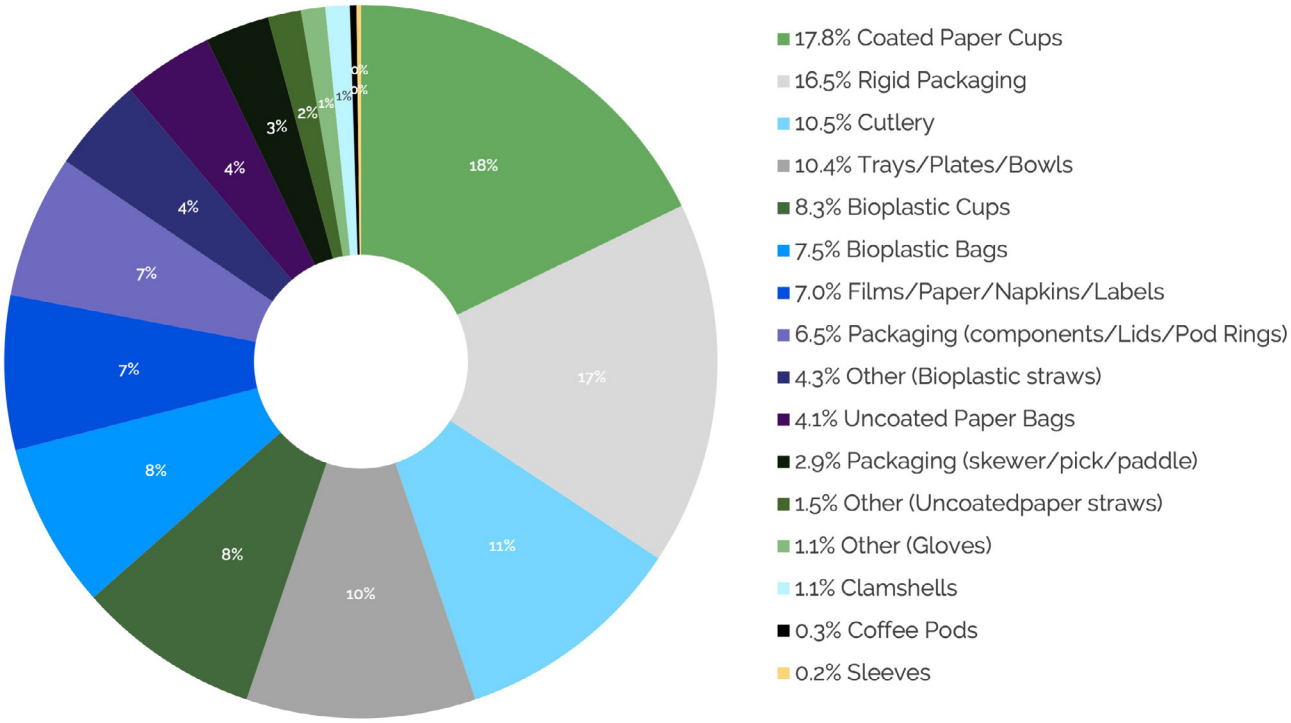
All products meet ASTM/EN/ISO compostability standards and have passed a third-party field test

49-Day Field Verified Certified Products by Material Type



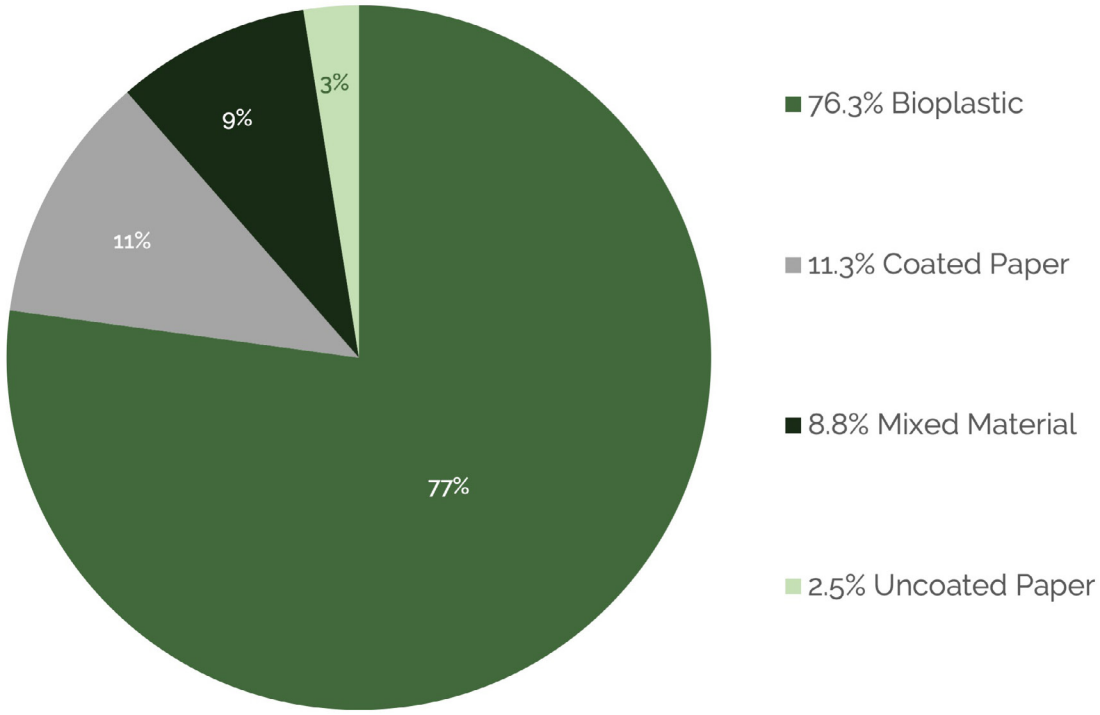
All products meet ASTM/EN/ISO compostability standards and have passed a third-party field test

