Anal Bioanal Chem (2014) 406:5–6
DOI 10.1007/s00216-013-7464-2

ANALYTICAL CHALLENGE

Blue garlic challenge

Hervé This

We invite you to participate in the Analytical Challenge, a series of puzzles to entertain and challenge our readers. This special feature of "Analytical and Bioanalytical Chemistry" has established itself as a truly unique quiz series, with a new scientific puzzle published every other month. Readers can access the complete collection of published problems, with their solutions, on the ABC homepage at http://www.springer.com/abc. *Test your knowledge and tease your wits in diverse areas of analytical and bioanalytical chemistry by viewing this collection.*

In this challenge, "discoloration" is the topic. And please note there is a prize to be won (a Springer book of your choice up to a value of €100). Please read on …

> "We remember the fish which wee did eate in Egypt freely:
> the cucumbers and the melons, and the leekes,
> and the onions, and the garlicke."
> *King James Bible, Num 11:5*

Meet the blue garlic challenge

Garlic, onion, and other plants of the *Allium* family are common food crops used in most parts of the world since antiquity. Many medicinal and mythological properties have been attributed to garlic, which might be a reason for its widespread culinary use. The antifungal, antioxidative, and antiviral activity of garlic, for example, has recently been explained on the basis of the copious amounts of sulfur compounds the plant contains [1, 2].

A gamut of phenomena occurs to plant tissues during culinary processes. These include changes of odor, taste, consistency, and color. Bulbs of garlic often have a cream color which turns brown on thermal processing [3]. One of the reasons for the appearance of this brown color is the so-called Maillard reaction, in which amino acids react with reducing sugars at high temperature leading to the formation of brown melanoidin [4]. Incidentally, the year 2012 marked the centenary of Louis-Camille Maillard's seminal publication on some nonenzymatic browning processes.

Chemistry is full of colors, and sometimes less-familiar colors can appear in the kitchen also. In particular, onion and garlic purées can turn pink, green, and even blue. Pinking of onions occurs when onions bulbs are puréed. Also, a blue pigment forms in a mixed purée of onion and garlic; this is called "greening" of garlic. Thermal treatment of onion bulbs before they are puréed results in a blue color which is significantly stronger than that obtained from unheated bulbs. "Greening" is also the name given to the discoloration of crushed garlic cloves from cream to green.

Even more intriguing is the fact that whole garlic cloves can also turn blue. A simple way of producing the color is to prepare traditional Chinese "Laba garlic", a vinegar-preserved garlic—when garlic cloves are soaked in vinegar for several days, a blue color develops (Fig. 1).

The challenge

What makes the garlic turn green or blue?

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Fig. 1 Vinegar-pickled garlic turns blue after several days. (Photograph courtesy of Hervé This, AgroParisTech, Paris, France)

References

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We invite our readers to participate in the Analytical Challenge by solving the puzzle above. Please send the correct solution to abc-challenge@springer.com *by February 1, 2014. Make sure you enter "Blue garlic challenge" in the subject line of your e-mail. The winner will be notified by e-mail and his/her name will be published on the "Analytical and Bioanalytical Chemistry" website at* http://www.springer.com/abc *and in the journal (volume 406/issue 12) where the readers will find the solution and a brief explanation.*

The next Analytical Challenge will be published in 406/7, March 2014. If you have enjoyed solving this Analytical Challenge you are invited to try the previous puzzles on the ABC homepage.