

Introduction

- 141 million tonnes of plastic packaging was generated in 2015, accounting for the highest waste generation sector
- 11 million metric tonnes of plastic enter the oceans every year
- Microplastics have been recently detected in human blood, due to high volumes of plastic production and consumption

Methods

Homemade biodegradable plastic film components:

- ½ cup of water
- 2 tablespoons of cornstarch
- ½ tablespoons of glycerin
- 1 ½ tablespoons of white distilled vinegar
- 2 drops of food color
- Masses of films were measured once a week over an 11 week period to evaluate loss of mass over time in a home compost
- CO₂ production was measured using a gas chromatograph to biochemically track the rate of degradation

Acknowledgements

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Literature Cited

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- Kuruppalil Z. 2011. Green Plastics: An Emerging Alternative for Petroleum Based Plastics? International Journal of Engineering Research and Innovation. 3.1 (2011): 59-64.
- Zhang Q-X, Yu Z-Z, Xie X-L, Naito K, Kagawa Y. 2007. Preparation and crystalline morphology of biodegradable starch/clay nanocomposites. Polymer. 48(24):7193-7200. doi:10.1016/j.polymer.2007.09.051

Results: Mass Degradation in Compost

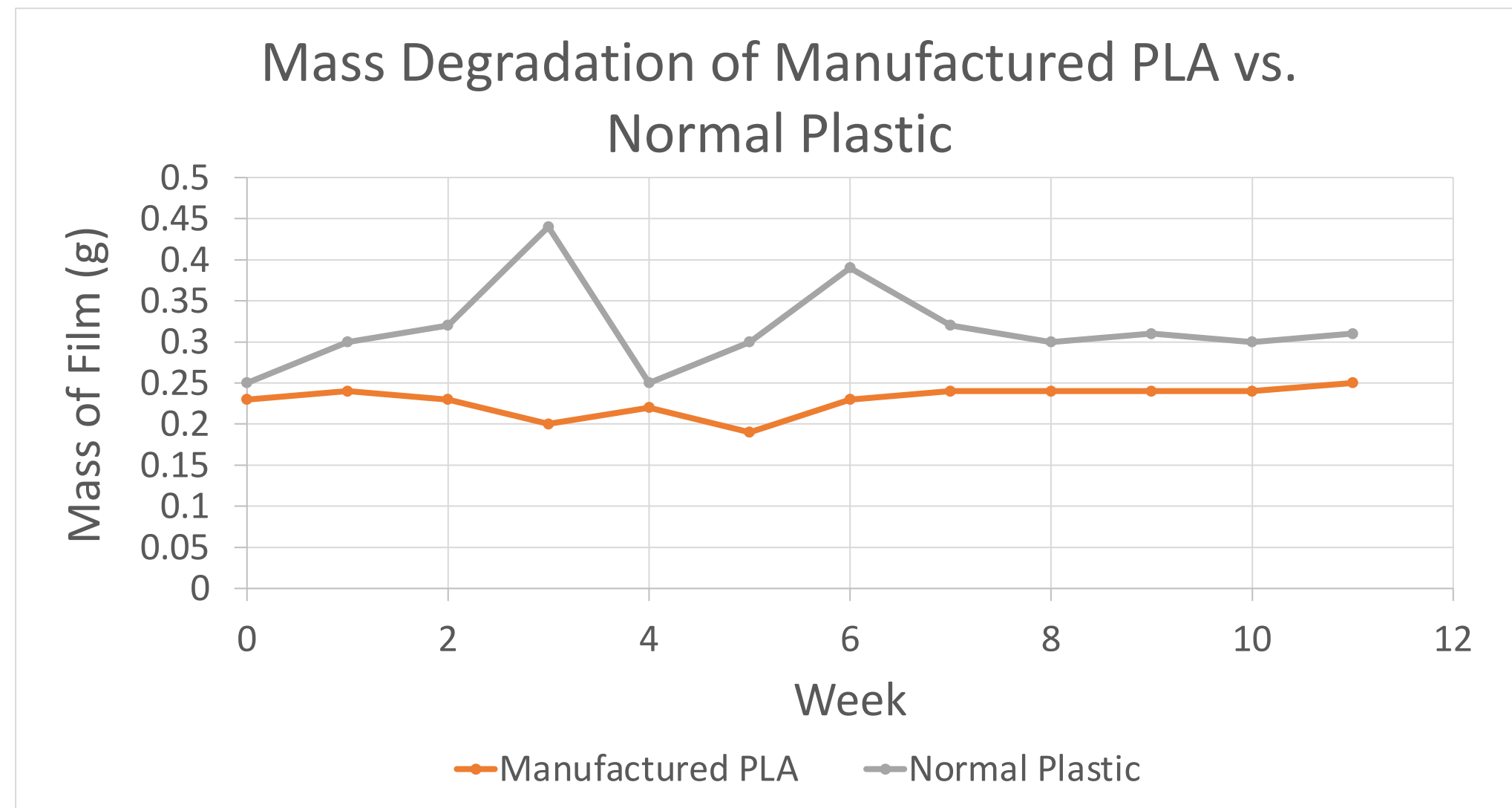


Figure 1. Film masses over an 11 week period; spikes in data represent dirt and organic material that was stuck to the films

