To what extent do Bioplastics actually decompose?

Science Paper 2

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Chong

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I have chosen to research how the decomposing of bioplastics benefits our environment. In order to understand if bioplastics are a smart mode for future production, I would like to learn how they decompose, and what factors catalyze, or inhibit this process. Climate change is a major problem that our world is facing, and the production of single use plastics only helps to increase the amount of waste that humans are creating. With new measures being implemented such as bioplastics, I chose to research how they biodegrade, and what their effects are on our environment from a chemistry viewpoint. This paper will answer the research question: To what extent do Bioplastics actually decompose?

First, in order to understand the decomposition of bioplastics, it is important to understand what they are. Bioplastics are made by converting sugar from various plants into plastic (Washam, n.d.). Bioplastics will biodegrade when placed into a commercial composting system. Some will decompose quickly when inside a compost pile due to microorganisms inside that will consume them. Others need more specified conditions, and may take longer (O'Connor, 2011). Most bioplastics are considered compostable, but factors such as heat, moisture, and numbers of microbes must be taken into consideration (Vitz et al., 2016). One of the most commonly used bioplastics is Polylactic acid (PLA) (Vitz et al., 2016).

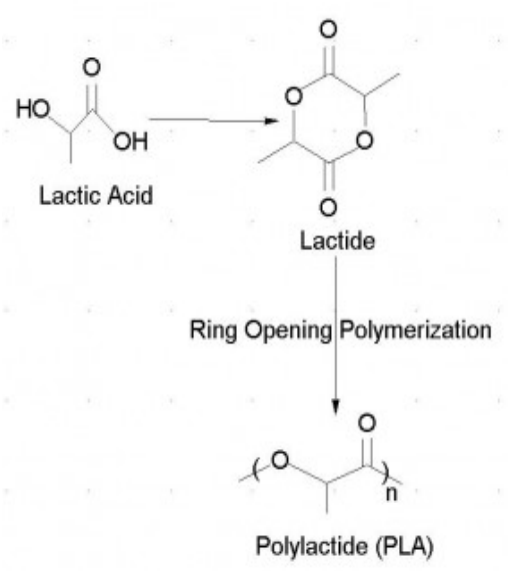

Figure 1 – Diagram showing the production of PLA (Vitz et al., 2016)

Polylactic acid is the bioplastic used in over 50% of our packaging today (O'Connor, 2011). PLA is used in plastic use such as general packaging, and paper

coatings (Vitz et al., 2016). PLA is produced by poly-condensation of naturally produced lactic acid, or by the catalytic ring opening of the lactide group (as seen in Figure 1) (Vitz et al., 2016). It is favourable because it is fully biodegradable when composted properly, however conditions must remain above 60^0C. The lactic acid that produces PLA, can be broken down by microorganisms into CO_2, biomass, and water (Shah et al., 2008). Environmentalists tend to like PLA because of its biodegradable factors, as well as its formation from easily obtainable materials such as corn, wheat, and beats (Vitz et al., 2016).

Is the application of this product actually beneficial to our environment? On the one hand, bioplastics being implemented into produce stores means that when food has perished, the industries can compost the product in its entirety, making it much more convenient and differing it from the landfill (O'Connor, 2011). However, while this idea has good intention, when taking into account the factors defining successful decomposition of the PLA and other plastics, effective composting systems are more complicated to implicate, going against the original intent with bioplastics. With confusion by the general public as to the sorting of their plastics, bioplastics can very commonly end up in the landfill. The problems caused by this are that the degradation of PLA becomes much less eco-friendly, and opposes the intent as it emits high levels of CO_2 back into the atmosphere (Washam, n.d.). The following reaction $2H_2O + C_6H_8O_4$ [PLA repeat unit] $\rightarrow$ $3CO_2 + 3CH_4$ represents the decomposing of PLA in a landfill atmosphere (Washam, n.d.), showing that when not disposed of properly, the process has potential to do more harm than good..

In Short, bioplastics decompose fully when under measured conditions including temperature, location, and moisture levels. In theory, the decomposable plastics act as a favourable alternative to single use plastics, as they are able to break down and can help with the decomposition of food waste. However, when taking into account the measures that must be in place in order for proper decomposition, waste practice needs to change in order to keep PLA plastics out of the landfill where they can do more harm than good. There is excellent potential, yet further development will be needed in order to successfully biodegrade plastics. With the production and funds for proper treatment and disposal facilities, bioplastics can fully decompose, giving them the potential to be a positive alternative to other plastic products in the market.

References

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