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COMMITTEE ON COMMODITY PROBLEMS

INTERGOVERNMENTAL GROUP ON TEA

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REPORT OF THE WORKING GROUP ON MAXIMUM RESIDUE LEVELS AND ON MAXIMUM RESIDUE LEVELS IN THE BREW[1]

The pesticide residue in tea remains important in the consumption and trade of tea in the world. For a long time, the difference of maximum residue levels (MRLs) for pesticide among regulatory authorities is a serious barrier in international tea trade. Given specialty, only the residual pesticide in tea brew, rather than dry tea, can come into human's body. Focusing on health risk of pesticide, it is critical to select pesticide applied in tea plantation and evaluate the safety of the pesticide scientifically. Concentrating on this concern, great efforts have been made in recent years.

I. ACTIVITY

1. Status of MRLs for pesticides in tea in China

Great progress has been made to fix pesticide MRLs in Tea in China. Until 2014, 28 MRLs for pesticides in tea have been issued by MOA (Ministry of Agriculture of the People's Republic of China) in regulation GB 2763-2014 (National food safety standard-Maximum residue limits for pesticides in food). A draft document, including amendments and reversion, were completed and will be issued later. In the new regulation, there will be more than 35 MRLs for pesticide in tea, as listed in Table 1. From the table, it concludes that EU MRLs are stricter than that in China. Most of MRLs for pesticides in China are the same or lower than that in Japan. The differences of MRLs for pesticides between countries and international organizations have been blocking the tea trade. Efforts are needed to harmonize the MRLs.

[1] Submitted by China.

Table 1 Comparision of MRLs for pesticides in tea in China, EU and Japan

Pesticide	Classification	China MRL mg/kg	EU MRL mg/kg	Japan MRL mg/kg
Acephate	insecticide	0.1	0.05	10
Bifenthrin	insecticide	5	5	30
Buprofezin	insecticide	10	0.05	30
Carbendazim	fungicide	5	0.1	10
Carbofuran	insecticide	0.05		0.2
Cartap	insecticide	20	0.1	30
Cyhalothrin lambda-cyhalothrin	insecticide	15	1	15
Cyfluthrin beta-cyfluthrin	insecticide	1	0.1	20
Cypermethrin beta-cypermethrin	insecticide	20	0.5	20
DDT	insecticide	0.2	0.2	0.2
Demeton	insecticide	0.05	-	-
Deltamethrin	insecticide	10	5	10
Diafenthiuron	insecticide	5*	-	20
Dicofol	insecticide	0.2	20	3
Difenoconazole	fungicide	10	0.05	15
Diflubenzuron	insecticide	20	0.1	20
Endosulfan	insecticide	10	30	30
Ethoprophos	insecticide	0.05	-	-
Fenazaquin	insecticide	15	10	-
Fenpropathrin	insecticide	5	2	25
Fenitrothion	insecticide	0.5	0.05	0.2
Fenvalerate/ S-fenvalerate	insecticide	0.1	0.1	1.0
Flucythrinate	insecticide	20	0.1	20
Glufosinate-ammonium	herbicide	0.5	0.1	0.3
Glyphosate	herbicide	1	2	1
HCH Hexachlorocyclohexane	insecticide	0.2	0.02	0.2
Hexythiazox	insecticide	15	4	35
Imidaclothiz	insecticide	3*	-	-
Indoxacarb	insecticide	5	5	-
Isazofos	insecticide	0.01	-	-
Isocarbophos	insecticide	0.05	-	-
Methomyl	insecticide	0.2	0.1	20
Omethoate	insecticide	0.05	-	1
Permethrin	insecticide	20	0.1	20
Phosfolan	insecticide	0.03	-	-
Phoxim	insecticide	0.2	0.1	0.1
Pyridaben	insecticide	5	0.05	10
Terbufos	insecticide	0.01	0.01	-

- *Not regulated.*

2. Harmonization of international MRLs for pesticides in tea

In 2008-2015, 7 international MRLs for endosulfan (CAC and EPA), cypermethrin (CAC), bifenthrin (EPA) and indoxacarb (China, CAC and EU) have been regulated on the basis of data submitted by China and IGG (Table 2).