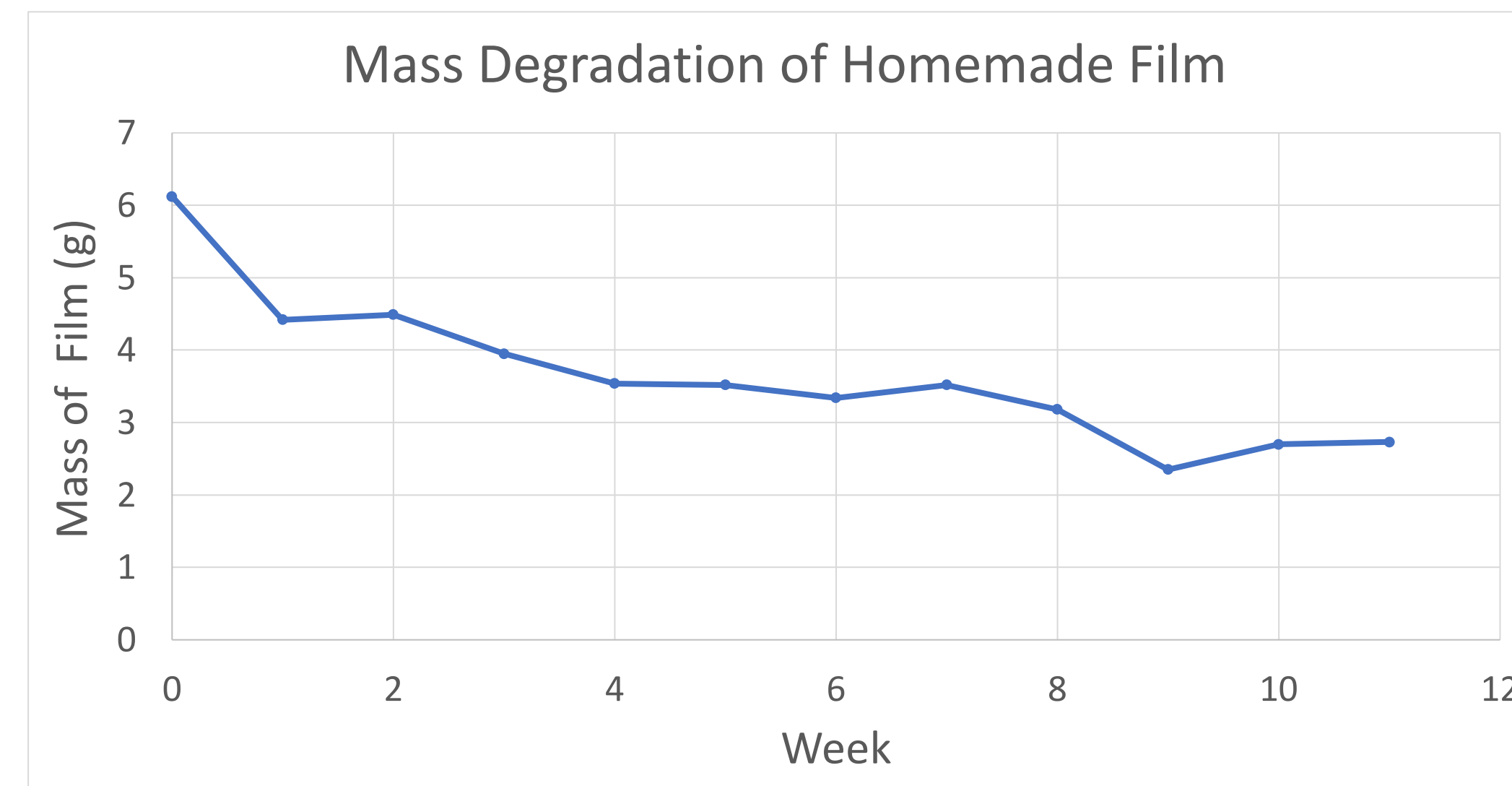


Figure 2. Homemade film masses over an 11 week period

- Mass of films relatively decrease over time, as a result of microbial degradation
- However, film mass was easily altered as a result of surrounding environmental particles in the compost

Research Question

