

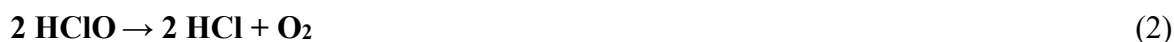
Title: **Savo-cola**

Work instructions

Task: Mix 25 ml of Coca-Cola and 15 g of Savo bleach.

Theory

Powdered bleach for pools (e. g. commercial product Savo) is a mixture of calcium hypochlorite ($\text{Ca}(\text{ClO})_2$). The reaction of this substance with the phosphoric acid present in commercial Coca-Cola produces a sparingly soluble calcium phosphate and *in situ* formation of hypochlorous acid, which partially decomposes in the light to hydrochloric acid and oxygen. The hydrochloric acid formed reacts with the residual hypochlorous acid. This symmetrical synproportionation results in the turbulent evolution of chlorine, which is the effect of this experiment.



It should be noted that after mixing the calcium hypochlorite, the effect does not come immediately, but only after a while, until the calcium phosphate has precipitated and until sufficient quantities of the reactants necessary for the turbulent evolution of chlorine have been formed *in situ*. The experiment is very popular on YouTube, but its chemistry is not discussed in the necessary depth.

Equipment: beaker (100 ml), larger spoon, glass rod, fume hood

Chemicals: commercial Coca-Cola, powdered bleach Savo or pure calcium hypochlorite

Procedures:

1. Pour 25 ml of Coca-Cola into a 100 ml beaker.
2. Add 15 g of Savo powdered pool bleach or calcium hypochlorite powder to this solution with a spoon. There must be sufficient excess of the powdered chemical to achieve the effect.
3. Stir the resulting mixture with a glass rod and there will be enough time left to close the fume hood.

4. After a while, you may observe a rapid development of a faint green chlorine which brings the calcium phosphate precipitate particles out of the beaker.

Management of chemical substances

Chemicals	Form	H-statements	P-statements
Coca-Cola, commercial	Liquid	---	---
Ca(ClO) ₂	Solid, powdered	H272, H302, H314, H400	P220, P273, P280, P310, P305 + P351 + P338

Sources of risk and assessment of risk severity

Chlorine, which is an irritant, is produced, so the experiment is carried out in a closed fume hood with the exhaust running.

Waste management method

Certified chemical waste disposal company.

Risk reduction measures

Lab coat, goggles, gloves.

Worksheet

Calculations

1. Assume that the concentration of phosphoric acid in Coca Cola is 0.540 g.dm^{-3} .
 - a. What stoichiometric amount of calcium hypochlorite will react with 25 ml of Coca Cola?
 - b. What is the excess over the stoichiometric quantity if we use 15 g of calcium hypochlorite.

$$M(\text{H}_3\text{PO}_4) = \dots\dots\dots \text{g.mol}^{-1}, M(\text{Ca}(\text{ClO})_2) = \dots\dots\dots \text{g.mol}^{-1}$$

Mass of calcium hypochlorite (stoichiometric quantity)

Excess calcium hypochlorite over stoichiometric amount

Observation

1. Describe the experiment after mixing Coca Cola with pool Savo.

Questions

1. Write the state reactions taking place in the Savo-cola experiment:
 - a. reaction of phosphoric acid with calcium hypochlorite
 - b. decomposition of hypochlorous acid
 - c. reaction of hypochlorous acid with hydrochloric acid
2. Write the half-reactions for oxidation and reduction half-reactions in the reaction of hypochlorous acid with hydrochloric acid.

Oxidation:

Reduction:
3. Indicate which of the substances formed during the Savo-cola experiment is:
 - a. low soluble,
 - b. in the gaseous state.
4. Describe, what is the visual effect of the Savo-cola experiment.

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Conclusion

Instructions to elaborate conclusions:

1. Briefly summarise the aim of the demonstration experiment. What was the experiment trying to find out or prove??
2. Describe what you observed during the experiment. What were the most important results and what connections did you notice?
3. Explain the results using theory. How do the results confirm or refute the assumed principles?
4. Think about the practical meaning. How can the findings from the experiment be used in real life or in further study?

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