



## Estimation of pesticide residues in empty pesticide containers following triple rinsing approach

Supported by -



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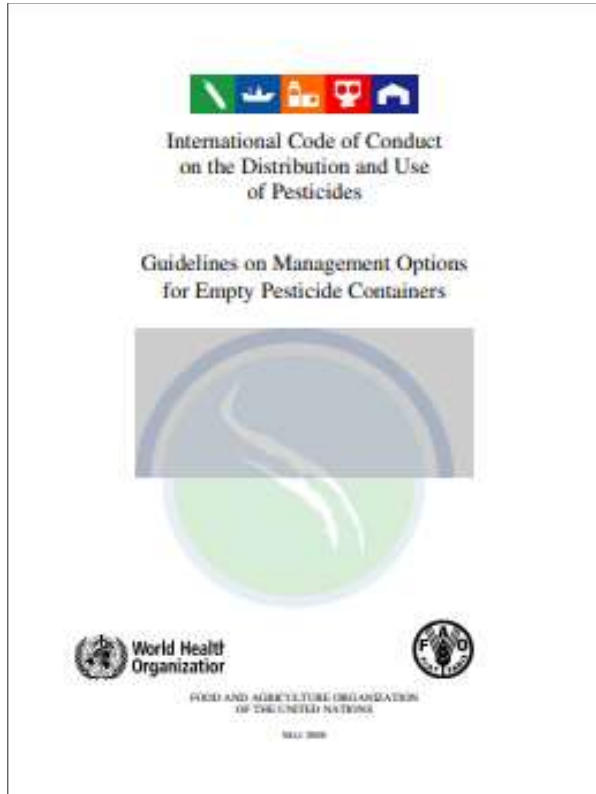


## Background

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- Waste management / disposal of containers comes under purview of CPCB/ SPCB. Guidance on Uniform framework for Extended producers Responsibility (EPR) under Plastic Waste Management (PWM) Rules, 2016 by Govt of India notified by MoEF & CC in June 2020
- Safe disposal of EPCs is mandated via Insecticide Act, 1968 and Rules, 1971. The current recommendations for **its break-up and burial** away from habitation are listed on the labels and leaflets accompanying a pesticide pack.
- Issues pertaining disposal of pesticide Containers was deliberated by the Inter-ministerial committee and by RC vide 425<sup>th</sup> - 25<sup>th</sup> January 2021 AINPPR appraised regarding project proposal submitted by CLI regarding triple rinsing of pesticide formulation containers for their classification from hazardous to non-hazardous category.
- Public notice inviting comments from Industry stakeholders on disposal of used EPCs issued in February 2021

## Objectives



International Code of Conduct on the Distribution & Use of Pesticides – Guidelines on the Management of Empty Pesticide Containers



- Triple rinsing of **rigid** EPCs results in residue reduction.
- Residue reduction vis a vis Container type, Pesticide Type, Pack size etc
- Suitability of triple rinsing to facilitate re-classification of EPCs



## Re-classification criteria

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According to **Waste classification** rules,

- Hazardous components of waste is considered relevant if **> 0.1%**.
- Below such a level it is not relevant i.e the waste is classified as non-hazardous by default.

## Next steps

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- Use results to support potential re-classification of triple rinsed EPCs and to help formulate sustainable policy for EPC management



## Experimental Set Up

### Estimation of pesticide residues in used pesticide formulation containers by triple rinsing approach

#### ▪ Fifteen (15) different pesticides in Six (6) formulations types:

- Emulsifiable Concentrate (EC)
- Soluble Liquid Concentrate (SL)
- Suspension concentrate (SC)
- Soluble Granules (SG)
- Water Dispersible Granules (WG)
- Capsule Suspension (CS)