What is the difference in degradation efficiency between homemade biodegradable plastic, manufactured biodegradable plastic, and traditional plastic in a homemade compost?

Results: CO₂ Degradation Rate in Soil

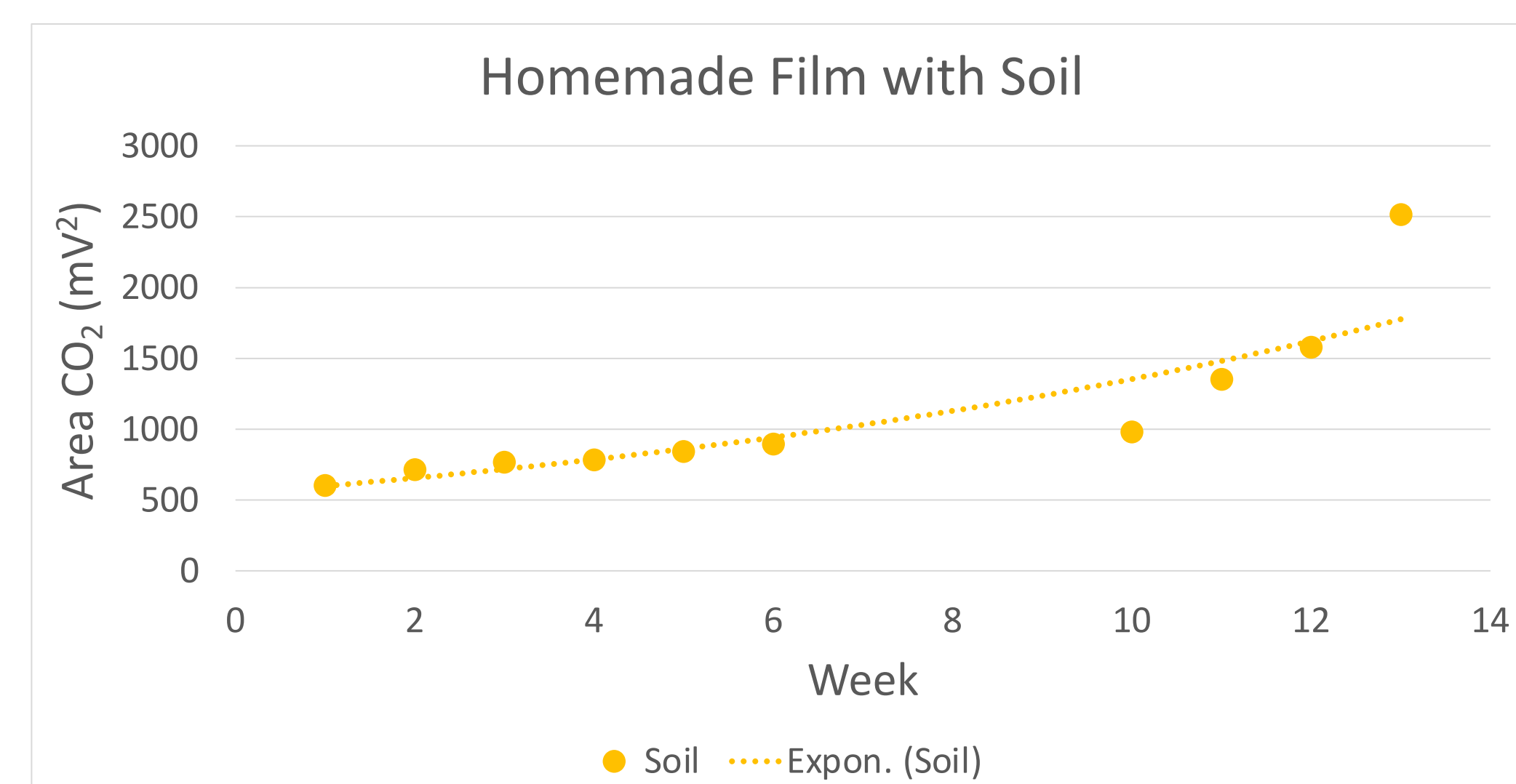


Figure 3. CO₂ production over a 14 week period from a homemade plastic film in a soil environment

