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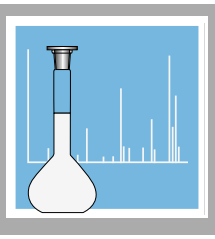

Highlights of Analytical Chemistry in Switzerland

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How Should the Release of Bisphenol A from Baby Bottles be Determined?

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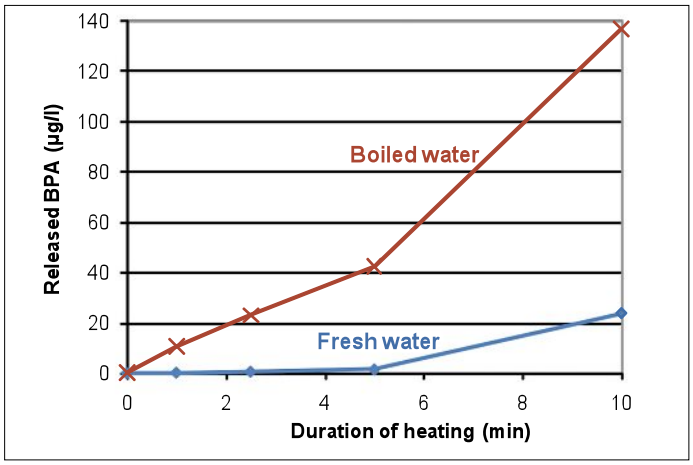
Bisphenol A (BPA) is probably the most famous synthetic chemical known to have an estrogenic effect. The Agence Française de Sécurité Sanitaire des Aliments (AFSSA) dealt with the question of whether microwave heating could result in higher concentrations of BPA from the polycarbonate of the bottle wall than considered so far, starting out from the bench mark of 50 µg/kg supported by the European Food Safety Authority (EFSA). Initially it seemed to be simple: polycarbonate absorbs little energy. Ehlert *et al.* supported this view: concentrations were clearly below 1 µg/l, as many tests reported with conventional heating. There was a single contrasting report from 2003, and it was from the German consumer journal *Oeko-Test*: BPA concentrations reached 157 µg/l with microwave heating, almost 1000 times more than all the scientific papers gave.

It turned out that the data reported by Oeko-Test was obtained with tap water. This opened the eyes to a more fundamental problem: In the past, milk was simulated by distilled water, focusing on migration, *i.e.* on diffusion to the surface of the plastic and transfer into the food. However, we have shown that BPA migration is negligible compared to release by hydrolysis of the polymer, primarily in alkali media. Upon heating of tap water, CO_2 evaporates which shifts the hardness equilibrium towards the carbonate and increases the pH to about 9. It is this high pH which caused the high levels of BPA reported by *Oeko-Test* – and since baby milk is made with tap water, the use of distilled water did not adequately simulate reality.

The graph shows the release of BPA into tap water during microwaving in a baby bottle. Using fresh water, the pH gradually increases and in the first 5 min, only 1.5 µg/l BPA was released, whereas 23 µg/l was measured during the second 5 min. Using water previously boiled in a pan, with a pH of 9.5, BPA was released at far higher rate: after 5 min (recommended for sterilization), the BPA concentration was 36 µg/l and it reached 137 µg/l after 10 min.



Increase of BPA concentration into tap water boiled by microwaving in a baby bottle.

Conclusions

- **Microwave heating does not increase the PBA release *per se*, but since it is the only practical way of boiling water in a baby bottle, it is indirectly responsible for the highest concentrations.**
- **Simulation designed for migration testing is not adequate for predicting release by chemical attack. With tap water, the release can be at least 100 times higher than with distilled water.**
- **Under reasonable worst case conditions, BPA release from baby bottles still did not exceed the 50 µg/l, but this value was approached.**
- **If tap water of no more than 60 °C is filled into baby bottles, BPA concentrations remain below 1 µg/l, which is lower than that in human milk.**

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References

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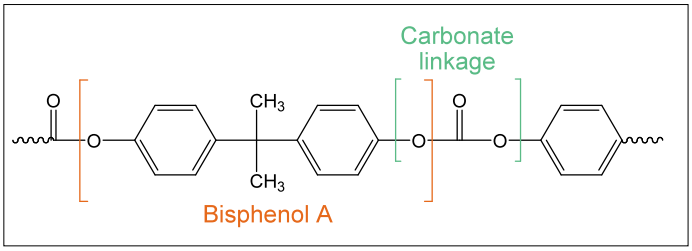
S. Biedermann-Brem, K. Grob, *Eur. Food Res. Technol.* **2009**, *228*, 679.

Bottles waiting for hungry babies.

Polycarbonate with the building block BPA and the chemically labile carbonate link.



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