"Breaking Down" the Problem:
Aligning Policy and Practice in the Compostable Plastics Industry

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Abstract

The University of California, Berkeley seeks to divert waste from landfills through composting and recycling in order to reach its zero waste goal by 2020. I explore how to create an efficient compostable plastic utensil composting system by analyzing federal and state policies, United States Composting Council Guidelines, and American Society for Testing and Materials standards pertaining directly to the compostable plastic certification process. Furthermore, I analyze composting practices at waste management facilities within a two hour driving radius of Berkeley, California. Many discrepancies exist between the policies and standards governing compostable plastic ware manafactures and the practices at the industrial composting facilities, which results in "compostable" plastic not decomposing at the industrial composting facilities. A key reason for this is that manufacturers use optimal laboratory standards, rather than the real life field standards established by the United States Composting Council that allow for all natural material to decompose. However, "compostable" plastic is not included in these guidelines for the industrial composting facilities. Examination of the composting process and analysis of the certification process for compostable plastic utensils led to the conclusion that the compostware manufactures are following standards that do not correlate with the field conditions at the industrial composting facilities resulting in a lack of plastic utensil decomposition. In order to improve the the life cycle of compostable plastic untensils, policy makers should take into account the field conditions at inducstrial composting facilities rather than rely on optimal laboratory conditions in order to ensure compostability.

Keywords

PLA utensils, UC Berkeley, zero waste, ASTM, industrial composting facilities

INTRODUCTION

As landfills fill up and resources become scarce, large academic organizations, such as the University of California, Berkeley, have begun to look at the effects that diverting materials from landfills, through either recycling or composting, could have on the environment. Landfills greatly contribute to global warming through greenhouse gas emissions and also pollute ground water by pollutants leaching through the thin barrier that lines the landfills (Bogner 2008, Mannall 2011). Composting, the reuse of material that is considered plant debris and kitchen scraps that biodegrades into a useful end product, directly confronts the issues associated with landfills by reusing materials and lowering greenhouse gas emissions. Recycling products and composting natural materials are alternative methods to reduce the effects of landfills, but until recently, composting had been overlooked and underrated. Composting may release carbon dioxide into the atmosphere, but it also stores carbon in an organic form as well as nitrogen that can be used as a natural fertilizer when the compost soil is spread over the earth. This, in turn, can help to improve food security and global warming by replenishing overused soils (Hermann 2010, Lal 2007, EPA 1994). Creating a comprehensive divergence plan for waste involves using less non-renewable resources and producing more renewable, reusable, and compostable items that can stay in a closed loop system.

The University of California, Berkeley recently created zero waste goals to be achieved by the proposed year of 2020 as stated in the 2009 Campus Sustainability Report. The importance of the zero waste goal is to divert waste from the landfill through composting, recycling, and reuse. The consumers and purchasers at UC Berkeley are under the impression that all of the compostable plastics, corn and potato based plastics, available on the market are in fact compostable by industrial standards, when in fact some products do not make it past the transfer facility that sorts items going to the compost facility (Shen 2011). Many organizations, similar to UC Berkeley, have adopted a “3R” policy: Reduce, Reuse, and Recycle. The 3R policy creates a simple, user-friendly, policy system that is easily recognizable by consumers and producers (Sakai 2011). Creating a zero waste policy that follows a system similar to the 3R policy can significantly lower costs for the campus, because diversion from the landfills is not only environmentally beneficial but also economically advantageous (Olivares 2007). UC Berkeley has redesigned its sustainability policies to create a more sustainable environment

through their zero waste policy, yearly sustainability reports avalable to the public for transparency, and green building requirements for new building projects and renovations, yet industrial composting policies and compostable plastic producers are not effectively working together to create a comprehensive policy that integrates composting facility knowledge and the manufacturers certification process.

There is currently insufficient amount of literature on the compostable plastic system which means that there is most likely miscommunication between the producer and the composting facility. The environment, and inevitably humans, will suffer consequences if a dialogue is not started that connects producer, consumer, and composter in the same system to exchange ideas and come to a unified set of standards. The EPA standards for composting specify hazardous materials that cannot be composted and offer guidelines for facility cleanliness, but fail to state duration and temperature of a compost pile which are the essentail foundations to an efficient industrial composting system (EPA 1994, Christensen 2009). The American Society for Testing Material (ASTM) sets one universal standard for manufacturers of compostable plastics and certifies that these materials are able to compost at a few industrial composting facilities based on a series of standards in a lab based setting. There are various effective methods of composting that have been around for decades, but none of the methods have specified which method is to be used to compost the compostable plastics that have recently become available on the market (Christensen 2009, Goldstein 1996). Therefore, no regulations are designed to regulate the new compostable plastic that manufactures label as better for the environment because of their compostability (Shen 2011). The literature demonstrations a gap of knowledge on the compostability of compostable plastic in a field based setting.