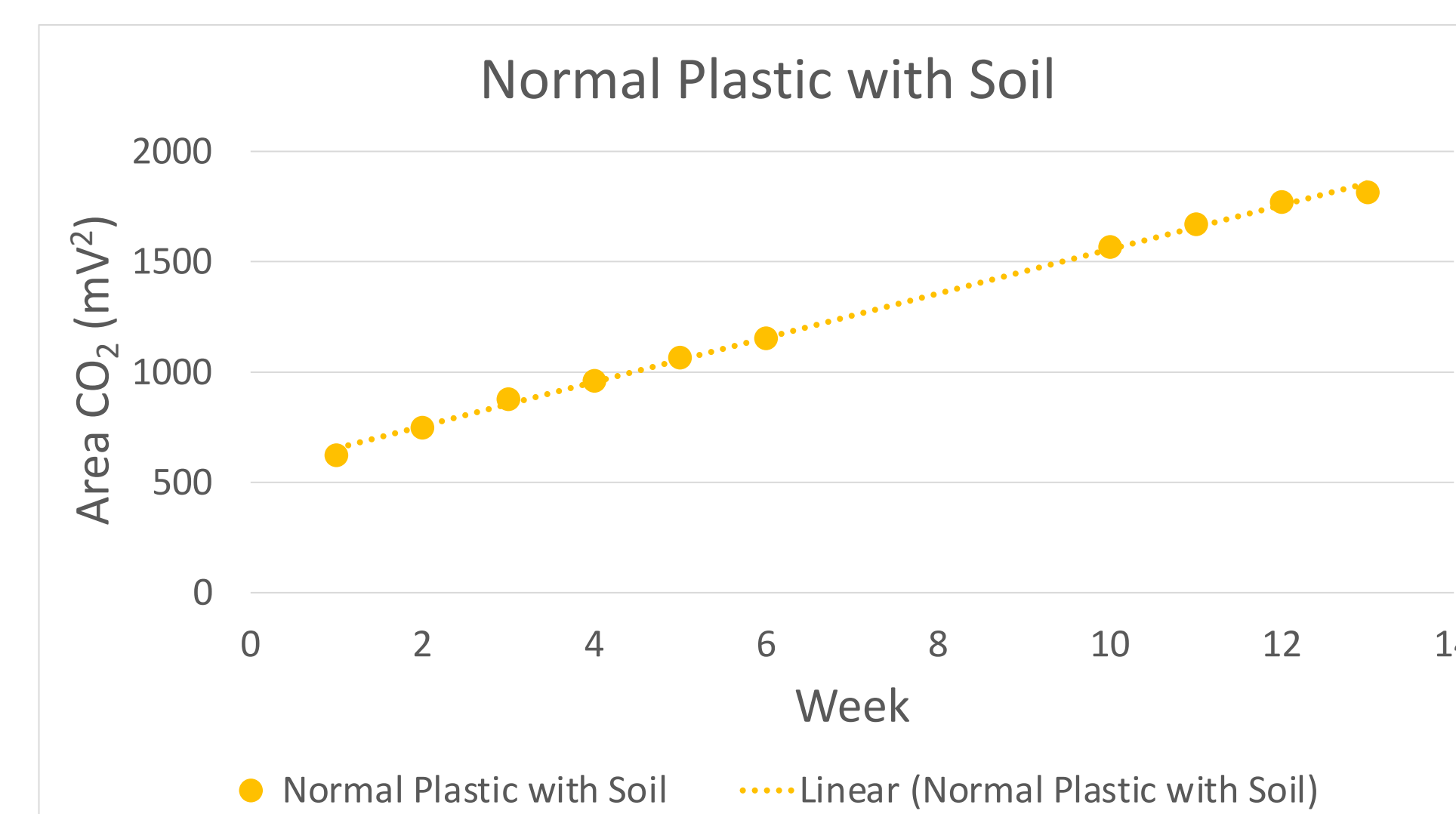


Figure 4. CO₂ production over a 14 week period from a normal plastic film in a soil environment

