Analysis of migration of melamine to food simulants

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Introduction

Melamine is a substance commonly used in plastic plates, cups and bowls. However, there is some concern about the effects of melamine when it comes in contact with food or drinks. In this study, food simulants are used to verify the degree of migration of melamine into food. With these simulants the influence of temperature and time in the oven on the migration of melamine was tested. HPLC is used to measure the amount of migration to the simulants.

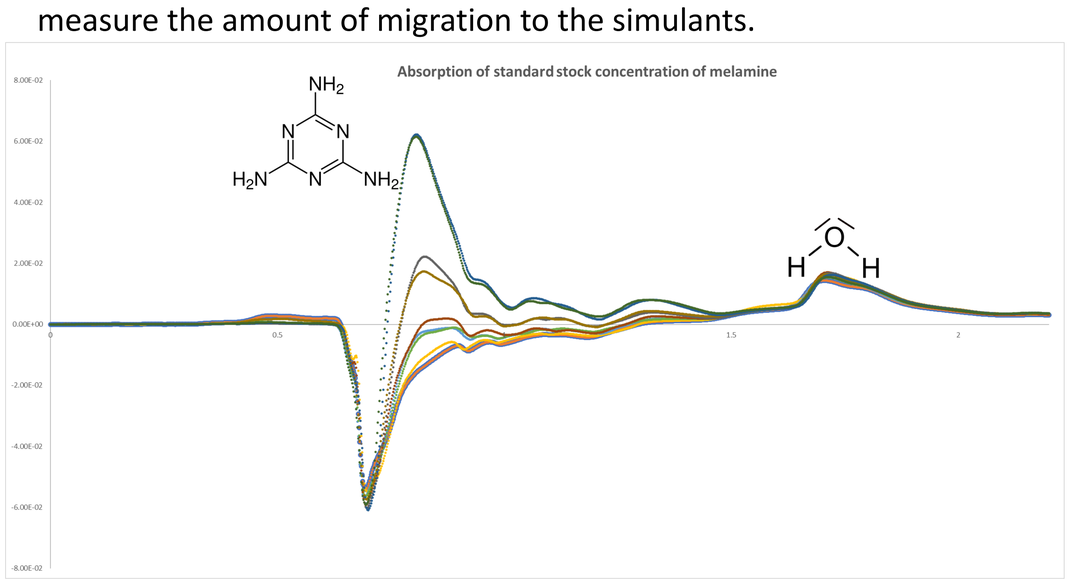

Figure 1: Absorption of standard stock concentration of melamine as seen on HPLC-machine

Materials and methods

To induce melamine migration from the tableware to the food simulants they were heated in an oven. The tests were performed with 3% acetic acid, 15% ethanol, milli-Q water and n-heptane as simulants.

To determine the influence of the temperature on the migration of Melamine the tableware were heated for 90 minutes at 30°C, 60°C and 90°C.

To determine the influence of heating time on the melamine migration the tableware were heated at 90°C for 30, 60 and 90 minutes.

After the presumed migration, the melamine concentration in the different food simulants was measured with HPLC. To prepare the samples for HPLC, 1 ml of simulant together with 9 ml acetonitrile were mixed and evaporated. Finally the melamine was redissolved into 1 ml of the HPLC mobile phase and measured.

Results

- Variation in temperature of the oven for 90 minutes

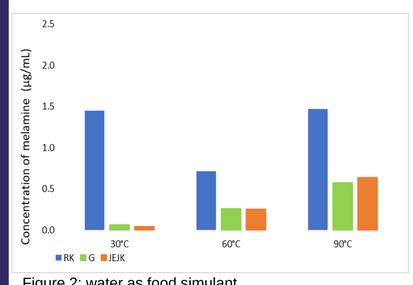

Figure 2: water as food simulant

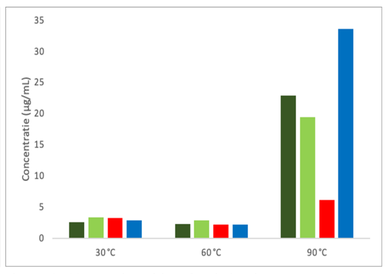

Figure 3: 3% acetic acid as food simulant

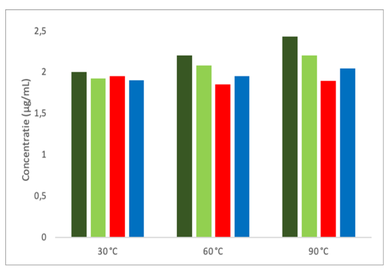

Figure 4: 15% ethanol as food simulant

- Variation in heating time in the oven at 90°C

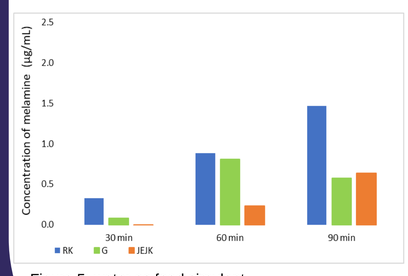

Figure 5: water as food simulant

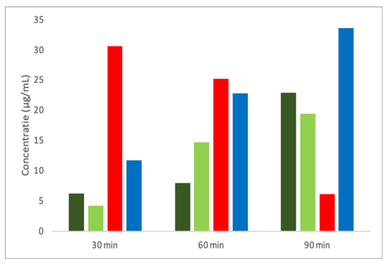

Figure 6: 3% acetic acid as food simulant

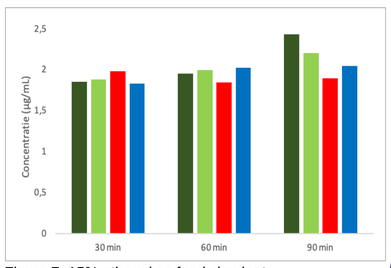

Figure 7: 15% ethanol as food simulant

Discussion

A general upward trend of concentration can be noted in function of both temperature and time. But there are also exceptions to this. These are the 60°C measurements of acetic acid, the RK (blue) measurements when testing different temperatures with milli-Q and both the 60 and 90 minute measurements of G (green), as well with milli-Q. Also, the values of "Bokrijk" (red) deviate from the predictions in almost every test. However, the effective presence of melamine in this type of tableware could not be confirmed which may explain this. The European standard of 30 µg/mL was exceeded only once, this when using 3% acetic acid for 90 minutes. This type of simulant also had the highest concentrations across all of the tests. When n-heptane was used as a simulant practically the entire content of the test tube evaporated, which means that the amount of migrated melamine to this apolar liquid was very low.

Conclusion

In general, the amount of melamine that migrated to the food simulant gets higher as the temperature at which the food simulant was exposed in the melamine tableware rises. The same is also true for an increase in the amount of time that the food simulant was heated in the melamine tableware.

It was found that the quantity of melamine that migrated to the food simulants was about ten times higher with the 3% acetic acid simulant than with the 15% ethanol simulant. From this and the fact that the measured pH value of the acetic acid simulant was 3 and that of the ethanol simulant was 5, it can be concluded that the more the simulant is acidic, the more melamine will migrate to it.

With the n-heptane simulant, the amounts that migrated were so small that they couldn't be calculated. Therefore, it can be concluded that melamine doesn't really migrate to apolar solutions.

When the kitchenware was damaged, it showed a significant increase in the amount of melamine that migrated to the simulant.

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