Compostable plastics are created from polylactic acid, PLA, derived from corn by a company called NatureWorks, which forms the resins that is the foundation for all PLA based compostable plastic in the United States. There are other compostable plastics derived from potato starch but is typically not favored by consumers because it has a low tolerance to heat (King 2011). Manufacturers see compostable plastic as a solution to a greater problem of waste diversion by making a disposable product out of PLA rather than petroleum based products (Tullo 2012). However, PLA is still a plastic by nature and requires a biological additive that allows microbes and water are able to break down the product into to smaller pellets and carbon

dioxide. Unfortunately the literature does not state the benefits of the decomposed plastic in the composting system (P. Nuti Personal Communication November 18 2011, Tullo 2012).

This study explores governmental policies, third party certification policies, and composting practices specifically pertaining to compostable plastic utensils in order to determine how to unite the producer, composter, and consumer under one universal set of standards and policies in order to make the most efficient and educated system. I documented the life-cycle of compostable utensils that are purchased by the University of California Berkeley and where they are disposed of in order to determine the most effective way to reduce Berkeley's impact on the environment through the campus waste stream. I hope to create a dialogue and suggestions that benefits the environment, the industry, and the consumer on the best policies for the future and suggestions to achieve a zero waste system with utensils currently available on the market.

METHODS

Study System

I conducted interviews with each Industrial Composting Facility within a 2-hour driving radius of the UC Berkeley campus and collected samples of all compostable utensils used on the University of California, Berkeley Campus. At the composting facilities, methods of composting utensils was analyzed and compared to the regulations that govern the facilites. There are five industrial composting facilities near UC Berkeley: Recology Grover in Modesto, CA, Richmond Sanitary in Richmond, CA, Recology Dixon in Vacaville, CA, Napa Recycling and Waste in Napa, CA, and Northern Recycling in Zamora, CA. Below Figure 1 gives a visualization of the locations of the facilities in relation to UC Berkeley which is denotted by the star in Berkeley. I also researched the utensils used in campus dining facilities by visiting the facilities and collecting information about the name and brand to conduct further research. My study focuses on the two compostable plastics that are specifically used by the UC Berkeley dining facilities, Taterware and Eco Products. I also visited the University of California, Berkeley Office of Sustainability in order to collect the documentation for the Zero Waste policy that was included in the 2009 Campus Sustainability Plan written by the Chancellor's Advisory Committee.

Scientific Knowledge and Regulation

I examined industrial composting policies and Manufacturing at 5 levels: the US Environmental Protection Agency polices, California State Laws and Regulations, compostable plastic ware manufactures standards, industrial composting facilities practices and policies, and the University of California Berkeley. I was able to find the government policies through the official government website of the Environmental Protection Agency, the manufacturing certification policy as stated in the ASTM 6400 manual, and industrial composting standards on the United States Composting Council website in the Guidelines for Best Practices. Finally, I obtained the UC Berkeley Zero Waste policy that was created by the University of California, Berkeley's Office of Sustainability in 2009 to determine the consumers role and concern for the composting market.

