BIODEGRADABLE PLASTIC

THE KING FAHAD ACADEMY

ABSTRACT

- During our time on brainstorming different ideas about what our project should refer to, we had comprehended that plastic is a major issue in our society, through many different factors. It can affect a range of aspects in our life, such as health condition, environmental issues, and even economically. An example of an environmental issue is plastic pollution. This involves the accumulation of plastic products in the environment that consequently does affect wildlife, wildlife habitat, humans and so fought. Due to this major concern we decided to research about which plastic is the most efficient for environment, health and more. As part of accomplishing this project, we needed to find out how biodegradable plastic was made. Therefore, this lab report is based on the making of biodegradable plastic. It includes information about the ingredients/materials, variables, method, result, and finally the conclusion.

- Another reason plastic is a major issue for this generation is the chemicals present in the plastic that can cause serious damage to the human body such as:

Bisphenol A – An industrial chemical found in plastic since 1960. Found in thousands of plastic products. Studies show that BPA affects the brain and increases blood pressure.

- **Phthalates** – Makes plastic flexible and is used in household cleaners, food packaging and fragrance/ cosmetic products. Linked to asthma, breast cancer, obesity and type 2 diabetes.
- **Vinyl Chloride** – colourless compound that is flammable.
- **Styrene** – found in Styrofoam, food trays, egg cartons and disposable cups and bowls. A possible human carcinogen.

AIM

To investigate the effect of amylase enzyme on the decomposition of biodegradable plastic under certain temperatures (25°C, 35°C, 45°C) and certain pH levels (4, 5, 6).

HYPOTHESIS

- The amylase solution will definitely have an effect on the plastic samples.
- When the temperature reaches a certain temperature, it will have no effect on the plastics as the amylase enzyme will denature due to the heat.
- As the temperature increases so will the enzyme activity increase until it reaches its optimum temperature.
- The pH will have an effect on the enzyme activity.
- As the pH level increases so will the enzyme activity increase until it reaches its optimum pH level.
- Once it reaches its optimum pH level, any level

VARIABLES

i. **Independent Variables:**
   1. Temperature of amylase solution (25°C, 35°C, 45°C).
   2. pH conditions (4, 5, 6)

ii. **Dependent Variable:**
The biodegradability of the plastic samples under the different conditions by measuring the loss in mass.

iii. **Control Variables:**
   1. Amount of amylase solution – 100 ml
   2. Amount of pH buffer solution – 50 ml
   3. Concentration of the amylase solution - 0.1g/dm^3
   4. Amount of plastic used in every trial – 3.55g

EQUIPMENT

- 1 x 100 cm3 Graduated Measuring Cylinder
- 2 x 25 cm^3 Graduated Measuring Cylinder
- 1 x Spatula
- 1 x Tripod
- 1 x Bunsen Burner
- 1 x Wire Gauze
- 1 x Heat Proof Mat
- 1 x Tongs
- 1 x Electronic Balance
- 1 x Rubber Gloves
- 1 x Weighing Boat
- 1 x Pipette
- 1 x Match
- 1 x Glass stirring rod
- 1 x 250ml Beaker
- 5ml x Vinegar
- 5ml x Vegetable Glycerin
- 14.3g x Corn Starch
- 80ml x Distilled Water
- 1 x Lab Coat
- 18g x amylase solution
- 1 x roll of silver foil

METHOD 1

1. Make sure to follow all safety precautions and get all of the equipment ready.
2. 14.03g of corn flour was measured using the weighing scale and weighing boat and poured into the beaker.
3. Using the pipette, 5 ml of vinegar was measured and added to the corn flour in the beaker. This was stirred using the stirring rod.
4. 5 ml of vegetable glycerin was measured with the pipette and added to the solution of corn flour and vinegar in the beaker.
5. The beaker was then placed on top of the Bunsen burner and heated with the blue flame while being mixed continuously.
6. When the mixture reached a sticky gel like texture, it was taken off the heat and poured into the mould.
7. This was flattened down and made smooth and thin.
8. The plastic was left for over 24 hours to cool down.

