LEVELS OF TETRABROMOBISPHENOL A AND ITS RELATED COMPOUNDS IN INFANT FOODS OF JAPAN

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Introduction

Bisphenol A (BPA) is raw feedstock in polycarbonate synthetics and epoxy resins. Polycarbonate plastics have many applications including use in some food packaging such as infant bottle. Epoxy resins are used as lacquers coat metal products such as various food cans. BPA finds its way into the human body as a result of the food coming into contact with the packaging materials or plastic containers. In recent year, it has been reported the adverse health for the infant health by BPA and is concerned about the impairing intelligence growth of infant[1]. In 2008, Canadian government prohibited to sale and import of the BPA use feeding bottle, as follows, they designated as regulated chemical substances in 2010.

On the other hand, Tetrabromobisphenol A (TBBPA) is used in the manufacture of flame-retarded epoxy and polycarbonate resins. TBBPA is suspected to be stable in the environment with possible widespread human exposure. Comparing to BPA, it has not known the adverse effect for human health by TBBPA. By the knowledge of *in vitro* and *in vivo* studies, it has been suggested the increase of the total cholesterol and the liver weight[2]. It has been also reported that TBBPA passes a blood-placenta barrier easily[3]. Moreover, the secondary toxicity of the debromination of TBBPA (BPA, MoBBPA, DiBBPA and TriBBPA) is concerned (Fig. 1). However, there is very little knowledge about contamination levels and health effect by the above compounds in the infant foods. In Dioxin 2012, we have already reported that analyzed BPA and TBBPA in infant foods (vegetables, potatos and meats)[4].

In this paper, we have cleared to contamination levels in other infant foods (beans, seeds, fruits, fungi, tubers, confectioneries, commercial powdered milk) of BPA and TBBPA. We will report on the debromination of TBBPA in the various infant foods.

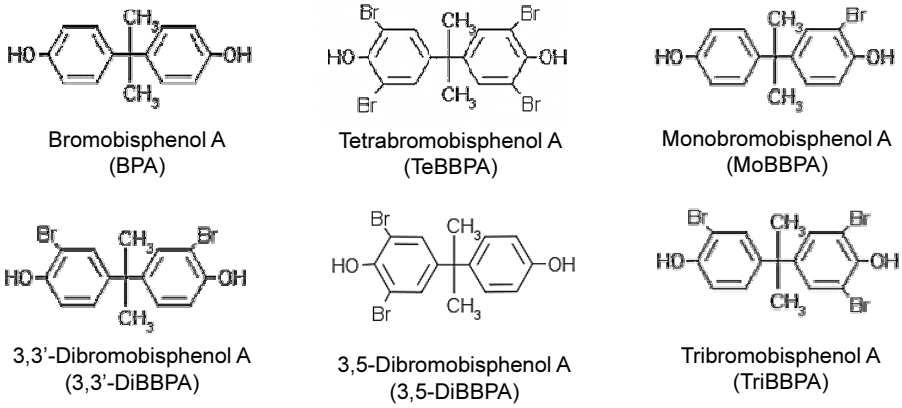

Fig. 1 Chemical structures of BPA, TBBPA and debrominated TBBPA compounds (MoBBPA, DiBBPA, TriBBPA)

Materials and methods

Samples collection

Thirty-three samples for nine different food categories were purchased from five grocery stores in Hirakata, Osaka and in Yawata, Kyoto, Japan. The collected samples included vegetables (pumpkin, tomato, pepper, broccoli, carrot), tubers (irishu potato, satoimo potato), meats (beef, chicken, pork), fungi (shiitake, shimeji), fruits (banana), beans (almond, soybean flour), cereals (wheat flour, starch, rice, dried macaroni, Japanese vermicelli, rice gruel) and confectioneries as baby food (bolo, biscuit). The food samples (vegetables and tubers) were washed with distilled water and measured weight, and then freeze-dried before analysis.

