Mentos and soda eruptions- lessons on explosive volcanic eruptions

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Experimental procedure

The required supplies are available in most grocery stores. The "eruptions" are safe but do not allow students to aim the soda bottle at people. This experiment must be completed outside.

(1) Unwrap one roll of Mentos candies. Stack the candies in a rolled up overhead transparency or piece of paper.
(2) Cover one end of the stack with another piece of paper and place this end directly on top of the open 2-liter bottle of soda. (Note cola works much better than plain soda water)
(3) Quickly remove the paper at the bottom of the stack of Mentos to allow the candies to drop into the bottle. Stand back. The eruption will propel liquid out of the bottle several meters into the air.

Classroom applications

The Mentos-soda demonstration is an example of a gas-driven eruption and compliments a lecture on volcanic eruptions (and/or sudden CO_2 release from lakes in some volcanic areas, e.g., http://perso.orange.fr/nyos/). Students can learn more about both soda and volcanic eruptions by running a series of experiments to isolate the factors that cause the soda eruption. Questions that will help the students think about the eruption process and design experiments to test their ideas, include:

(1) Is the eruption a result of an acid + base reaction, like the vinegar and baking soda eruption?
(2) Is heterogeneous nucleation the only process that causes the eruption (i.e. could you use any type of particle in the soda)?
(3) Is there a product in the candies that lowers the surface tension of the soda?

Supply the students with several liquids such as orange juice or vinegar (non-carbonated and acidic), plain water (non-carbonated and non-acidic), soda water (carbonated and non-acidic) and cola (carbonated and acidic). Also give them a selection of particles including a few types of candies, baking soda and something inert such as silica beads. Encourage students to predict which combinations will produce the most vigorous eruptions. To further examine the effect of surface tension, students may compare an eruption with plain soda water to an eruption with a drop or two of dishwashing detergent added to the soda water.

Have students try several combinations and record observations such as eruption duration, maximum height, and the amount of liquid left in the bottles. As an alternative to outdoor eruptions with 2-liter bottles, student can observe the vigor of bubble formation as they add objects to cups of liquid in the classroom. Discuss the results and differences between baking soda-vinegar reactions and the Mentos-soda eruption. Have students compare and contrast Mentos-soda and volcanic eruptions.

More advanced students can also vary the eruption conditions. For example, you can change the vent radius of the soda bottle by drilling a hole in the bottle cap (e.g., http://www.tabblo.com/studio/stories/view/14370/). Measurements of eruption column height can be used to calculate eruption velocity, which can then be used to calculate the required pressure to produce the eruption (e.g., Harpp et al. 2005). Students can then assess how velocity and pressure change with variations in the vent radius.