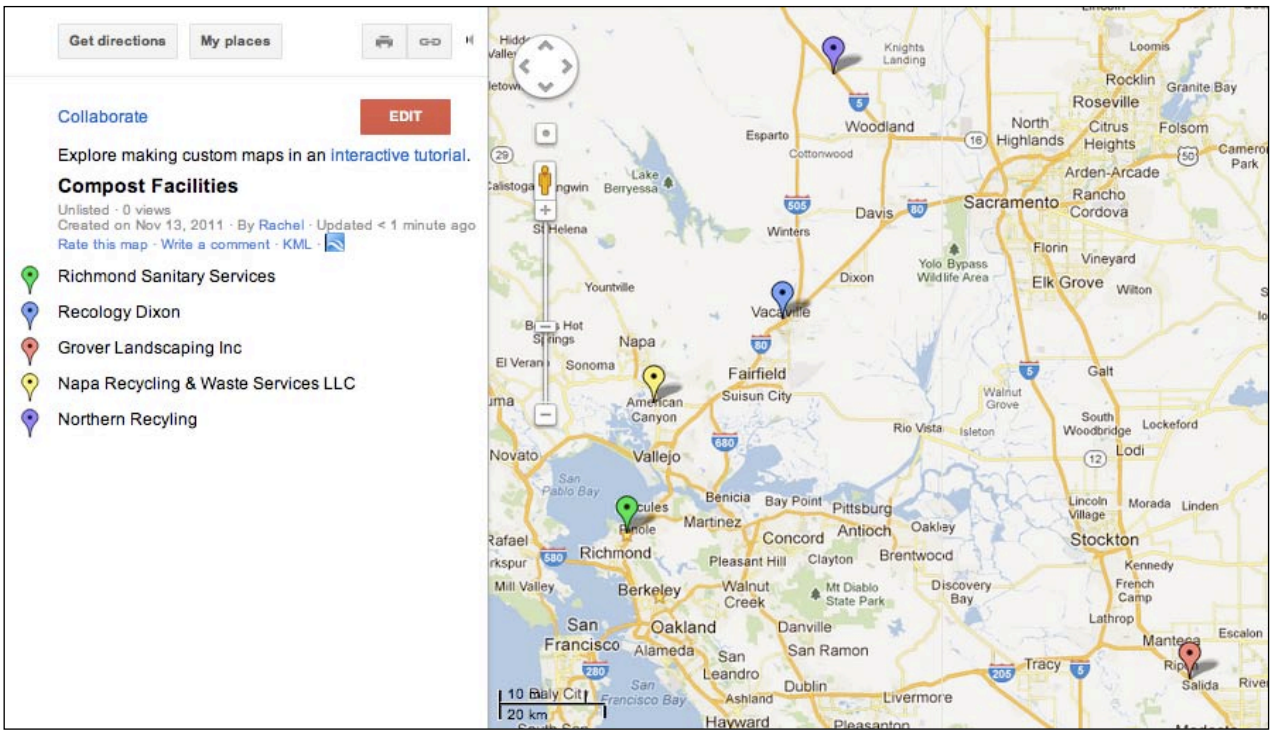

Fig 1. Composting Facility Locations within a 2 hour radius of UC Berkeley

Composting Facility Manager Interviews

To identify discrepancies between facility guidelines and producer manufacturing practices, I conducted interviews with representatives from each of the facilities. I have included contact information in table 1 for future contacting purposes. I asked each facility manager which products they chose to compost and why these products were chosen. I obtained information on each composting facility's method of composting. I specifically focused on the duration, number of days, of an average compost cycle and the average temperature of each compost pile during its cycle. I then compared the ASTM Standards to the standards listed by the USCC focusing on intended duration, in number of days, of an average composting cycle and average temperature that each document states.

Table 1. Facility Contact Information

Name	Location	Position	Contact Information	Date Contacted
Tim Dewey-Mattia	Napa and Zamora	Public Education Manager	Tim@NapaRecycling.com # 707.255.5200 x1204	Feb 28, 2012-Mar 2, 2012
Anastasia Nicole	Recology East Bay	Sustainability Consultant	anicole@recology.com # 415.716.9992	Nov 11, 2011
Vince Tye	Recology Grover	Manager	vtye@recology.com # 209.830.3003	Nov 28 20011-May 2 2012
Peter Nuti	Richmond Sanitary	Division Manager	PNuti@republicservices.com # 510.412.4503	Nov 18, 2011-Mar 6, 2012

RESULTS

Scientific Knowledge and Regulation

I identified current EPA Policies, California Laws and Regulations, USCC Guidelines, and the ASTM Standards pertaining to industrial composting and compostable plastic manufacturing. Both the EPA and the state of California have not established policies concerning compostable plastic. The ASTM 6400 manual, which sets standards for compostable plastic certification, has established a universal standard that it takes 180 days to decompose "compostable" plastic at a temperature of 138°F in an ideal laboratory setting . According to the USCC, a best practice composting facility runs a cycle of 45-90 days and reaches a temperature range of 130-160°F.

