Chocolate cake in a mug

SAFETY AND WASTE DISPOSAL

- This experiment is not to be done in the laboratory!
- Biowaste should be sorted in the biowaste container and empty food cartons should also be sorted accordingly.
- The mug is hot when it comes out of the microwave! Take care! With small students the teacher should provide necessary assistance.

INTRODUCING QUESTIONS

Why is baking powder added to the batter when making cakes and pastries?

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BACKGROUND

This experiment is an example of a molecular gastronomy experiment. Molecular gastronomy tries to understand the science behind cooking. In molecular gastronomy we study the chemistry behind food, conduct experiments related to food and also taste the foods that have been prepared.

In this experiment you will prepare a chocolate cake in a mug. A chemist sees the cake as consisting of gas bubbles enclosed within a protein network. The bubbles must be small, numerous and the surrounding network of proteins must be resilient in order to keep the structure firm. Once the bubbles are made into the cake batter, protein and starch are added for structure. The final structure is formed in the heat of the oven, or in this case the microwave.

REAGENTS

- Flour
- Baking soda
- Sugar
- Cocoa powder
- An egg
- Cooking oil
- Milk

EQUIPMENT

- A microwave
- A microwave safe mug
- A teaspoon
- A tablespoon
- A fork

INSTRUCTIONS (FOR TWO SERVINGS)

1. Mix 2 tablespoons of flour, a pinch of baking powder, 2 tablespoons of sugar and 2 tablespoons of cocoa powder in a microwave safe mug.
2. Add an egg, 1 tablespoon of cooking oil and 1 tablespoon of milk. Stir well with a fork.
3. Heat the mug in the microwave at full power for 1 minute. If the cake does not look ready, put it back in the microwave for about 10-20 seconds. Be careful with the hot mug!
4. Now the cake is ready to be enjoyed! You can add some toppings on the cake if you want.

CONCLUDING QUESTIONS

When the cake was in the microwave, vapour came out of it. Where did the vapour come from and what was it?

What happens to the volume of the cake when it is baked? Why?

Why were milk and cooking oil added to the batter? What about sugar?

ADDITIONAL INFORMATION

When all ingredients have been added to the mug, the batter is loose in structure. When the batter is heated in the microwave, carbon dioxide gas is released from the reaction between the acid and the base in the baking powder. Small bubbles of carbon dioxide form all over the batter and the batter rises. As you continue to heat the mixture, starch in the flour and the egg proteins will deform and the batter will become firmer as the cake cooks. Finally, the water evaporates, and the cake is ready to eat!