#### ▪ Formulations represented different classes of toxicity:

- Extremely toxic
- Highly toxic
- Moderately toxic
- Slightly toxic

#### ▪ Packaging materials assessed

- HDPE/ Co-extruded HDPE
- Tin
- PET
- Aluminium

#### • Packaging sizes ranges

- 50 mL
- 150 mL
- 200 mL
- 250 mL
- 500 mL
- 700 mL
- 75 g
- 1 Kg/ L

## Method Optimization

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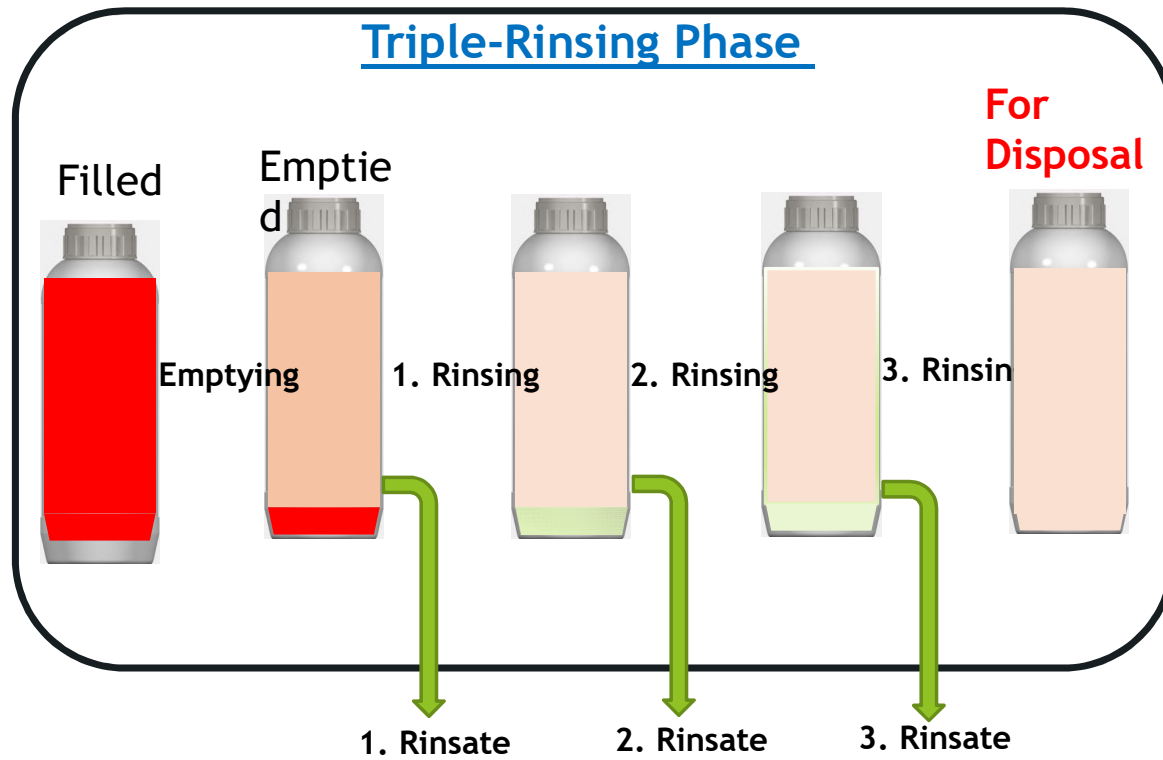
- Estimation of pesticide residues in the rinsates obtained from each pesticide/formulation were analysed on HPLC-PDA using following parameters:
- LOQ (0.01 – 1 mg/L)
- Linearity ( $r^2 > 0.99$ )
- Recovery (75.69 - 111.87)

\*The recovery of fenvalerate was found to be <60% repeatedly





## Methodology Triple-Rinsing Study

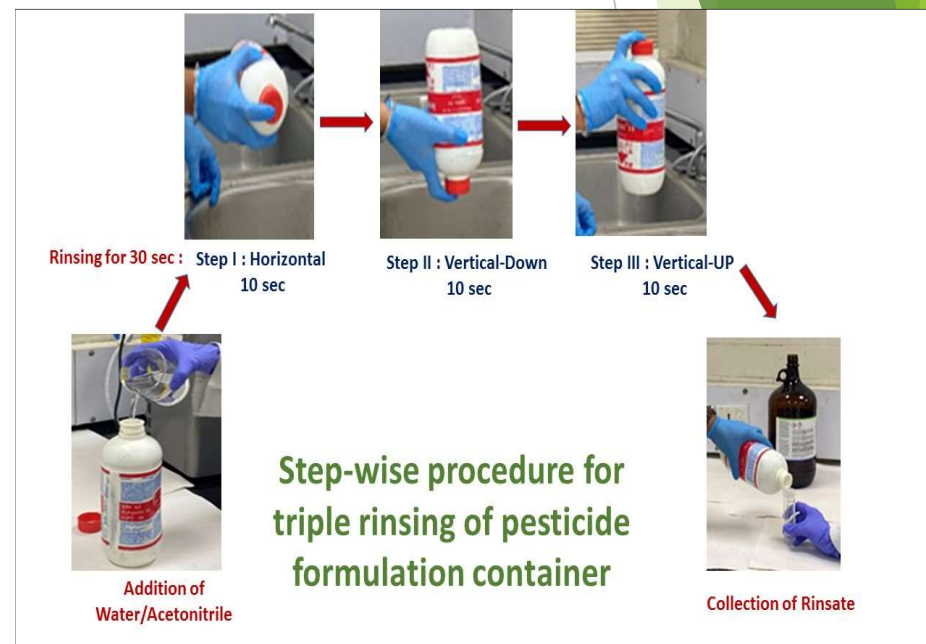


## Procedures

Draining of Container for 30 Sec.