At the time this study was was conducted, UC Berkeley purchased utensils from Taterware, a "compostable" plastic utensil made from potato starch. Taterware does not currently follow any composting certification standards. Eco Products follows ASTM standards. According to the manufacturer, Eco Product PLA products decompose in 180 days and must be at a temperature of 138°F in order to degrade. Through personal communication with Claudia Capitini, an EcoProducts Representative, all PLA based plastics in the United States are produced by the same manufacturer, NatureWorks, and therefore degrade at the same rate. Through this statement I conclude that all PLA Based products degrade in an ideal laboratory setting of 138°F for a period of 180 days.

Composting Practices

I found that all 5 industrial composting facilities within a two hour driving radius of UC Berkeley closely follow USCC guidelines. Richmond Sanitary, follows a system that runs a full cycle between 82-92 days and each composting pile, also known as a windrow, reaches an average temperature between 140-150°F. Similarly, the Zamora commercial composting facility operates on a 45 day cycle and composting piles reach temperatures between 130-170°F, but average 140-150°F. Zamora also attempts to re-compost any debris that is screened out at the end of each cycle by returning any material that has not completely degraded into a new compost pile in order to extend the duration of the cycle for specific material. On the other hand, Napa follows a 15 day cycle because they are a smaller facility that only accepts yard waste; they have an average composting pile temperature between 140-150°F. Both Recocolgy Dixon and Grover have a 45-90 day cycle that range in temperature between 130-160°F. I summarize these results below in table 2.

Table 2. Composting Duration and Temperatures Within Selected Composting Facilities

Composting Facility	Policy	Composting Duration (days)	Composting Temperature (°F)
Recology Grover & Dixon	USCC	45-90	130-160
Richmond Sanitary	USCC	85-92	140-150
Napa	USCC	45	130-170 Avg: 140-150
Zamora	USCC	45-90	130-170 Avg: 140-150

Contradictions Between the Regulatory Standards and the Practices

UC Berkeley is in the process of implementing a Zero Waste Policy that requires that the entire campus be at 75% divergence by June 2012 and zero waste by 2020. In order to reach this goal, the campus is implementing two main waste streams, recycling and composting, in all campus spaces. Unfortunately, the 75% divergence rate has not been met at the writing of this study, so the 75% goal has been extended to 2015 (Lam, 2012).

Campus Taterware and other PLA based utensils, as of April 2012, are being sent to the composting facility, Recology Grover. But due to contradictions between regulations and standards governing the compost ware manufacturers and composting facilities, the plastic is not decomposing, and is being removed prior to composting and being sent to the landfill. This means that UC Berkeley will not reach its zero waste goal through its composting waste stream if Taterware or other PLA based utensils are used.

DISCUSSION

I found discrepancies between practices at the industrial composting facilities and the regulations and standards governing compostable plastic ware manufacturering certification, resulting in supposedly “compostable” plastic not actually decomposing at the facilities. The facilities either send the utensils directly to the landfill before even attempting to compost, or “re-compost” the utensils multiple times before they either decompose or send them to a landfill after the attempt to re-composting is unsuccessfully. This is a result of putting a bulk of the responsibility for the decomposition of the utensils on the compost facility (Dauvergne 2010). The root of the problem is regulatory in nature, resulting in a lack of coordination between the compostable plastic regulations and the composting facilities practices. Due to this, UC Berkeley is left as the misinformed consumer trying to pick the best utensils to use on campus as the next step to reach zero waste goals by 2020 (Lam 2012).

Scientific Knowledge and Regulation

Regulatory policies are crucial to creating an efficient compostable utensil life cycle system, but I found that the current policies are ineffective in assuring that plastic ware labled as compostable is successfully composted because the regulations that apply to the compostable plastic ware manufacturing are not followed by composting facilities. Federal laws pertaining to composting do not include any regulations on compostable plastics. More importantly, the ASTM 6400 compostable plastic standard does not acknowledge the duration of composting times at composting facilities. A typical facility operates on a schedule of 30-60 day cycles, but the ASTM requirement is that less than 10% of biomass remain within 90 days or less (World Centric 2012). Also, there is little to no scientific evidence available to the general public on the compostability of the product they are purchasing. The manufacturing companies claim that their products are compostable, but their practices and certifications are not transparent. They do not provide scientific proof that their product is compostable as they claim it to be. Therefore it is difficult for a consumer to make an informed decision about which product to buy and if it should be sent to a landfill or a composting facility.