Recently, indoxacarb was selected to substitute neonicotinoids in tea industry in China. Given the information of eight experiments conducted in China from 2011-2013, the MRL of indoxacarb in tea was set at 3 mg/kg in China in 2013. At the same time, the application for setting MRL of indoxacarb in tea in Codex was submitted. The MRL of indoxacarb was approved to be 5 mg/kg in JMPR meeting in October, 2013 and discussed and approved as Codex MRL in tea in CCPR meeting in May, 2014. In May, 2015, EU modified the initial MRL of indoxacarb 0.05 to 5 mg/kg referring to Codex MRL. In the draft document GB 2763-2015, 5 mg/kg MRL of indoxacarb in tea in China was discussed in July, 2015 and will be adopted later.

Table 2 Regulation and modification of seven international MRLs

Pesticide	Regulator	Initial MRLs	To be modified MRLs mg/kg	Modified MRLs mg/kg	Year
Endosulfan	US EPA	30	0.01	10	2008
	CAC	30	0.01(EU suggest)	10	2010
Cypermethrin	CAC	20	0.01(EU suggest)	15	2012
Bifenthrin	US EPA	5	0.01	5	2009
Indoxacarb	CAC	not set	not set	5	2014
	EU	0.05	0.05	5	2015
	China	3	5	5	2015

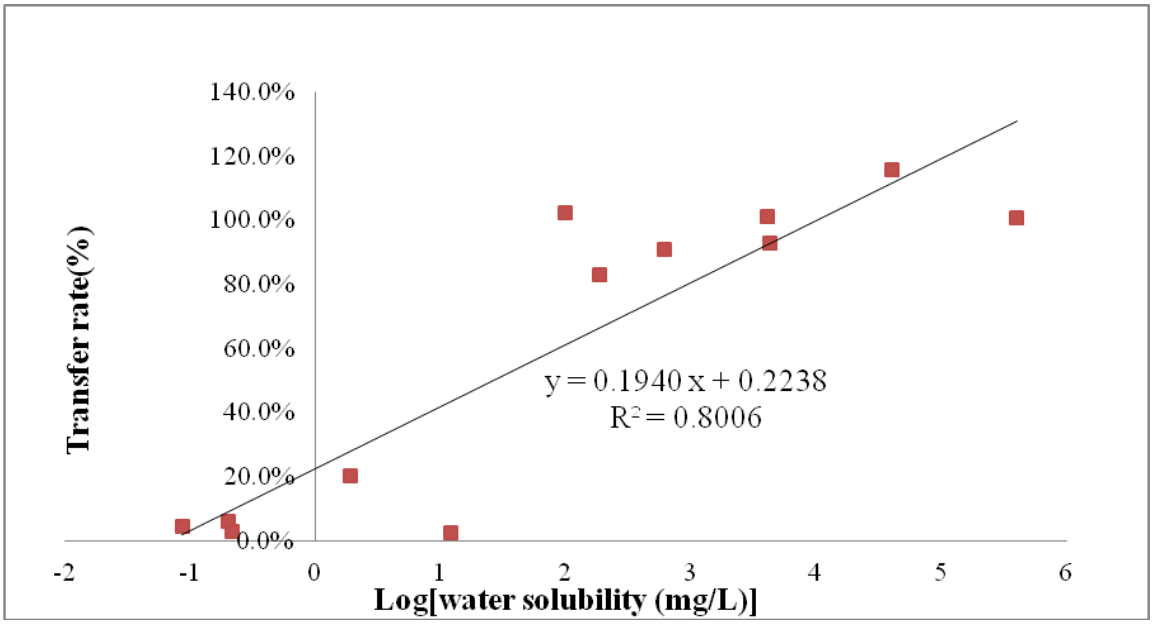
3. Data collection on effect of physical-chemical properties on infusion rate of pesticide

