2-PHENYLPHENOL (056)

First draft prepared by Stephen Funk
US Environmental Protection Agency, Washington, D.C., USA

EXPLANATION

2-Phenylphenol (*o*-phenylphenol, OPP) and sodium *o*-phenylphenate (SOPP) are used as a post-harvest treatment on fruits to protect against microbial damage during storage and distribution. The compound was evaluated under the Periodic Review Programme in 1999. The 1999 JMPR recommended MRLs for citrus fruits and citrus commodities, but recommended the withdrawal of the existing MRLs for apples and pears. Post-harvest treatment data were reported for pears, but the JMPR considered that the two trials were insufficient to make a recommendation.

The CCPR retained the CXL for pears for four years under the Periodic Review procedures.

The Pear Bureau Northwest, USA, has reported additional trials for the post-harvest treatment of pears with SOPP.

USE PATTERN

Information was supplied by the Pear Bureau Northwest and by the US EPA on the post-harvest uses on pears (Table 1).

Table 1. Registered uses of 2-phenylphenol on pears in the USA.

Formulation	Solution concentration (Kg SOPP tetrahydrate[1] /hl)	Method	Comments
Foaming cleaner 24% SOPP[2] 14% SOPP	2	Mechanical foamer or spray	Foam and brush or spray for 15-30 seconds. Rinse with fresh water.
SC, 21-23% SOPP	0.30- 0.49	Dip or flood	0.5-2 minutes. Rinse with fresh water.

[1] Sodium *o*-phenylphenate tetrahydrate
[2] Sodium *o*-phenylphenate (anhydrous)

RESIDUES RESULTING FROM SUPERVISED TRIALS

Pears. In a post-harvest study in Washington, USA (Johnson and Strickland, 2000) organically-grown d'Anjou pears were removed from cold storage, allowed to warm to ambient conditions, and divided into twenty groups of ten pears each (about 2 kg per group). Ten independent trials were conducted in duplicate. For each trial two 19 litre batches of dipping solution were prepared by the dilution of a commercial product (22.6% sodium phenylphenate by weight, 1.1 kg ai/l, US EPA registration no. 8611-2) with water in a calibrated plastic container. The actual concentration of SOPP in the treatment solutions was determined by analysis as was the pH and temperature. A commercial flotation material (calcium lignosulfonate) was added to raise the density of the water solution to assist floating of the pears

and to lower the pH of the solution from about 13.5 to 9-11, and the solutions mixed. The characteristics of the dipping solutions are shown in Table 2.

Table 2. Sodium *o*-phenylphenate solutions used for pear trials.

Trial no.	Duplicate	SOPP tetrahydrate (mg/l)	pH	Temperature (°C)
T1	1	4500	9.2	18
	2	4700	9.2	18
T2	1	4600	9.2	16
	2	4700	9.2	16
T3	1	4000	9.2	15
	2	4500	9.2	15
T4	1	4400	9.2	16
	2	4600	9.2	16
T5	1	4400	9.2	16
	2	4600	9.2	16
T6	1	4800	9.2	16
	2	5000	9.2	16
T7	1	4600	9.2	16
	2	4500	9.2	16
T8	1	4500	9.2	16
	2	4700	9.2	16
T9	1	4700	9.2	16
	2	4800	9.2	16
T10	1	4700	9.2	14
	2	4800	9.2	14
C1[1]		0	9.2	14
C2		0	9.2	14

[1] Controls made from formulation without the active ingredient.

For each trial twenty pears were equally divided between two plastic racks. The racks were completely immersed in the treatment solutions for 120 seconds, then removed and immediately dipped into fresh water for 2 seconds. The pears were air-dried, placed in plastic bags, and stored frozen until analysis 20-27 days later.

Each 10-pear sample was homogenized with liquid nitrogen and about 20 g taken for analysis. In a one-step hydrolysis/steam distillation/extraction procedure the sample was combined with 5 ml of 1 N HCl, 2 ml of water, and 2 ml of iso-octane in a flask attached to a micro-Nielson-Kryger apparatus. The mixture was refluxed for 1.5 hours, and the iso-octane extract derivatized with *N,O*-bis(trimethylsilyl)trifluoroacetamide (BSTFA) and analysed by GC-MS in the selected ion mode (m/z 211 and 227). The analyte is the trimethylsilyl derivative of o-phenylphenol (OPP-TMS). Calibration was by 5-point external standard with derivatized OPP. The method was validated at 0.1 mg/kg with fortified pears; recoveries were 76 and 85%. Satisfactory recoveries were also demonstrated at 1 and 5 mg/kg.

