IMPLEMENTATION OF THE GLOBAL MONITORING PLAN OF POPs IN MALI/ POPs MONITORING IN AMBIENT AIR AT BAMAKO CENTRE

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Introduction

Mali ratified the Stockholm Convention on May 2003[4]. Under the Stockholm Convention provisions, each country should demonstrate evidence by environmental monitoring analyses that POPs levels in the environment are declining[1]. This work was done under the UNEP/GEF project "Supporting the Implementation of the Global Monitoring Plan (GMP) of POPs in Western African Countries which was launched to strengthen the monitoring capacity of African countries. Thus, they can contribute with National data to the GMP. One objective of this research was to strengthen the analytical capacity of ETQCL which has never analyzed air samples before the implementation of the project. Therefore, ETQCL benefited funding from the UNEP/GEF project and the staff was trained locally by an expert from IVM. During this training one filter from Passive Air Sampling was extracted and analyzed. Another objective of this 12-months study was to monitor POPs in ambient air of an urban site (Bamako Centre) of the capital city which has been object of a 6 months monitoring in a 2008 MONET study. The site is urban with an open burning area nearby; it was the most contaminated site from all sites in Mali in the 2008 MONET Study. In this 2008 study, PCBs levels [Min 14.9, Max 26.1, Mean 20.0, Median 19.4] were comparable to other African industrial site like Kenya, Sudan or Congo; higher chlorinated congeners were found at higher concentrations than more volatile congeners. HCHs level [Min 6.9, Max 45.1, Mean 22.3, Median 17.8] ng per sample were elevated with γ-HCH being up to ten times more abundant than α-HCH. DDT concentration [Min 68.6, Max 164, Mean 113, Median 101] ng per sample was the fourth highest in this study with *p,p'-DDT* being 2-4 times higher than *p,p'-DDE*. HCB [Min 1.4, Max 4.7, Mean 2.6, Median 2.6] ng per sample and PeCB [Min 0.3, Max 3.3, Mean 1.3, Median 0.9] ng per sample were detected at similar level like the other sites; PAHs were an order of magnitude higher[2] [Min 3400, Max 6310, Mean 5040, Median 5280] ng per sample . The current study will allow checking the status of POPs level at this site if they are declining.

Materials and methods

Sampling site

The sampling site is located 12°38.155' N, 008°01.352' W and it is an urban waste dumping site where open fire incineration is nearby

Photo 1. Passive Air Samplers deployed at the Bamako Centre site

Filters

Filters were received from RECETOX (Czech Republic) under the UNEP/GEF Project "Supporting the Implementation of the Global Monitoring Plan of POPs in West Africa countries". They consisted of Polyurethane foam (PUF) disks pre-cleaned and wrapped under 2 layers of aluminum foil. They were placed at -18 °C in a freezer until deployment in the field.

Air Sampling

Five Passive Air Samplers (PAS) were deployed for 12 months at the urban site of Bamako Centre ACI 2000 in April 2010. Prior to deployment samplers were washed and solvent- rinsed with acetone. For each sampler, filters were exchanged every 3 months according to Table1 below.

Table1. Exposure periods for filters

	Exposure starting date	Exposure ending date	Effective days of exposure
First exposure	1 April 2010	1 July 2010	91
Second exposure	1 July 2010	1 October 2010	92
Third exposure	1 October 2010	04 January 2011	95
Fourth exposure	04 January 2011	31 March 2011	86

Filters from samplers 1 and 2 (8 in total) were sent through DHL (+4°C) at the Institute for Environmental Studies (Amsterdam) for the basic POPs analyses (mirror analysis).
Filters from samplers 3 and 4 (8 in total) were kept at the Environmental Toxicology and Quality Control Laboratory (ETQCL, MALI) which is the National POPs Laboratory for analyses of basic POPs.
Filters from samplers 5 (4 in total) were sent through DHL (+4°C) at the MTM Research Center (Örebro University, Sweden) for the analyses of dioxins-like POPs.
After each exposure period filters were removed from samplers, wrapped under 2 layers of aluminum foil and placed in a cooler at +4°C for transport at the ETQCL where they were kept at -18°C till analysis or shipment to IVM and MTM.

Sample analysis

Only one sample was analyzed during the IVM training in Mali. For the extraction, a shaking device was used (the lab was lacking a soxhlet device); the PUF filter was cut in small pieces in an Erlenmeyer; extraction was done with acetone during 8 hours and after the same amount of hexane was added to the mixture of sample and acetone; this was extracted overnight. The extract was evaporated using a rotary evaporator until a volume of 10mL and then transferred to 15 mL tubes and evaporated to 1 mL with a nitrogen evaporator (30°C). The extract was cleaned using alumina columns (8% water deactivated alumina). The extract was again evaporated by rotary evaporator until a volume of 10 mL, transferred to a 15 mL tube and evaporated to 1 mL using a nitrogen evaporator. The extract was fractioned using silica columns. The fractions were collected in weighted tubes and evaporated until 100 µl. By weighing the tubes empty and with the evaporated extracts the volume was calculated using the density. A calibration series from 1 – 1 000 $\eta g.ml^{-1}$ was prepared from the Quasimeme standards QOR01CA (PCB) and QOR03CA (pesticides) by means of weighing the vials and added volumes. Both sample and the calibration series were analyzed on GCµ/ECD (30 meter HP5 column: I.D. 0.32 mm, df 0.25µm). From these measurements only the concentration of dieldrin was calculated. After the first measurement the extracts were cleaned with silica/H_2SO_4, the eluates were evaporated until 0.5 ml and measured again. The results were calculated against the external standard. The values of the volatile components were corrected for the recovery of PCB 103 and the less volatile ones were corrected for the recovery of PCB 198[3]. Internal standards consisted of mixture of PCB 103 and PCB 198 with a concentration of 100 $\eta g.ml^{-1}$. 100 µl of the 100 $\eta g.ml^{-1}$ internal standard was added to the sample. Samples were analyzed for PCBs (28, 52, 101, 105, 118, 138, 153, 156, and 180) and pesticides (HCB, α-HCH, β-HCH, γ-HCH, trans nonachlor, dieldrin, p,p'-DDT, p,p'-DDE, p,p'-DDD.

The other samples has not been analyzed yet; ETQCL is awaiting the repair of the GC-µECD

Results and discussion:
All results from ETQCL samples cannot be provided yet; ETQCL is waiting for the repair of the µECD detector. The results for one sample extracted during the IVM training is below (Table 2)
Table 2. Results for the sample MLI-1-I analyzed in Mali during the training

Résultats en ng per PAS filter	MLI-1-I	MLI-1-I extra clean up H_2SO_4
Dieldrin	14	
HCB		4.3
ppDDE		310
ppDDT		56

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