49-Day Field Verified Certified Products by Category



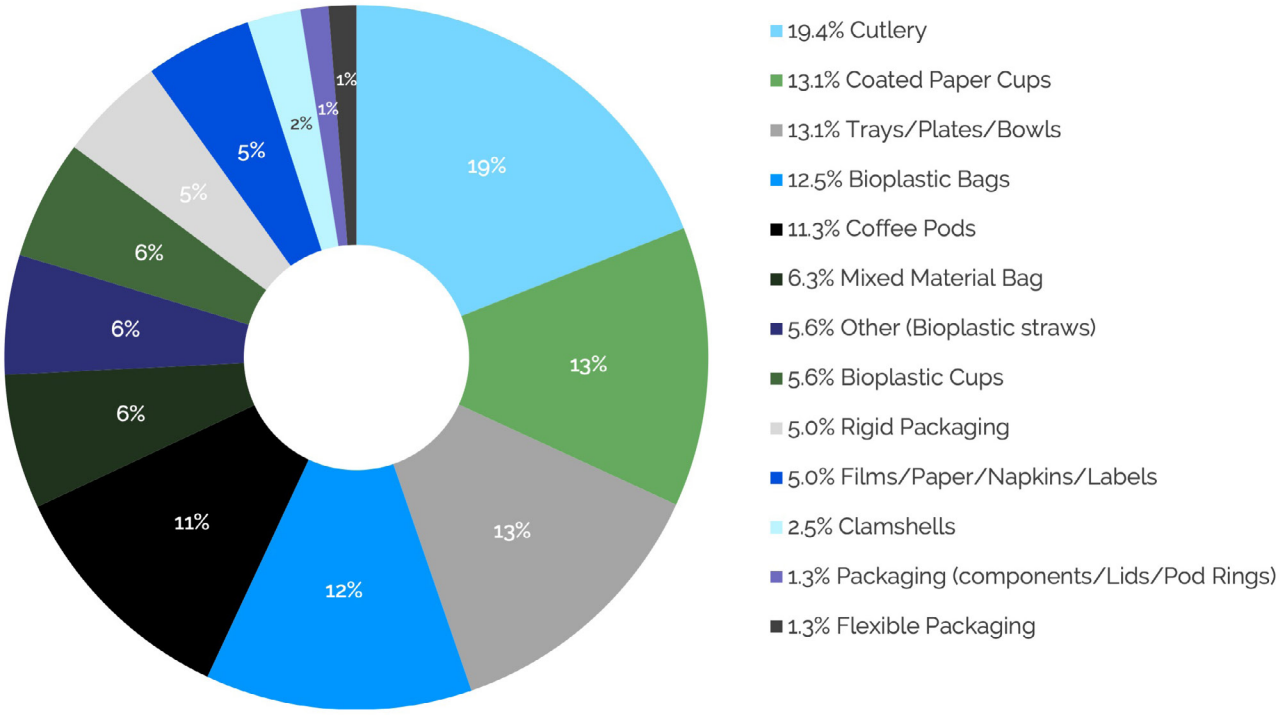
All products meet ASTM/EN/ISO compostability standards and have passed a third-party field test

90-Day Field Verified Certified Products by Material Type



All products meet ASTM/EN/ISO compostability standards and have passed a third-party field test

90-Day Field Verified Certified Products by Category



All products meet ASTM/EN/ISO compostability standards and have passed a third-party field test

Chart Highlights

• Nearly 57% of all field verified products belong to the Bioplastic category. This category includes: clear cold cups, food containers, cutlery, bags and other non-fiber products.

