

DIOXIN AND FURAN LEVELS FOUND IN TAMPONS

J.C. Archer¹, R. Mabry-Smith², S. Shojaee¹, V. Litman¹, J. Threet¹

¹Food & Drug Administration, Arkansas Regional Laboratory; 3900 NCTR Rd, Bldg 26, Jefferson, AR 72079

²Food & Drug Administration, Pacific Regional Laboratory, NW; Bothell, WA 98021

Introduction

Human exposure to dioxins and furans has been of major concern for many years. One specific concern, related to exposure in women's health, is the possible link to endometriosis. Although differences in opinion exist regarding this link, the concern from the public is real. Congressional interest within the United States has prompted investigations to determine the amounts of dioxins and furans present in feminine hygiene products available within the United States.

Low levels of dioxins and furans have been reported in tampons¹ and then related to theoretical human exposure. Other studies² of theoretical exposure calculations indicated that tampons would contribute six-thousandths of the daily dose of dioxin and one-thousandth of the average body burden found in the US female population.

Method

Experimental Set-Up

Tampons were purchased either via Internet or from department stores. A total of seven brands of tampons varying in the percentage of rayon-cotton to 100% cotton were included in the study. Two lots of "Regular Absorbency" and two lots of the highest absorbency of each brand were purchased. Roughly 10 grams of each lot, were extracted in duplicate resulting in the collection of four data points for each "brand-absorbency" group. One additional (highest absorbency) portion from each brand was spiked with a low level performance and recovery standard to verify extraction efficiencies as well as note precision and accuracy between brands.

Extraction

Each portion was cut into strips after outer wrappers and applicators were removed. All samples were spiked with fifteen 2,3,7,8-chlorine containing C¹³ congeners (ranging from 10 to 20 pg per extract) for direct isotope dilution analyses similar to EPA Method 1613 Revision B³. All tampons were Soxhlet extracted during an 18 to 24 hour period using a 50 % hexane : 50% methylene chloride. Each extract, at minimum, was subjected to a clean-up process using multi-layered silica gel and alumina columns. Some extracts needed additional clean-up procedures.

Analyses

All samples were analyzed via GC/HRMS using a Micromass AutoSpec Ultima high resolution mass spectrometer at 10000 mass resolution. Since data were confirmed and quantified using direct isotope dilution, only the seventeen 2,3,7,8-chlorine containing dioxin and furan concentrations were calculated from these analyses. An initial Method Detection Limit (MDL) study was completed before sample analyses to give baseline limits. For each extract, congener specific Estimated Detection Limits (EDLs) were determined.

HUMAN EXPOSURE I

Data Evaluation

Since much of the data were in the neighborhood of the instrumental EDL, Hypothesis Testing was used to determine statistical significance. All hypothesis testing assumes a normal distribution. The Null Hypothesis was set equal to or less than the found value. The Alternative Hypothesis was set greater than the found value. The Critical Region (CR) indicates a rejection of the null if the absolute value of “t” is greater than the value obtained from the Student t Table. If the null was rejected, the found value was considered significant. Using the Student t Distribution with 10 degrees of freedom at 99 %, the CR is 2.764. Any calculated value greater than the CR suggests that the number (or finding) is statistically significant.

Results and Discussion

As previously mentioned, the amounts found were near detection limits. The MDL study was completed prior to the extraction and analyses of any of the samples. This study was based on 5 replicates, similar to that described in 40CFR Part136 Appendix B of the Federal Register. Elevated EDLs for two congeners (1,2,3,4,6,7,8-HpCDF and OCDD) were reported, but neither were so elevated to interfere with reporting levels. The MDL gave a baseline of reportable amounts, which in many cases were less than the blank EDL average. Although the MDL study was completed as a baseline, the detection limits are reported as sample dependent.

Data were collected for each of the seventeen 2,3,7,8-chlorine containing dioxins and furans. A TEQ, using the World Health Organizations TEF values, was calculated for each sample. The calculated TEQs for samples were not significantly greater than that of the calculated TEQs using the average EDL from the associated blanks.

Only Brand C Super-Plus had levels of 2,3,7,8-TCDF that were statistically significant above the average blank at the 99 % level. Although the level found in the Regular absorbency was not rejected at the 99 % level, chromatographic peaks were observed above the noise level. The null hypothesis, associated with the TCDF congener for Brand C “Regular,” would be rejected at the 95 % level, thus indicating a possible observable significance. Several brands had levels of HpCDD and OCDD significantly greater than the blank average, thus leading to the rejection of those null hypotheses.

