

# A Multi-Residue Analysis of Pesticides in Agrochemical Plastic Containers (Post Consumer Resin) Using Micro-Extraction Technology

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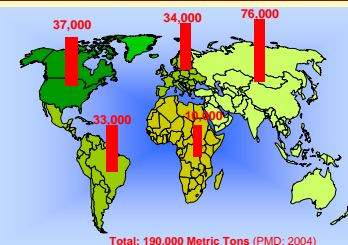


## Why Do We Analyze Plastics?

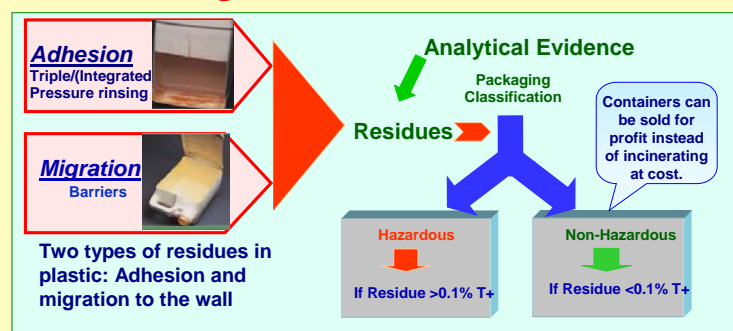
In many countries around the world the pesticide containers are considered to be hazardous waste because of the uncertainty of the residue levels inside the plastic containers. If we could prove that the residues are <0.1% by weight (ECPA limit), these containers can be sold to recycling companies for profit instead of incinerating at cost. Industry wide savings from recycling would be **100 million Euro** annually. This triggered the development of an analytical method to detect the residues as adhesion and migration in plastic containers.

## Background

Ag Chemical Companies sell their pesticide products in high density polyethylene (HDPE) containers.  
 • Global Packaging Waste in 2004 ~190,000 metric tons  
 • Containers are triple rinsed by farmers  
 • Containers are sent for disposal by incineration.



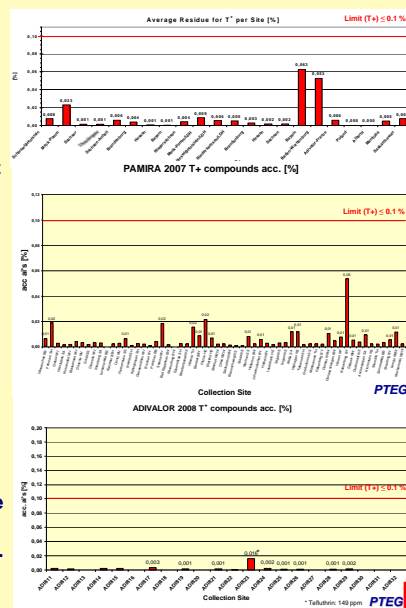
## Grinding Trash Into Cash \$\$\$\$



Pesticides migration into the walls of the container is a concern. The containers were considered hazardous due to this uncertainty.

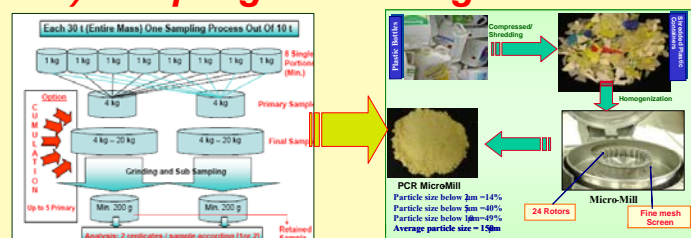
## Results

- Currently the multi-residue ME method can quantitatively measure **51 AI's**.
- In 2006, 2007 and 2008 the collection schemes in different countries (Germany, France, UK, Poland, Belgium, Brazil and Canada) were tested. The samples were analyzed using the Multi-residue ME method for proving the non-hazardous classification of Agro packaging waste and recycled materials.
- The residues of T+ and non-T+ compounds from all these samples were less than 0.1% by weight.
- The most recent analyses were conducted by contract labs in Germany, Poland and Belgium.



## Development of the Analytical Method

### A) Sampling and homogenization



**Sampling of the plastic containers**  
 Farmers triple rinse containers. Containers are homogenized and chopped into pieces (2 X 2 cm). Sampling according to established scheme produces lab samples.

**Processing at BASF**  
 Chopped PCR samples are soaked in liquid N<sub>2</sub> then micro-milled into a fine powder (<250 μm particle size) through an ultracentrifugal mill (in the presence of liquid nitrogen) equipped with a 0.5 mm screen.

## Applications of Recycling

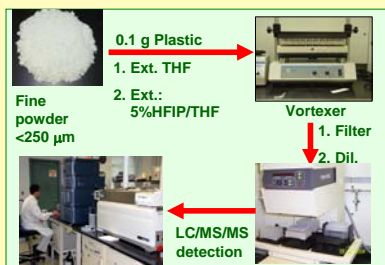


Recycling must be carried out using acceptable processes. The following are examples of recycling products: underground utility conduit, construction site mats, speed bumps, parking stops, etc.

## B) Multi-Residue Using Micro-Extraction

What is Micro-Extraction?

Micro-Extraction (ME) can be described as the miniaturization of residue analysis and homogenization of the bulk post consumer resin (PCR) samples to a fine powder with particle size <250 μm. A small sample size (0.1 gram) is used for the analysis; this small sample size allows for the use of simpler extraction techniques. This results in significantly lower solvent consumption and increases the efficiency of the analytical methods (96 samples/set/day).



ECPA and Crop Life International promote ME as the global method after it passed round robin testing by 18 contract laboratories. The pesticides are extracted from the fine powder with THF and a second extraction using a mixture of 1,1,1,3,3,3 hexafluoro-isopropanol and THF is conducted. The combined extracts are filtered, diluted to the appropriate final volume, and then analyzed using LC/MS/MS.

## Conclusion

The multi-residue ME method has been utilized to analyze PCR samples collected in 2006-2008 from different collection schemes in Europe (Germany, France, Poland, UK, Belgium), Canada, and Brazil. The residue results (<0.1%) indicated that a non-hazardous classification of the Agro packaging waste was appropriate and that it could be recycled. Based on the residue results from different schemes of collection, the FAO/WHO published, "Guidelines on Management Options for Empty Pesticides Containers" in May 2008. The publication recommends that countries classify properly rinsed containers that have been inspected as non-hazardous. The ME method is also used to determine pesticide residues in plant, soil, and water samples.