Composting Practices

I found that all composting facilities in this study operate under the same guidelines that have always worked for decomposing natural green waste (Christensen, 2009). In this sense, the composting facilities operate under an environmentally and financially suitable model that separates environmentally beneficial material from trash. Each facility removes uncomposted waste material from each compost pile after its life cycle and either recomposts it or sends it to the landfill. “Compost-overs,” the act of returning uncomposted material back into a compost pile after having already been run through a full composting cycle, is a fairly new phenomenon that has developed due to the need to accommodate materials that take a bit longer to process than the typical banana peel or wood chip (Christensen, 2009). Facilities are trying to adapt to the growing compostable plastic market, but not all of them have the economic resources and manpower to implement an extra process to an already intensive cycle as mentioned by Peter at Richmond Sanitary. The discrepancies highlight the discrepancy between compostable plastic

certification standards that the manufactures follow and the practices that the composting facilities are currently using.

Effects on UC Berkeley

The contradictions between compostable plastic manufacturing policy and current composting practices present a problem to those responsible for utensil procurement at the University of California, Berkeley, who are seeking to make an informed decision on the best disposable utensils to use in the grab-and-go dining facilities on campus in order to lessen the impact of utensils on the waste stream. It appears that Taterware, the brand of the compostable utensils that UC Berkeley purchases for campus patrons, is not on the list of acceptable material provided by the San Francisco Department of the Environment, SFE. I find the list provided by SFE to be accurate because it comes from a government agency working to bring the city to zero waste just as I am working to help bring UC Berkeley to zero waste. On the other hand, the list by SFE does include the other products in my study. Unfortuneately, I have proved through this study that it is poorly informed and not supported by scientific evidence that the products listed in fact compost within an industrial composting facility.

Limitations & Future Directions

The location of my chosen facilities and the amount of time I had to conduct the study limited the depth of my study and the inferences of my information as it relates to other composting facilities across the nation. The location of the composting facility affects the duration of a composting cycle and some modern facilities are more advanced than the ones located within the vicinity of Berkeley, this means that the facility has modern closed tube technology that can bring a composting pile closer to laboratory standards. My facilities are all within a 2-hour driving distance from the University of California Berkeley, which has a moderate Mediterranean climate. These facilities may be biased in their composting cycles because the ground does not freeze, unlike some locations in the United States, likewise some locations across the United States have extreme seasonal temperatures, which can in turn effect the composting cycles and breakdown temperatures and cycle lengths (days). A future study

could include composting facilities over a broader range of climate variations. Inevitably policies should be based on what is best for each situation.

A next step would be to test the compostability of the various utensil brands in the real life situation of multiple composting facilities. My study relies on the information provided from the composting facility managers first hand experience with the compostable plastic utensils. Testing was not plausible for this short study, but materials should be tested outside of the lab and at actual composting facilities.

Conclusions & Broader implications

This study demonstrates that compostable plastic utensils have limitations as means of reducing waste diversion to landfills because they do not decompose in the allotted time at the facilities in close proximity to the University of California Berkeley. Although compostable plastic utensils are intended to be composted in an industrial composting facility, in practice it is still plastic that composting facilities are reluctant to introduce to their organic material systems due to an economic hardship and lack of space and time.

My suggestion to University of California, Berkeley, as mentioned by every facility, is to stick to the basics. This means paper, wood, greens, and food scraps. To become sustainable and achieve a zero waste utensil system on the Berkeley campus, the University must support a reuse campaign by offering an alternative to single use utensils. Many brands, such as To-Go Ware, offer bamboo based reusable utensils that are also compostable if they break since they are purely plant-based material. In terms of disposable utensils, there are many companies that now offer one time use wood based utensils that are completely compostable due to their natural properties. These terms also apply to other universities that have a grab-and-go dining facility on campus and are attempting to make their facilities more sustainable.

In order to improve the life cycle of compostable plastic untensils policy makers should examine the long-term objectives of inducstrial composting facilities and compostable plastic manafacturers to create and effective certification for compostable plastic utensils based on field conditions and not optimal laboratory conditions. Although the products are produced in a more environmentally beneficial way (Shen 2011), they should not be labeled as compostable if they

do not compost under the terms of the local composting facility because it only confuses the consumer and clutters the waste stream.

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