The results are shown in Table 3. Residues in all control samples were <0.1 mg/kg. Results were not corrected for recoveries.

Table 3. Residues of 2-phenylphenol (OPP) in pears after post-harvest dip treatment at 4900 mg/l (Johnson and Strickland, 2000).

Trial no.	Duplicate no.	Residue (mg/kg)[1]	Trial, residue (mg/kg)
T1	1	8.6	13
	2	13	
T2	1	8.0	8.0
	2	6.2	
T3	1	6.4	6.4
	2	5.3	
T4	1	7.4	10
	2	10	
T5	1	7.1	7.9
	2	7.9	
T6	1	8.9	8.9
	2	8.3	
T7	1	7.8	12
	2	12	
T8	1	6.9	6.9
	2	6.2	
T9	1	5.6	6.3
	2	6.3	
T10	1	5.9	5.9
	2	5.4	

[1] Average of 2 alternatives

The 1999 Meeting had considered two similar trials in which the residues were 1.4 mg/kg and 0.82 mg/kg and the treated pears, having been rinsed under flowing water rather than dipped for 2 seconds, were stored frozen for 6 months. A storage stability study showed a 50% loss of residue after the 6 months. Loss during 4 months was $\leq$20%.

APPRAISAL

The 1999 JMPR as a result of its periodic re-evaluation recommended MRLs for 2-phenylphenol (OPP) (biphenyl-2-ol) and it sodium salt (SOPP) in citrus and citrus commodities. The JMPR also recommended withdrawal of its previous recommendations for maximum residue levels for apples and pears. The CCPR retained the CXL for pears for four years under the Periodic Review procedures. The Pear Bureau Northwest (USA) has supplied information in support of maximum residue levels for pears.

Residues resulting from supervised trials

Pears. US GAP specifies the post-harvest treatment of pears as (1) foamer and spray cleaning with 2 kg sodium ortho-phenylphenate tetrahydrate/hl for 15-20 seconds followed by a rinse, or (2) dipping in 0.49 kg ortho-phenylphenate tetrahydrate /hl solution for 1.5-2 minutes, followed by a rinse. Ten trials using a dip at a nominal 0.49 kg/hl were reported from the US. The ranked order of 2-phenylphenol residues is 5.9, 6.3, 6.4, 6.9, 7.9, 8.0, 8.9, 10, 12, and 13 mg/kg. Two trials conducted under similar conditions were considered by the 1999 Meeting with results of 0.82 and 1.4 mg/kg. The samples from the latter trials were stored for six months before analysis, and storage stability studies under freezer temperatures with pears have indicated a lack of residue stability beyond 4 months. Thus, these earlier results are considered unreliable.

The Meeting estimates a maximum residue limit of 20 mg/kg and an STMR of 8.0 mg/kg.

RECOMMENDATIONS

On the basis of the data from supervised trials the Meeting estimated the maximum residue level and STMR listed below. The maximum residue levels are recommended for use as MRLs.

Definition of the residue for plant commodities, for compliance with MRLs and for the estimation of dietary intake: sum of 2-phenylphenol and sodium 2-phenylphenate, free and conjugated, expressed as 2-phenylphenol.

CCN	Commodity	MRL, mg/kg		STMR, mg/kg
		New	Previous	
FP 230	Pear	20	W	8

DIETARY INTAKE ASSESSMENT

Chronic intake

STMRs for two raw agricultural commodities, citrus and pears, and one processed commodity, orange juice, were used for a chronic dietary intake assessment. The International Estimated Daily Intakes for the 5 GEMS/Food regional diets, based on these STMRs, were all <1% of the ADI. The Meeting concluded that the intake of residues of 2-phenylphenol resulting from its uses that have been considered by the JMPR is unlikely to present a public health concern.

Acute intake

The 1999 JMPR decided that an acute RfD is unnecessary. The Meeting therefore concluded that the short-term intake of 2-phenylphenol residues is unlikely to present a public health concern.

REFERENCES

Gregory G. J. and Strickland, M.D., 2000. Magnitude of Residues in/on Fresh Pears After Post-harvest Fungicidal Treatments with Sodium Orthophenylphenate, Project PBN 00-01, 2000.