

# Quantitative Analysis of Endocrine Disrupting Compounds at ppt levels in Consumer Composts and Soils using HRGC/HRMS

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## Introduction

Consumers often choose organic practices for home gardening in order to lower their exposure to pesticides and other synthetic chemicals found on commercial produce. However, soil amendments and composts may not be free of endocrine disrupting compounds including chlorinated pesticides, chlorinated dioxins and furans and PCBs. Fourteen types of soil amendments, including both commercial and home produced were tested. The use of HRGC/HRMS coupled with isotope dilution allowed for quantitation of analytes down to sub ppt levels. Unique clean-up strategies were employed for these complex matrices to improve both baseline and peak shape required for low-level analyses.

## Methodology

The samples were extracted and analyzed for selected chlorinated pesticides using EPA Method 1699, for chlorinated dioxins and furans using EPA Method 1613, and for PCBs using EPA Method 1668. The extracts were cleaned up using silica gel, acid/base silica gel and/or acid alumina, florisil, and carbon on florisil. The pesticides are separated on a 60m ZB-50, dioxins and furans on a 60m ZB-5ms, and PCBs on a 60m ZB-1 GC column. Minimum resolution was 8,000 for 1699 and 10,000 for 1613 and 1668.

## Waters Autospec Premier



### Analyte Occurrence

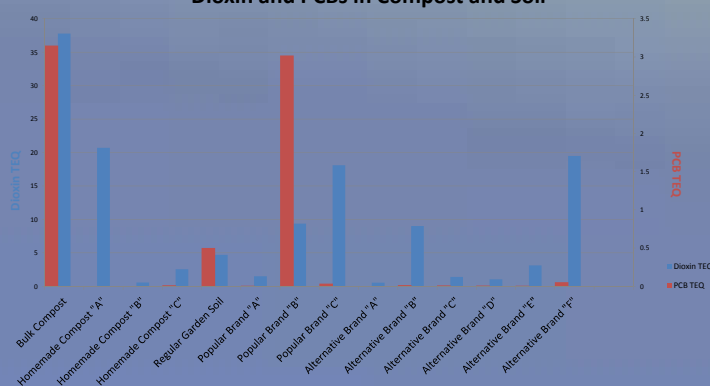
Compound	Occurrence
Hexachlorobenzene	13
Alpha-BHC	13
Beta BHC	5
Delta BHC	0
Lindane	10
Heptachlor	3
Aldrin	7
Oxychlorane	6
trans-Heptachlor Epoxide	7
trans-chlordane	14
trans-nonachlor	14
cis-Nonachlor	8
cis-Heptachlor Epoxide	14
cis-chlordane	14
Endosulfan I	5
2,4'-DDE	13
4,4'-DDE	14
Dieldrin	13
Endrin	1
Endosulfan II	4
2,4'-DDD	14
2,4'-DDT	9
4,4'-DDD	14
4,4'-DDT	13
Endosulfan Sulfate	4
4,4'-Methoxychlor	1
Mirex	0
Endrin Aldehyde	1
Endrin Ketone	1

### DDT Degradation

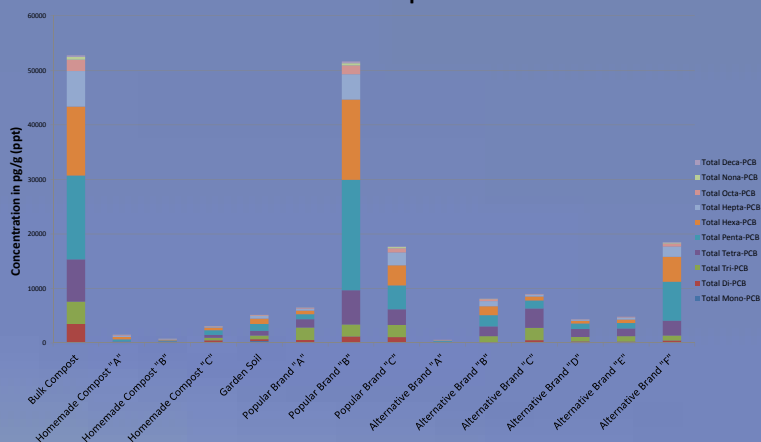
	DDT/DDE <sup>1</sup>	(DDE+DDD)/DDT <sup>2</sup>	DDD/DDE <sup>3</sup>
<b>Bulk Compost</b>	<b>0.002</b>	<b>618.119</b>	<b>0.120</b>
Homemade Compost "A"	0.420	2.461	0.033
Homemade Compost "B"	0.285	3.712	0.058
Homemade Compost "C"	0.179	5.879	0.055
Regular Garden Soil	0.166	7.041	0.166
Popular Brand "A"	0.539	2.131	0.149
Popular Brand "B"	0.056	19.727	0.112
Popular Brand "C"	1.228	1.547	0.900
Alternative Brand "A"	0.061	17.468	0.068
Alternative Brand "B"	0.000	N/A	0.121
Alternative Brand "C"	0.128	9.112	0.165
Alternative Brand "D"	0.094	12.906	0.215
Alternative Brand "E"	0.144	7.807	0.126
Alternative Brand "F"	0.120	9.303	0.116

<sup>1</sup>An increased ratio indicates more recent DDT application, or reduced degradation<sup>A</sup>. Technical grade DDT has a ratio of 1.0.  
<sup>2</sup>A ratio of >0.5 indicates long-term weathering<sup>B</sup>.  
<sup>3</sup>A ratio of DDD/DDE less than 1 indicates aerobic degradation of DDT to DDE, while ratios of greater than 1 indicate anaerobic degradation of DDT to DDD<sup>C</sup>.

### Dioxin and PCBs in Compost and Soil



### Total PCBs in Compost and Soil



### Total Chlordane and DDX

	DDx Sum (pg/g, ppt)	Total Chlordane (pg/g, ppt)
<b>Bulk Compost</b>	<b>56541</b>	<b>42695</b>
Homemade Compost "A"	7356	16195
Homemade Compost "B"	704	763
Homemade Compost "C"	4726	2165
Regular Garden Soil	3137	17325
Popular Brand "A"	2276	1748
Popular Brand "B"	19983	29588
Popular Brand "C"	19177	16949
Alternative Brand "A"	279	69.6
Alternative Brand "B"	2523	1282
Alternative Brand "C"	25280	2817
Alternative Brand "D"	2142	1361
Alternative Brand "E"	1603	510
Alternative Brand "F"	15732	8202

## Conclusions

Although organic gardeners do not directly apply synthetic pesticides on their plants, these compounds as well as other endocrine disrupting compounds may be present in other additives, such as compost and soil amendments. Large variations in concentrations were seen among all amendment types. While consumers have the most control over their soil amendments by making their own compost, further testing is required to characterize the differences between popular and alternative brands.

## References

- Saadati, Naghme, et al. „Distribution and fate of HCH isomers and DDT metabolites in a tropical environment – case study in Cameron Highlands - Malaysia, Chemistry Central Journal, 2012, 6:130.
- Tavares, T.M. et al., Ratio of DDT/DDE in the all saints bay, Brazil and its use in environmental management, Chemosphere, Vol. 38, Issue 6, pg. 1445-1452, March 1999.