The Effect of Sodium Chloride On Earthworm Burrowing

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Abstract:

Sodium chloride is commonly known as salt. It is used to melt snow and ice on roads, sidewalks, and driveways. Road salts contain high concentrations that show to be dangerous for living organisms including bugs and plants. Sodium chloride can also cause rust to form on cars. Whether or not earthworms are affected by the chemical is important because worms play a big part in every ecosystem. They assist in breaking down organic matter in which plants can use. In order to test our theory that the earthworms will burrow faster with higher concentrations, we diluted the salt into water to create a solution with specific concentration percentages. Different earthworms were then tested with the different concentrations and the time was recorded as to how long it took the earthworms to burrow. Our results suggests that the worms burrowed slower when exposed to higher concentrations. A high concentration of sodium chloride presented in the soil can cause the worms to work less efficiently than needed and can slow down the process of decomposition that crops and plants rely on. That also means that food production for human consumption can be slowed down.

Introduction:

Sodium chloride is an inorganic compound. It is made when sodium and chloride come together to form crystalline cubes(1). It is an ionic compound, being made up of equal numbers of positively charged sodium and negatively charged chloride ions(2). Salt is widely used to season foods, preserve fish, and cure meats. As a chemical, salt is used to make glass and pottery. Salt is also used as a raw material for the production of chlorine and sodium hydroxide. Sodium chloride is used in large amounts to melt ice and snow on streets and highways (1). It has been reported that road salt can contaminate water by infiltration to groundwater, runoff to surface water, and through storm drains. The chloride discharged into the waters cannot be naturally removed, only dilution can reduce the concentration. During winter, chloride levels can exceed 800mg/L. The salt can influence the chemistry of the soil. It will cause changes in the soil permeability causing the soil to not allow liquid to pass through. It will reduce soil stability and decrease the soils pH balance. The persistence of chloride poses a risk to the water quality, plants, and animals that depend on it (3). The purpose of this experiment is to observe and detect the effect of sodium chloride on earthworm burrowing ability. Our hypothesis is that earthworms will burrow faster when exposed to higher concentrations because of increased irritation at the surface of the soil.

Materials:

- Cups (5)
- Soil (3 cups)
- Rock Salt (4 tbs)
- Water (five cups)
- Spoons
- Earthworms (6)
- Timer

- Pipette
- Paper bowl

Method:

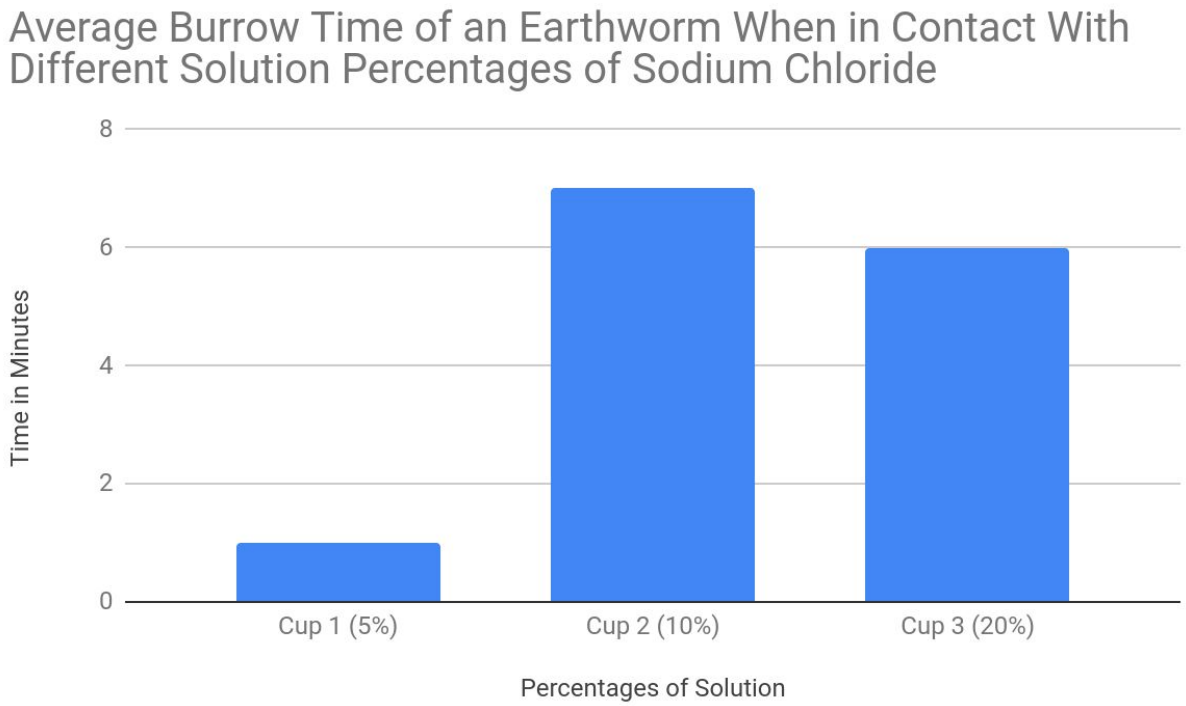
1) Gather materials
2) Lay out all the cups and the bowl in a row.
3) In the first cup, you will fill it halfway with soil. Label it “Testing Cup”
4) In the second cup, fill it with 1 tablespoon of rock salt and 1 cup and 3 tablespoons of water.
5) Stir until dissolved and label “5%”
6) In the third cup, add 1 tablespoon of rock salt and 9 tablespoons of water.
7) Stir until dissolved and label “10%”
8) In the fourth cup, put 1 tablespoon of rock salt and 4 tablespoons of water
9) Stir until dissolved and label “20%”
10) In the first cup, lay a worm on top of the dirt and use the pipette and fill it up with the 5% solution.
11) Drop 5-6 drops of the solution on the soil and immediately start the timer.
12) Stop the timer when the worm has burrowed fully or until you can not see the worm anymore.
13) Record time.
14) Find and remove the worm. Place the worm in another bowl of dirt.
15) Remove the dirt from the first cup and fill it up halfway with new soil.
16) Place a new worm on top of the soil
17) Drop 5-6 drops of the solution on the soil and immediately start the timer.
18) Stop the timer when the worm has burrowed fully or until you can not see the worm anymore.
19) Find and remove the worm. Place the worm in the other bowl of dirt.
20) Remove the dirt from the first cup and fill it up halfway with new soil.
21) Repeat the same process twice with the 10% solution and 20% solution