Analytical method

The analytical method for BPA and TBBPA measurement in infant foods worked out according to manual by Ministry of the Environment of Japan. After spiking with ^{13}C-labelled TBBPA and d-labelled BPA, food samples extracted for 30 min with methanol by ultrasonic wave. The extract was evaporated to dryness, allowing the gravimetric determination of the fat content. The extract was filtered by glass fiber filter, then the filtrate was extracted with ethyl acetate by liquid-liquid extraction. The extract was derivatized with diethyl sulfate. This solution concentrated to less than 1 ml, purification was performed Florisil column chromatography. The GC/HRMS detection was performed on a Hewlett-Packard 6890 gas chromatograph, equipped with a BPX-50 column (30 m x 0.25 mm, 0.25 μm film thickness), coupled to a JEOL JMS-700 high-resolution mass spectrometer. The mass filter operated at a resolution 10,000 in the selected ion-monitoring (SIM) mode using electronic impact as the ionization technique.

Results and Discussion

As shown in Fig. 2, the levels of BPA and TBBPA were investigated in meats (chicken, pork and beef). TBBPA and BPA were detected in all meat samples. The contamination levels of TBBPA and BPA were 2.2 - 3.9 ng/g, and 2.9 - 4.1 ng/g, respectively. It was not observed a big difference of contamination levels among three meat sample analyzed. Fig. 3 showed the contamination levels of vegetable, fungi and fruit samples. BPA and TBBPA were less than 1.0 ng/g in these samples. They were low concentration compared with meat samples. Further, as shown in Fig. 4 and 5, contamination levels of most food samples were very low, except Bolo A. Although, it is unclear the reason why BPA level was comparatively high in Bolo A, we presently estimated its contamination to transfer from packing bag.

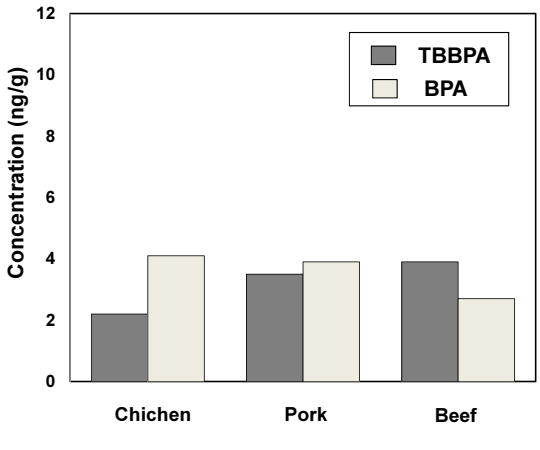

Fig. 2 Levels of TBBPA and BPA in meats (chiken, pork and beef)

