Effect of Acetone on Zebrafish Development

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ABSTRACT

In this experiment, we tested to see the effects of acetone on zebrafish development. We observed to see if acetone sped up or delayed the process of development in the embryos. We found that exposure to acetone tends to speed up development, but if the concentration of acetone is too high, development is delayed. Pregnant women should try to avoid acetone in nail polish remover, detergent, and cleaning products to ensure that it will not affect the fetus.

INTRODUCTION

Acetone is a colorless liquid used as an organic solvent that is clear in color and has a “fruity” odor. It is used in products such as nail polish and nail polish remover, plastics, paint, adhesives, inks, and even fruits and vegetables. Getting acetone in your eyes, on your skin, and breathing too much of it in through the air can cause problems and irritation in the body. According to the Health Protection Agency, breathing in too much acetone can cause lung and throat irritation and tightening of the chest. Intaking acetone can cause, nausea, vomiting, and inflammation of the mouth. Getting it on your skin it may cause dry skin or skin irritation and getting acetone in eyes may cause eye damage. During pregnancy, acetone would be unlikely to affect the baby if the amount does not affect the mother, but this is not guaranteed. If it does affect the mother, it can cause depression of the nervous system, skin irritation, and negative effects to the brain and heart of the child (Avoiding Harmful Toxins). We performed the experiment to test the effects of acetone on smaller animals or embryos of a developing animal. In the experiment, we are tested acetone on zebrafish embryos to see how the chemical affects their development. Robert L. Hill Jr. and David M. Janz, from the Department of Zoology at Oklahoma State University, conducted an experiment by putting zebrafish embryos in a dish with clean water and a in a dish with acetone solution. The end results were that the acetone solution did not significantly affect the reproductive system of the female fish, just made it more sensitive compared to the female fish in the clean water. With the knowledge of these findings, we predicted that the zebrafish in the acetone would have a slower development process compared to the zebrafish in out control wells with Instant Ocean solution.

REFERENCES

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MATERIALS AND METHODS

Embryo Media: 200mg/L Instant Ocean incubated at 28°C

Methods:

Day 1
- Make up the solutions by mixing acetone with Instant Ocean Solution
- Put 3mL of Instant Ocean in the control wells, 3mL of the 0.5% concentration in the low wells, 3mL of the 1% concentration in the medium wells, and 3mL of the 2% concentration in the high wells
- Place 5 embryos in each well
- Make observations (hatched, dead, abnormalities?)
- Put in incubator at 28℃

Day 2
- Carefully get the Falcon dish from the incubator
- Place under microscope and record observations and take pictures
- Remove dead embryos and count the number hatched (if any)
- Replace the solutions
- Place back in incubator

Days 3 and 4 repeat steps from Day 2

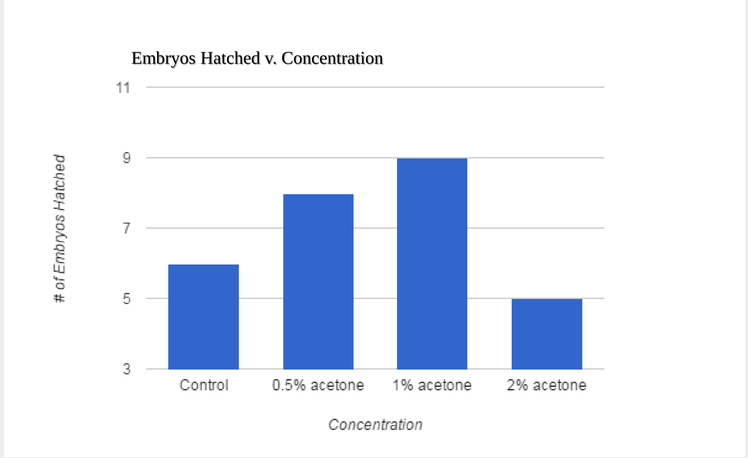
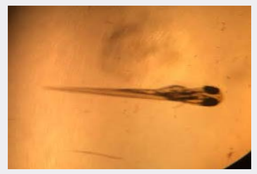


Figure 1.

The graph compares the number of embryos hatched to the concentration of the acetone in the Instant Ocean solution by day 4. It can be concluded from the graph that that a small amount of acetone such as the 0.5% and the 1% stimulates the growth and development process which causes the embryos to hatch and develop quicker than the embryos in the control. Too much acetone however, as in the 2% concentrated wells, can be damaging to the development process of the embryos and slow the development.

Day 3: Control.



Day 3: Low Concentration

Day 3: Medium Concentration

Day 3: High Concentration

RESULTS

The 40 zebrafish embryos were placed in a falcon dish with 8 wells, 5 embryos in each well, and 3mL of water in each well. Two wells were used as the control with no acetone, only the Instant Ocean solution; two wells were used for Treatment 1 with the low 0.5% concentration of acetone; two wells were used for Treatment 2 with the medium 1% concentration of acetone; and two wells were used for Treatment 3 with the high 2% concentration. Data was collected on the stage of development, the number dead, and any abnormalities the embryos may have. The embryos in the high concentration of acetone had the slowest development and had the least eggs hatched, but the embryos in the medium concentration had the fastest development and most eggs hatched. This is showing us that there is a limit to how much acetone an embryo can handle before it has negative effects or even fatal effects.

DISCUSSION

Overall, our results were not supported by our hypothesis. We predicted that the acetone would slow the growth and development of the zebrafish embryos. Although our hypothesis was supported with our 2% wells, showing the embryos development slower than the control, the .5% and the 1% acetone solution wells failed to support it. The embryos’ growth and development in those wells quickened the process and more of the fish hatched. There was no difference of the number of embryos hatched between the .5% concentrated solution and the 1% concentrated solution. The control and .5% concentration as well as the control and 2% concentration had no major difference. However, our control wells and our 1% wells did have a more obvious difference, showing that a small (but not too small) amount of acetone speeds up the process of the zebrafish embryos growth and development. There was also a difference of hatched embryos between the 2% concentrated wells and the 1% and .5% concentrated wells. Although there was not a difference between the control and the 2% concentration, by looking at the graph you can see there were still less hatched in the 2% concentration than the control. This suggests that too much acetone compared to only a little, clearly slows the growth and development process of the zebrafish embryos. A limitation to our experiment was that we only observed the zebrafish for three days while some were still alive and hatchlings. Although some were dead, there were some zebrafish still alive and if doing this experiment again, we would expand the experiment to let the zebrafish live into adulthood to see the full effects of acetone on the embryos and developed/developing embryos.