Results:

Burrowing Time For Earthworms Exposed to Sodium Chloride(Minutes)

	Test #1-	Test #2-	Average TIme
Cup 1 (5%)	1:03 minutes** Worm 1	1:33 minutes** Worm 4	1:18 minutes
Cup 2 (10%)	2:31 minutes** Worm 2	12:40 minutes** Worm 5	7:27 minutes
Cup 3 (20%)	8:38 minutes** Worm 3	4:23 minutes** Worm 6	6:30 minutes

(Figure 1)



(Figure 2)

Results paragraph:

The purpose of this experiment is to test salt concentration on an earthworm to see how long it will take the worm to burrow fully when different concentrations percentages are added to the soil. We were looking to see if the worm would burrow faster when exposed to higher concentrations because of irritation. The independent variable measured in this experiment is the sodium chloride concentration in the solution. The effect of the independent variable is the dependent variable which is the amount of time, in minutes, that it takes for the worm to completely burrow after exposure to the different concentration percentages. When the road salt is included in the earthworms environment, the result is that burrowing time increases then when exposed to a lower concentration of the solution. The maximum amount of time given to burrow was 15 minutes. The 15-minute mark was almost reached when worm number 5 was exposed to the 10% solution. The 20% solution provided enough toxicity to kill 2 worms in under 10 minutes. As shown in Figure 1, the worms burrowed more quickly when exposed to the 5% solution than the 10% solution. The 5% solution provided enough to trigger the worms to leave but not enough to kill the worms. As shown in Figure 2, the burrow time had a significant rise when the concentration percentage went up by an extra 5%. Once the percentage went up by another 10 percent, the concentration was strong enough to kill.

Discussion:

Our hypothesis stated that if there is more salt concentration then the earthworm will burrow faster because it has very thin skin and is sensitive to harsh chemicals and therefore they would want to escape the source of the irritation. Our results showed the higher concentrations of sodium chloride caused the earthworm to slow down and burrow slower, which disproved our hypothesis. The lowest concentrations burrowing time occurred for five minutes of exposure with a 1 minute 18 second average burial time. In comparison, the ten percent concentration with a ten-minute exposure was exceeded by an extra 2 minutes 40 second for test number two. These two average times relate to back to disprove our hypothesis, which is that the greater the concentration, the quicker the worm burrows. One source of error with the results is the amount of solution added to each test. We didn't use the measurements in the pipettes when depositing our solutions, instead we used a cup and generally refilled to the same amount. There is a possibility that some worms were exposed to more solution than others. Our results support the idea that sodium chloride is harmful to ecosystems where earthworms reside. Due to the slow burrowing times, decomposition could be harmed and affect how plants grow.

Works Cited:

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