**Draining/ emptying containers**



**Triple rinsing**





# Results

Active Ingredient	Formulation				Container			Residue (a.i)		
	Pesticide	%	Type	Classification (India)	Material	Pack size	Weight (g)	After solvent rinse - 4 <sup>th</sup> rinsate (mgL <sup>-1</sup> )	Rinsing Efficiency (%)	In total waste (%)
Acephate	Insecticide	95.00	SG	Moderately	HDPE	1 KG	166.79	0.677	100.000	0.000
Imidacloprid	Insecticide	70.00	WG	Highly	HDPE	75 g	25.47	3.810	100.000	0.001
Monocrotophos	Insecticide	36.00	SL	Extremely	HDPE	1 Litre	105.48	3.167	99.999	0.003
Fenvalerate	Insecticide	20.00	EC	Highly	HDPE	1 litre	77.98	3.167	99.998	0.004
Propaquizafop	Herbicide	10.00	EC	Slightly	Aluminum	500 ml	70.31	7.427	99.993	0.005
Propiconazole	Fungicide	25.00	EC	Moderately	Aluminum	1 Litre	115.03	10.200	99.996	0.009
Pretilachlor	Herbicide	50.00	EC	Slightly	HDPE	1 Litre	74.56	11.420	99.998	0.015
Cypermethrin	Insecticide	25.00	EC	Highly	PET	250 ml	26.60	25.557	99.990	0.024
Azoxystrobin	Fungicide	23.00	SC	Moderately	HDPE	200 ml	41.90	102.900	99.956	0.049
Lambda Cyhalothrin	Insecticide	5.00	EC	Highly	PET	500 ml	46.90	51.303	98.974	0.055
Difenoconazole	Fungicide	25.00	EC	Moderately	HDPE	500 ml	59.95	66.737	99.733	0.056
Oxyfluorfen	Herbicide	23.50	EC	Slightly	Aluminum	250 ml	41.34	202.477	99.914	0.122
Buprofezin	Insecticide	25.00	SC	Moderately	HDPE	100 ml	22.21	522.910	99.791	0.235
Dimethoate	Insecticide	30.00	EC	Highly	Tin	1 Litre	123.31	410.633	99.863	0.332
Pendimethalin	Herbicide	38.70	CS	Moderately	Co-ex HDPE	700 ml	100.44	550.637	99.858	0.382



# Results

Active Ingredient	Formulation				Container				Toxicity Calculations			
	Pesticide	%	Type	Classification (India)	Material	Pack Size	Weight (g)	In total waste (%)	Acute oral (mg/kg) < 2,500 mg/kg	Acute Derma < 4,300 mg/kg	Acute inhalation < 10,000 ppm	Acute aquatic tox. (Acute 3) ≥ 25%
Acephate	Insecticide	95.00	SG	Moderately	HDPE	1 KG	166.79	0.000	213459200.98	492977369.5	65938448.2	0.041
Imidacloprid	Insecticide	70.00	WG	Highly	HDPE	75 g	25.47	0.001	40114623.23	445718035.9	589351849.5	1.122
Monocrotophos	Insecticide	36.00	SL	Extremely	HDPE	1 Litre	105.48	0.003	466346.63	3730773.1	2925506.5	3.002
Fenvalerate	Insecticide	20.00	EC	Highly	HDPE	1 litre	77.98	0.004	1728819.09	123135263.2	145128.9	0.406
Propaquizafop	Herbicide	10.00	EC	Slightly	Aluminum	500 ml	70.31	0.005	94680.72	37872.3	2612838.0	0.528
Propiconazole	Fungicide	25.00	EC	Moderately	Aluminum	1 Litre	115.03	0.009	17109038.32	45112.8	1019833.9	0.887
Pretilachlor	Herbicide	50.00	EC	Slightly	HDPE	1 Litre	74.56	0.015	14365291.07	20242001.1	1436612.9	1.531
Cypermethrin	Insecticide	25.00	EC	Highly	PET	250 ml	26.60	0.024	17281833.58	20488342.5	612690.9	>25
Azoxystrobin	Fungicide	23.00	SC	Moderately	HDPE	200 ml	41.90	0.049	10185393.59	4074157.4	123719.5	4.909
Lambda Cyhalothrin	Insecticide	5.00	EC	Highly	PET	500 ml	46.90	0.055	263397.07	1156020.5	17431.6	>25
Difenoconazole	Fungicide	25.00	EC	Moderately	HDPE	500 ml	59.95	0.056	2611714.78	3612902.1	4877.4	55.634
Oxyfluorfen	Herbicide	23.50	EC	Slightly	Aluminum	250 ml	41.34	0.122	4088186.54	4088186.5	1253876.3	>25
Buprofezin	Insecticide	25.00	SC	Moderately	HDPE	100 ml	22.21	0.235	935668.10	851381.3	190215.7	23.491
Dimethoate	Insecticide	30.00	EC	Highly	Tin	1 Litre	123.31	0.332	54231.51	30128.6	64388.6	33.191
Pendimethalin	Herbicide	38.70	CS	Moderately	Co-ex HDPE	700 ml	100.44	0.382	274667.35	591188.8	7288540.8	38.228



## Conclusions

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- **Rinsing efficiency** ranged from **99.733% - 99.999%** demonstrating robustness of **Triple rinsing**
- **Residues decline achieved** irrespective of packaging type, size, toxicity group etc
- Residues were below 0.1% in majority of the pesticide/packaging
- For few pesticides which exceeded the 0.1% criteria, toxicity estimates were worked out according to GHS classification -
  - Acute Oral, Dermal & Inhalation and **were well above the established thresholds.**
  - Acute Aquatic toxicity showed slight exceedance for only 2 cases which is very close to the established trigger values.
- These results can be considered to support re-classification of triple rinsed empty pesticide containers in India

# धन्यवाद



Thank You!



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