• 25% of all field verified products belong to the Coated Paper category. This category includes: paper hot cups and soup cups, lined food trays, and other products utilizing a fiber base with a bioplastic (or other) compostable lining.

• Mixed material items include flexible packaging, paper items with a bioplastic window, etc.

• The majority (85%) of publicly available data is for products that have passed field tests with 49-day time frames, which suggests that the 12 week (84-90 days) disintegration tests in ASTM, EN, and ISO standards may still be sufficiently conservative for a majority of products being certified today.

• Bioplastics (55%) and Coated Paper (27%) account for the majority of material types that passed 49-day field tests.

• 16 different product categories have passed 49-day field tests:

  • Coated Paper Cups (162 items)
  • Rigid Packaging (150 items)
  • Cutlery (96 items)
  • Trays / Plates / Bowls (95 items)
  • Bioplastic Cups (76 items)

• Bioplastics account for the majority (76%) of material types that have passed 90-day field tests.

• 13 different product product categories have passed 90-day field tests:

  • Cutlery (31 items)
  • Trays / Plates / Bowls (21 items)
  • Bioplastic bags (20 items)
  • Coffee pods (18 items)

Additional Data

In reviewing a limited amount of raw field test data confidentially submitted by BPI members in support of this report, it appears that paper and fiber items, despite being "generally recognized as compostable" in many programs, may have more difficulty passing both the 49- and 90-day tests. This includes molded fiber products without PFAs; molded fiber as a material type is almost entirely absent from the publicly available data. Similarly, the limited raw data BPI reviewed showed bioplastic coatings on paper (e.g. hot cups) sufficiently breaking down, but leaving behind a mostly intact paper substrate. Partially degraded paper and fiber items may be less concerning to composters than partially degraded plastic-like items, since they are not typically part of the contamination limits on finished compost regulated in places like California and Canada. But, the differences between lab and real world performance may shed light on testing protocols.

Conclusions

The data provided here demonstrate that certified products have been shown to successfully disintegrate in existing processes, despite those conditions not being identical to the lab tests. Over 900 products demonstrated they successfully passed 49-day field tests, and another 160 passed 90-day field tests, with no big gaps in categories compared to BPI's certification portfolio other than products made from molded fiber.

Regrettably, without more data from products that failed field tests, and without documented conditions beyond processing time, this report cannot make a definite conclusion on correlation between lab and public field test results. Conditions such as temperature, moisture, C:N and pH ultimately control the presence and activity of specific microorganisms that are involved in the overall composting process, and are therefore important variables that need to be considered in addition to time.

This review of both publicly and privately available data highlights the need for additional research to identify what may lead items to not break down, including isolation of root causes. In some cases, the root cause may be specific to a bioplastic or a lignocellulosic ingredient. In other cases, it may stem from the specific composting environment and its conditions. Understanding root causes would prevent repeated field testing of items that are working (such as the range of bioplastic items documented here), and focus on identifying characteristics in items that are not consistently breaking down that may be limiting factors (e.g. polymer crystallinity, lignin content, polymer molecular weight/polydispersity, sample surface to volume ratio, presence of additives, etc.).

Conditions and variables at composting facilities are critical to ensuring that field tests are representative and reproducible. This suggests the need for a set of standardized composting practices to be used in field tests based on generally recognized good management practices, including ranges for temperature, moisture, C:N ratio, compost maturity, etc. Today there are two leading field testing programs in the U.S. that have complementary strengths:

- The Compostables Field Testing Program (CFTP), operated by the nonprofit Composting Research and Education Foundation (CREF) and BSIbio, has developed a standardized field testing program this open source. Tests are based on an individual composter's conditions, with data entered into a public database to inform the industry on how those conditions impact disintegration.

- The Compost Manufacturing Alliance (CMA) conducts field testing using privately developed testing protocols based on individual composting methods (e.g. windrow, aerated static pile, etc.); the public output is a list of products that passed the tests, approved for acceptance at CMA partner facilities.

Merging these approaches would result in a publicly available standardized field test that includes defined operating parameters, so that results are comparable when assessing whether certified compostable items break down in the real world. In some ways, this returns to the original premise of compostability certification in North America, where products meeting the ASTM standards were demonstrated to break down according to the USCC *Compost Facility Operating Guide (1995, out of print)*. With a coordinated effort on this merged approach to field testing, planned for 2022, and (hopefully) a more consistent flow of data, swift progress towards mutually agreed upon acceptability criteria should be possible.