- CO₂ area production increases over time, as a sign of microbial degradation within a soil environment
- Homemade film is made up of natural ingredients, easier for degradation, thus leading to an exponential growth of CO₂ area

Results: CO₂ Degradation Rate in Water

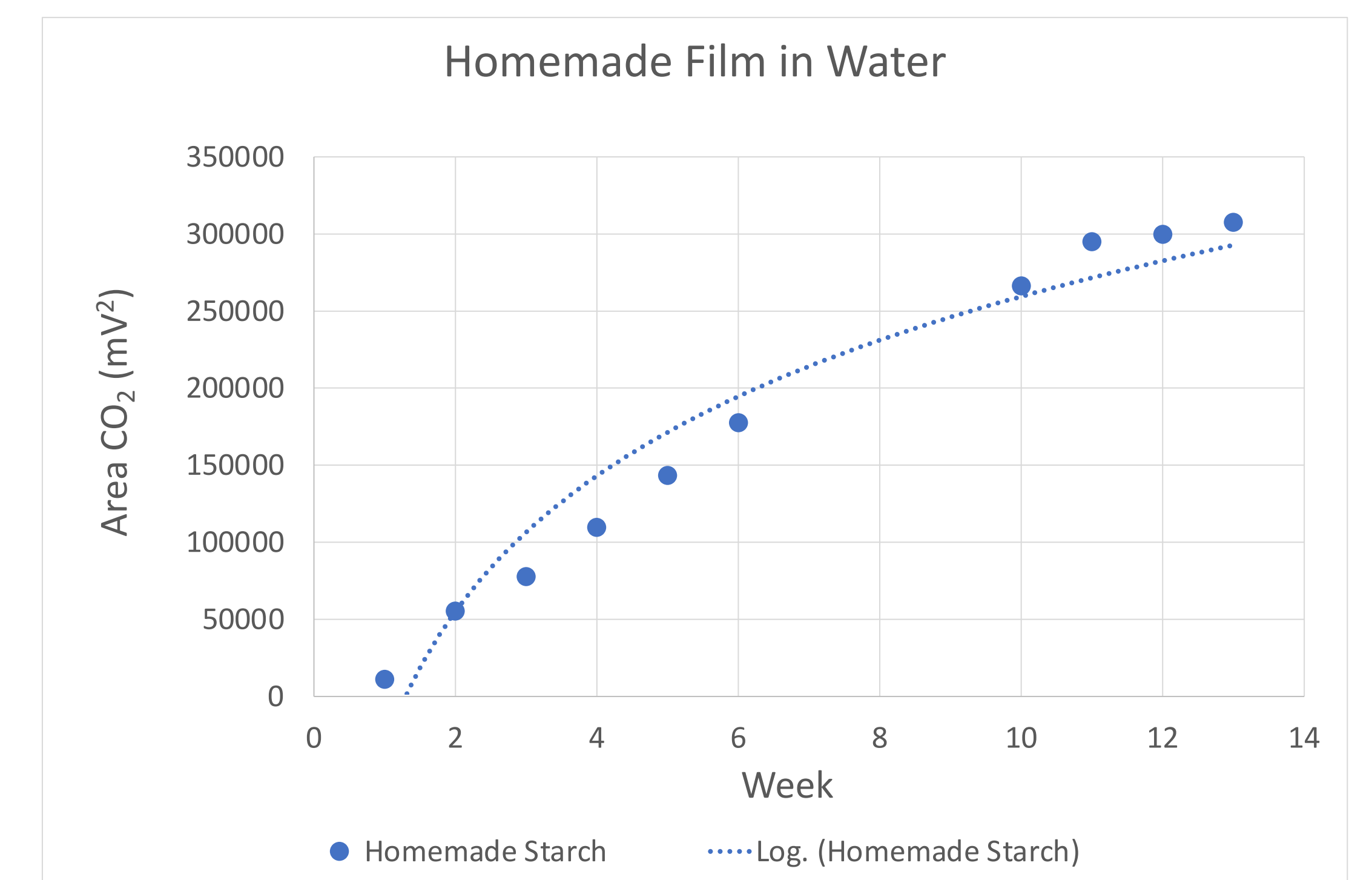


Figure 5. CO₂ production over a 14 week period from a homemade film in a water-based environment

