Testing Finds Industrial Chemical Phthalates in Cheese

Introduction. Phthalates are chemicals of high concern widely used in plastics, rubber, coatings, adhesives, sealants, printing inks, and fragrance. The global chemical industry produced about 12 billion pounds in 2014. Phthalates can migrate into food products during processing, packaging, and preparation. Although not intentionally added to food, phthalates are "indirect" food additives when they escape from food contact materials. Phthalates tend to be found at higher levels in highly processed or fatty foods.

Phthalates are hormone-disrupting chemicals that pose a serious threat to the health of pregnant women and children. Many studies have linked prenatal exposure to phthalates to abnormal development and function of the brain and reproductive system. According to federal scientists, up to 725,000 American women of childbearing age may be exposed daily to phthalates at levels that threaten the healthy development of their babies, should they be pregnant. Most people are primarily exposed to phthalates from the food we eat.

Several phthalates are banned in children's products in the United States. And Europe banned most phthalates for plastics in contact with fatty foods, including dairy products.

Summary of Major Findings

1. Phthalates were detected in **nearly every cheese product** tested (29 of 30 varieties). The testing identified ten different phthalates in all, with up to six in a single product;
2. Average phthalate levels were **more than four times higher** in **macaroni and cheese powder** samples than in hard blocks & other natural cheese, in fat of products tested;
3. **DEHP**, the most widely restricted phthalate, was found more often and at a much higher average concentration than any other phthalate, among all the cheese products tested.

Why test cheese products? A recent scientific review (Serrano *et al.*, 2014) concluded that dairy products were the greatest source of dietary exposure to the phthalate DEHP for infants and women of reproductive age. Therefore, cheese products were chosen as the first in a series of dairy products and other foods to test for phthalates. To the best of our knowledge, this is the first-ever report on phthalate levels in cheese powder from macaroni and cheese. About 710 million boxes of dry mix mac & cheese were sold in the U.S. in 2012.

Table 1. Macaroni & Cheese Powder Had Highest Phthalates of Products Tested

Products Tested	Product Description	Number of Varieties Tested	Concentration of TOTAL Phthalates Average and Range, in µg/kg or parts per billion (ppb)					
			In FAT (measured)			In PRODUCT (calculated)		
			Avg.	Low	High	Avg.	Low	High
Cheese Powder	Macaroni and Cheese, dry mix	10	940	365	2,523	106	34	218
Processed Cheese	Slices	5	569	180	1,223	105	38	216
Natural Cheese	Hard, Shredded, String & Cottage	15	216	< 55 *	567	53	< 17 *	203

* The highest limit of quantification (LOQ) in fat, and in a hard cheese product with a fat content of ~ 30%, for DEHP.

What was tested? 30 cheese product items, representing several varieties and brands, were purchased at retail in the Unites States and shipped in their original packaging to an independent laboratory, VITO (Flemish Institute for Technological Research), in Belgium. Both certified organic and conventional dairy products were tested. These items were analyzed for thirteen *ortho*-phthalates using validated test methods and quality control measures (Fierens *et al.*, 2012). Phthalates were measured in the extracted fats, blank-corrected, and reported in micrograms of phthalate per kilogram of fat (µg/kg), equal to parts per billion (ppb). The phthalate concentration in the tested items was calculated based on their measured or labeled percent fat content. VITO is 99% certain that reported phthalates were present in the product (rather than from lab contamination) above the limit of quantification (LOQ), which varied for the phthalates from 0.02 to 55.0 µg/kg in fat.

What did this testing show? Table 1 shows that the average total concentration of phthalates in macaroni and cheese powder was more than four times higher than in natural cheese, on a fat basis. ("Natural cheese" is an industry term meaning *not* processed or imitation). Processed cheese slices had nearly three times the phthalates of natural cheese. Products with higher phthalates in fat likely pick up more of these chemicals during food processing and packaging. After adjusting for percent fat content, cheese powder and processed cheese still had two times higher average fresh-weight phthalates concentration.

Table 2. The Phthalate DEHP Was Found Most Often in the Highest Amounts

The Thirteen Phthalates			Phthalates in FAT, in µg/kg or ppb			Detection Frequency
Acronym	Chemical Name	CAS Reg. No.	Average	Low	High	
DEHP	Di(2-ethylhexyl) phthalate	117-81-7	295	< LOQ	1,816	93 %
DEP	Diethyl phthalate	84-66-2	64	< LOQ	305	90 %
BBP	Benzyl butyl phthalate	85-68-7	36	< LOQ	912	13 %
DINP	Diisononyl phthalate	28553-12-0	35	< LOQ	481	20 %
DIBP	Diisobutyl phthalate	84-69-5	26	< LOQ	116	77 %
DnOP	Di-*n*-octyl phthalate	117-84-0	24	< LOQ	516	37 %
DIDP + DPHP	Diisodecyl phthalate Di(2-propylheptyl) phthalate	26761-40-0 53306-54-0	23	< LOQ	546	17 %
DBP	Di-*n*-butyl phthalate	84-74-2	12	< LOQ	79	60 %
DMP	Dimethyl phthalate	131-11-3	0.7	< LOQ	13	7 %
DnHP	Di-*n*-hexyl phthalate	84-75-3	0.6	< LOQ	18	3 %
DAP	Diallyl phthalate	131-17-9	< LOQ	< LOQ	< LOQ	0 %
DCHP	Dicyclohexyl phthalate	84-61-7	< LOQ	< LOQ	< LOQ	0 %
For all 30 cheese products tested:			**516**	**< LOQ**	**1,816**	**97 %**

Table 2 shows that DEHP, DEP, DIBP, and DBP were frequently detected in the cheese items tested. The average DEHP concentration was 25 times higher than DBP, and five times higher than DEP. The U.S. chemical industry still produces more than 100 million pounds of DEHP annually. And U.S. FDA still allows use of DEHP and 27 other phthalates in food contact materials, based on outdated safety data and policies adopted decades ago.

CONCLUSION: Further research is needed on the phthalate levels in food and further action should be taken to eliminate phthalates in any food products