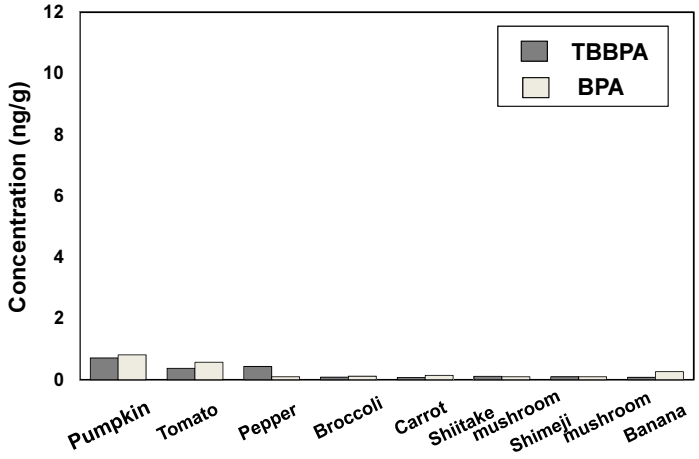

Fig. 3 Levels of TBBPA and BPA in vegetables, fungi and friut

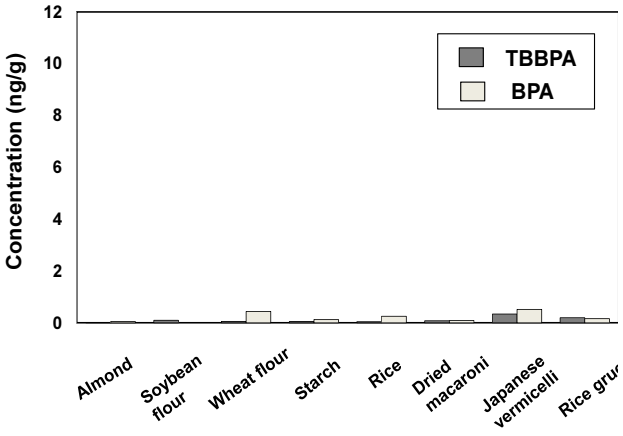

Fig. 4 Levels of TBBPA and BPA in beans and cereals

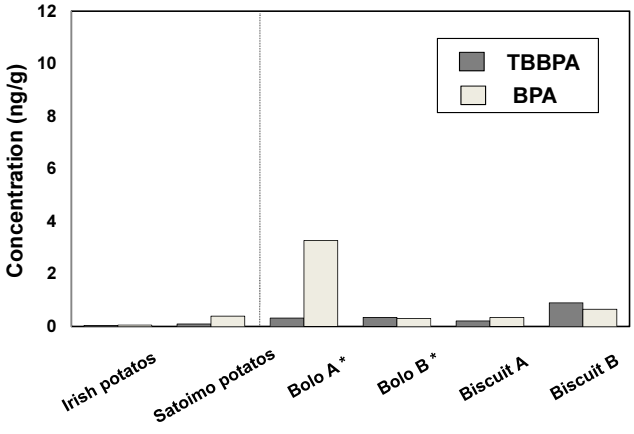

Fig. 5 Levels of TBBPA and BPA in tubers and confectioneries

* Bolo is baked cake from wheat flour, egg and sugar, and often used for baby foods in Japan

As shown in Figure 6, it was compared the contamination levels of BPA and TBBPA in eight kind of commercial powdered milk. The levels of BPA and TBBPA were detected in all powdered milk samples. The contamination TBBPA levels ranged between 0.17 and 3.8 ng/g. On the other hands, that of BPA ranged 0.40 and 11 ng/g. Four powdered milk samples (sample A-D) were detected high level compared with other powdered milk samples. In particular, BPA of sample C was high level. Now, we deal with this contamination pathway of commercial powdered milk.

Further study is needed to search of BPA and TBBPA in human breast milk. Then, it needs to evaluate daily intake of these compounds from infant food and human breast milk.

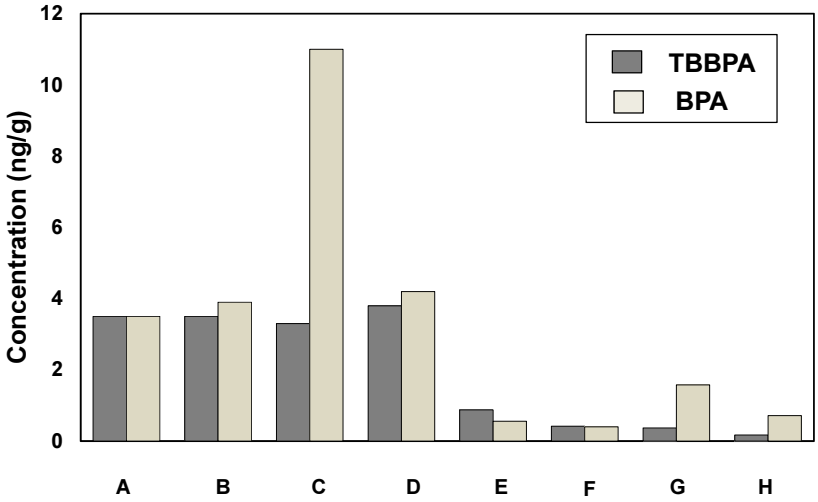

Fig. 6 Levels of TBBPA and BPA in eight kind of commercial powdered milk

Acknowledgements
This work was supported by the Health and Labour Sciences Research Grant (H23-Food-Young scientist-017).

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