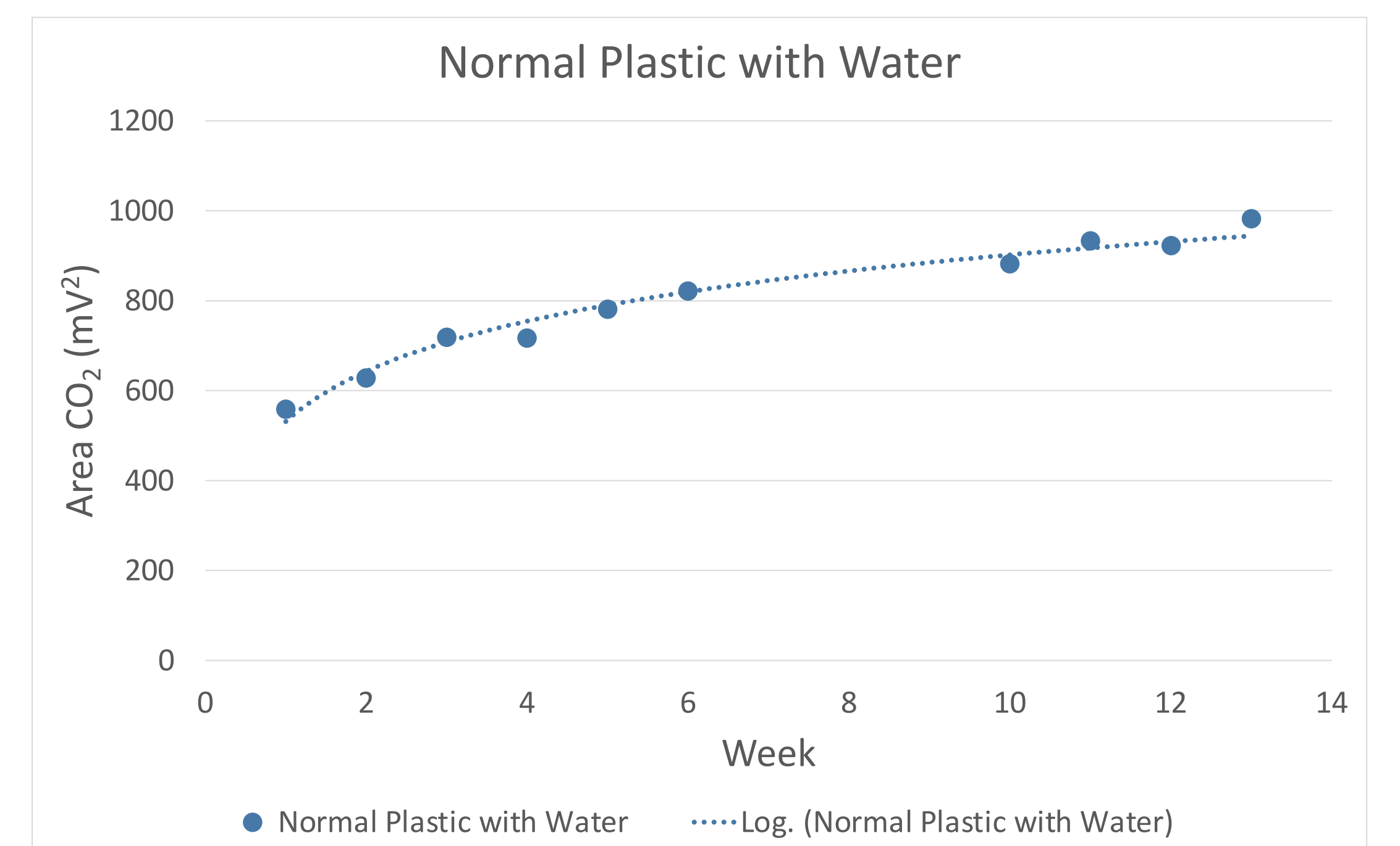


Figure 6. CO₂ production over a 14 week period from a normal plastic film in a water-based environment

- CO₂ area production of the homemade film is substantially higher than normal plastic in a water-based environment
- Higher water content increases microbial activity and degradation, hence a higher CO₂ area

Conclusion

- Biodegradable homemade films are easily attainable with common food ingredients
- Higher increases in CO₂ production of homemade films in both water and dirt environments indicate more microbial decomposition at a faster rate as a result of more natural ingredients