CONCLUSION

- In conclusion we saw that the plastic dried exactly after 3 days. Our hypothesis was that it might dry in one day (24 hours). After we checked the results of the plastic sample, the plastic was how we wanted it to be and our objectives were met by following the right method and using the correct equipment's. If we were to repeat this experiment we would've done it several times than just once so that we get accurate results in the future. Overall the experiment was successful.

METHOD 2

1. 1g of amylase powder was added to 10ml of distilled water. More distilled water was added until the solution was measured to be 100ml.
2. 3.55g of plastic was measured using an electronic balance and a weighing boat. The plastic was placed in the beaker containing the amylase solution. The beaker was covered with silver foil to avoid the amylase solution from being evaporated.
3. The beaker was left in the room for the room temperature. The mass of the plastic was weighed after …….
4. This was then repeated for 3 trials to get an average.
5. The same experiment was repeated 3 times but placed in an incubator at the temperature 35°C and then at 45°C.

METHOD 3

1. 0.5g of amylase powder was mixed with 50ml of pH buffer.
2. 3.55g of plastic was measured using an electronic balance and a weighing boat.
3. The plastic was placed in the beaker containing the amylase solution.
4. The beaker was covered with silver foil to avoid the amylase solution from being evaporated.

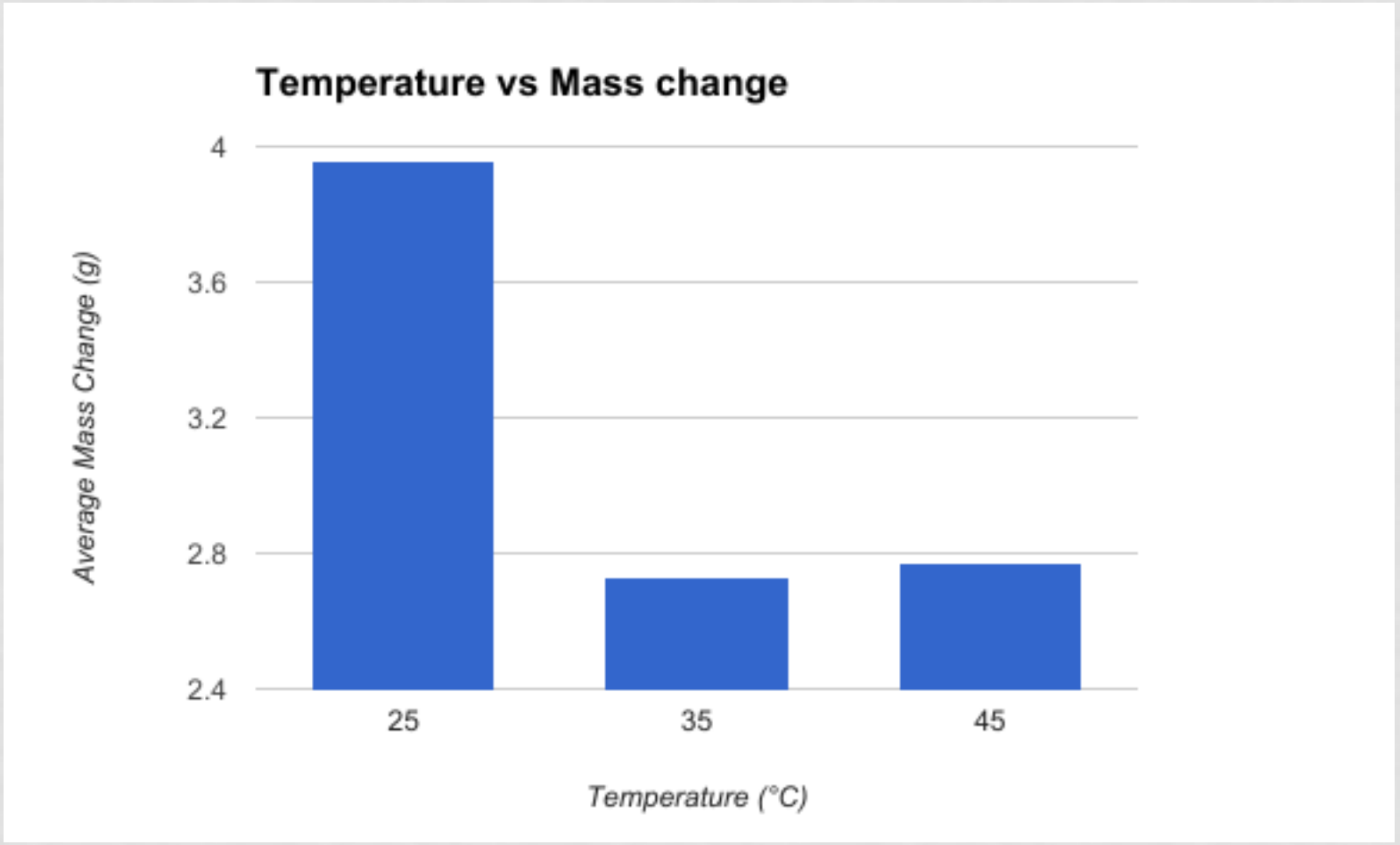
SAFETY PRECAUTIONS

1. Make sure lab coat, safety goggles and disposal gloves are used when handling the amylase powder as it is irritant.
2. Goggles should be worn when handling glycerin and kept away from the Bunsen burner as it is a flammable chemical.
3. Goggles and disposable gloves should be worn when handling the vinegar as it is an irritant chemical. It also has acetic acid which can be a hazardous chemical if not used in a safe way. It is a highly corrosive to the skin and eyes and should be handled with extreme care. Acetic acid can also be damaging to the internal organs if ingested or inhaled.

RESULTS – TEMPERATURE

	Trial 1		
Temperature (°C)	**Initial Mass (g)**	**Final Mass (g)**	**Mass Change (g)**
25	3.55	2.43	1.12
35	4.18	1.40	2.78
45	4.94	1.51	3.43
	Trial 2		
25	5.72	1.23	4.49
34	4.23	1.52	2.71
45	3.27	0.83	2.44
	Trial 3		
25	5.72	1.21	4.49
35	4.23	1.52	2.71
45	3.27	0.83	2.44

