

**The purpose of this experiment is to use the acid-base properties of sodium bicarbonate to inflate a balloon by releasing carbon dioxide.**

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| Materials required: | 1 balloon,<br>1 empty bottle,<br>1 funnel,<br>200mL of vinegar,<br>20g of sodium bicarbonate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Safety:             | An adult must monitor the experience. Sodium bicarbonate is not a dangerous product. However, you should take care not to directly mix the vinegar and the bicarbonate to avoid projections.<br>Acetic acid is a corrosive and irritating product, especially for the eyes and other sensitive mucous membranes that should not come into contact with this compound. In this experiment, the acid concentration in the vinegar being low, only the wearing of protective glasses is sufficient. Take care to deflate the balloon at the end of the experiment. |

At first, inflate the balloon to relax the rubber before allowing it to deflate. Pour the vinegar into the empty bottle, then, using the funnel, introduce the sodium bicarbonate inside the balloon. Then place the balloon on the opening of the bottle being careful not to pour the bicarbonate on the vinegar. Finally, straighten the balloon so that the sodium bicarbonate falls into the bottle. You then observe a boil in the vinegar and the swelling of the balloon. The volume of the bottle was initially occupied by air and the current reaction releases carbon dioxide which increases the volume of total gas in the bottle-balloon system.

The reaction observed in the system is a reaction involving sodium bicarbonate  $\text{NaHCO}_3$ , the base, with acetic acid  $\text{CH}_3\text{COOH}$  vinegar, acid.

The balanced equation of the reaction is:



The products formed are sodium acetate (a salt), water and gaseous carbon dioxide.

This reactivity of sodium bicarbonate with acidic species gives various possibilities of product application.

It is used to neutralize the acidity of certain fruits or vegetables (tomatoes, etc.) and to soften the meat.

In bakery, bicarbonate can be used to prepare yeast (emission of  $\text{CO}_2$  bubbles) by mixing it with acid products such as milk and its derivatives.

In addition, sodium bicarbonate has an anti-odor power because many odors are generated by acid substances that it reacts with and thus neutralizes them. Due to this reactivity baking soda is a treating agent for flue gas acidity; but it is also added to animal feed to increase the welfare and milk production of cows that often suffer from acidosis.