Figures 1 and 2 show concentrations of various congeners detected above the sample and average blank EDLs for both absorbency groups in the six completed brands. Each bar represents reportable data and indicates that the null hypothesis was rejected for that test. Comparing the data, Brand C has greater amounts of OCDD and TCDF in the Super Absorbency than the Regular Absorbency. Brands A,B,D and F results demonstrated higher OCDD concentrations found in the Regular Absorbency. This suggests that the manufacturing process may be different between absorbency groups as well as possible variations between lots. Brand E demonstrated nearly identical concentrations found for the OCDD in the separate absorbencies. The largest mass contribution found in each case was from the OCDD congener.

Most results were near the detection limit, thus resulting in the need for a statistical determination to accept or reject the data. With the exception of the 2,3,7,8-TCDF for Brand C Regular Absorbency the null Hypotheses were rejected at a 99 % level, thus increasing the confidence that those congeners were present. Brand C Regular Absorbency for the 2,3,7,8-TCDF was reported at a 95 % level, suggesting a possible observable significance rather than a statistical significance. These findings from Brand C warrant further studies to determine if the TCDF concentrations found were truly significant by investigating additional lots.

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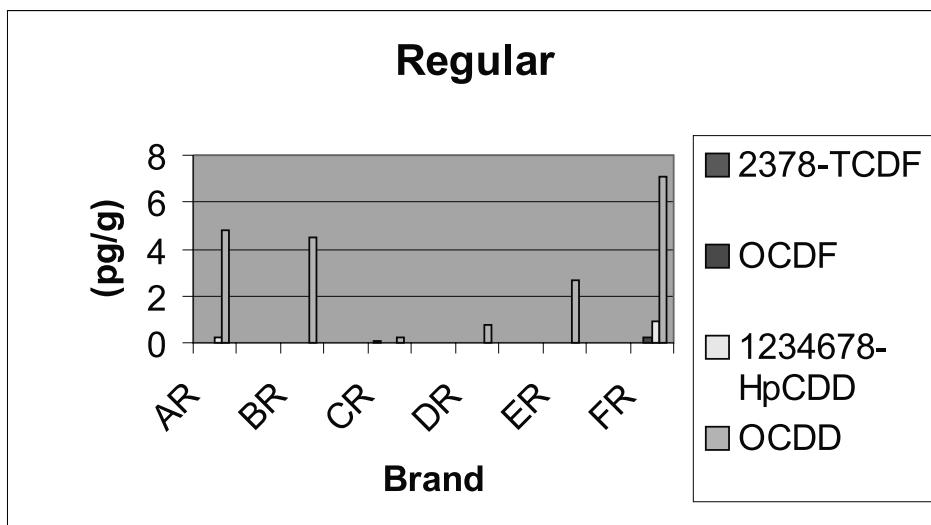


Figure 1. Concentrations found of various congeners in Regular Absorbencies

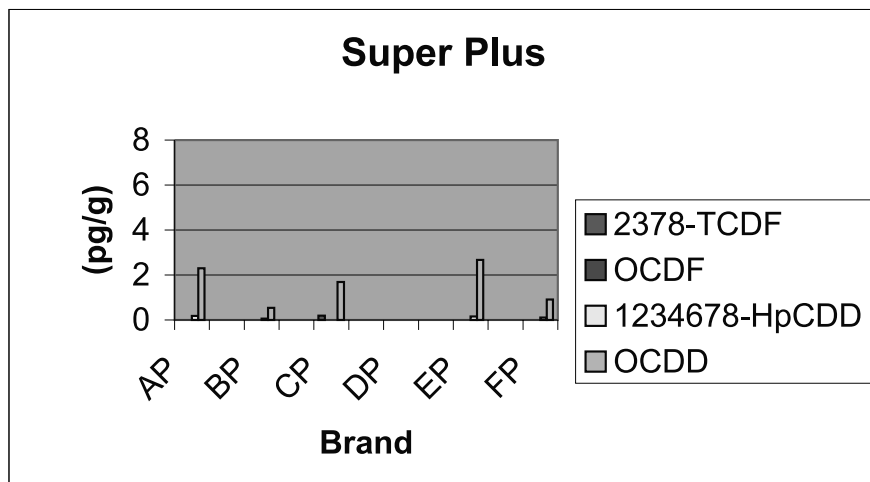


Figure 2. Concentrations found of various congeners in Super-Plus Absorbencies.

Dioxin group that participated at various levels to complete the project as needs arose along with the coordination efforts from supervisors Ralph Furth and John Eckert.

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