GRAPH - TEMPERATURE



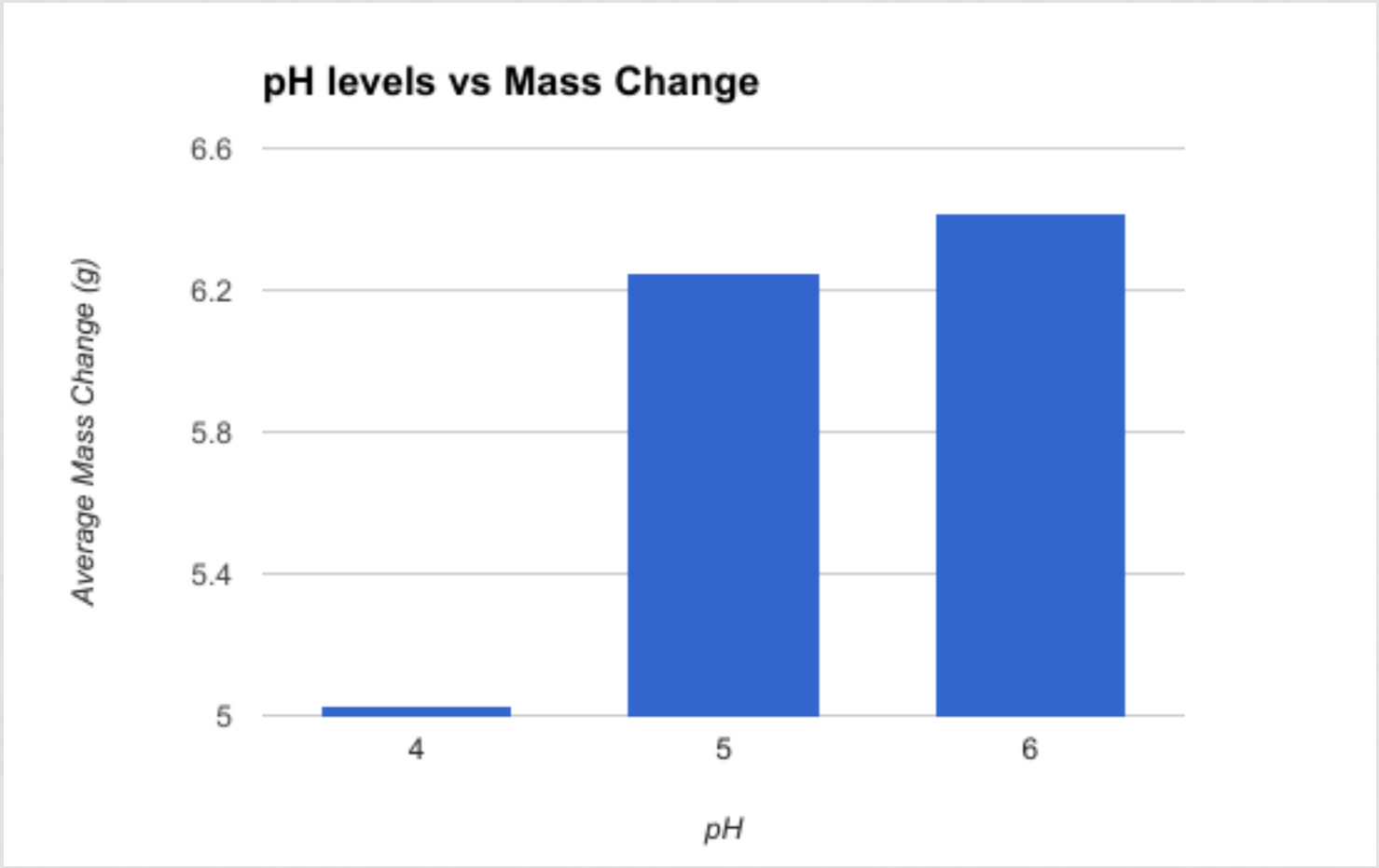
CONCLUSION

- The hypothesis regarding the temperature was supported with the results obtained. The amylase solution did have an effect on the biodegradability of the plastic. All temperatures including the room temperature had an effect on the biodegradability of the plastic. The temperature that caused the highest mass change was when it was exposed to the temperature of 45°C. One hypothesis made, stated that the high temperature would have no effect because the amylase enzyme would denature, was contradicted as the highest temperature had the greatest mass change.

RESULTS - PH

	Trial 1		
pH Level	**Initial Mass (g)**	**Final Mass (g)**	**Mass Change (g)**
4	7.25	1.92	5.33
5	7.20	0.98	6.22
6	7	0.70	6.30
	Trial 2		
4	6.31	1.92	4.39
5	6.98	0.97	6.01
6	7.45	0.98	6.47
	Trial 3		
4	7.54	2.16	5.38
5	7.79	1.27	6.52
6	7.59	1.10	6.49

GRAPH - PH.


pH levels vs Mass Change
Average Mass Change (g)
6.6
6.2
5.8
5.4
5
4
5
6
pH

CONCLUSION

- The results supported the hypothesis as the pH had an effect on the biodegradability of the plastic. As the pH level increases so did the mass change as the enzyme activity increased with the increase in pH level. The results suggest that pH level 6 could possibly be the amylase enzyme's optimum pH level as the mass change was extremely high.

EVALUATION

- If we were to do this experiment again we would choose a higher range of temperatures (25°C, 35°C, 45°C and 55°C) to see which temperature was the best for the amylase enzyme to work in because it would show the effect of temperature on the biodegradability of plastic much clearer. Especially if it would show the optimum temperature.
- We also would have used a larger range of pH levels (4, 5, 6 and 7) to see which level works the best for the amylase enzyme to break down the plastic. And to clearly see which pH level is its optimum temperature for the amylase enzyme.