For more detailed data, supervised field trials as par Good Agricultural Practice (GAP) were conducted in China in 2014. 12 pesticides including tolfenpyrad, indoxacarb, propargite, pyraclostrobin, chlorfluazuron, propiconazole, thiacloprid, imidacloprid, thiamethoxam, acetamiprid, dimethoate and dinotefuran were selected. The water solubility of the pesticides range from <0.1mg/L to 3×10^5 mg/L. Pesticides were sprayed on tea plants, fresh tea leaves were picked at the planned time and processed to dry tea, 2g dry tea were brewed in 100 mL boiling water. The pesticide residue in dry tea and tea brew were determined. The transfer rate for 12 pesticides listed in Table 3 (marked with *New trial* in Author column) showed that the infusion rate of pesticides is correlated to water solubility (Figure 1).

Table 3 Physical-chemical properties and transfer rate of pesticides from dry tea to tea brew

Pesticide	Water solubility (mg/L, 20℃)	Log Kow (pH7, 20℃)	Herry's law Constant (Pa m^3 mol^{-1},25℃)	Transferring rate (%)
Acetamiprid	4200	0.8	5.30×10^{-8}	93
Chlorfluazuron	0.012	5.9	$<1.6 \times 10^{-3}$	2.5
Dimethoate	39800	0.704	1.42×10^{-6}	115.9
Dinotefuran	398000	-0.549	$<1.7\times10^{-3}$	100.7
Imidacloprid	610	0.57	1.7×10^{-10}	91
Indoxacarb	0.02	4.65	6.0×10^{-5}	6.1
Propargite	0.215	5.7	6.4×10^{-2}	2.5
Propiconazol	100	3.72	9.2×10^{-5}	102.4
pyraclostrobin	1.9	3.99	2.6×10^{-5}	20.1
Thiacloprid	185	0.73	1.1×10^{-10}	82.9
Thiamethoxam	4100	-0.13	4.6×10^{-15}	100.1
Tolfenpyrad	0.087 (25 °C)	5.61 (25 °C)	2.2×10^{-3}	4.4

Figure 1. Relationship of transfer rate of 12 pesticides with the water solubility



4. Suggestion on restricting use of imidacloprid and acetamiprid in tea

Recent years, the adverse effects of neonicotinoids have been criticized, especially the neurotoxicity and reproductive toxicity. In 2013, EFSA (EFSA Journal, 2013, 11(12) 3471-3522) proposed that imidacloprid and acetamiprid were developmental neurotoxicity potential to rats. It demonstrated imidacloprid could decrease pup body weights, reduced motor activity level and change the dimensions of brain structures, and acetamiprid could decrease pup body weights, reduce pup pre-weaning survival and decrease maximum auditory startle response. In the same year, EFSA concluded that thiamethoxam, clothianidin and imidacloprid posed an unacceptable risk to bees. Other reports also indicated the neonicotinoid pesticide was toxic to honey bees. Except death, the delayed toxicity and sublethal effects would impair the learning, motor activity and memory of the bees, which alter the behavior of social bees and reduce survival of entire colonies at the end. More importantly, according to the research published in Nature in 2015 (Nature, 2015, 521,38-40), bees cannot taste neonicotinoids and are not repelled by them. Instead, bees preferred those pollens and nectars containing imidaclprid or thiamethoxam. In a result, bees cannot control their exposure to neonicotinoids in food. If the neonicotinoids were applied in flowering crops, it was inevitably to be a sizeable hazard to bees.

The developmental neurotoxicity potential of acetamiprid and imidacloprid has been considered by the EU and USA EPA. It is worthy to point out that these two pesticides should be especially drawn attention to during application in tea industry. In the report of the WG on pesticide maximum residues in tea brew (2014), drafted by Chinese delegation, it indicates the risk exposure of imidacloprid and acetamiprid via tea brew is high, owning to the high detection rate and high infusion rate of imidacloprid and acetamiprid from dry tea to tea brew. According to the information, it was suggested that the imidacloprid and acetamiprid were banned to use in tea production in China.

5. The substitution action of water-soluble pesticides

Selection of pesticides with low water solubility to substitute the imidacloprid, acetamiprid, and dimethoate has been conducted since 2011 in China. The bioassay and residue dynamic experiments under field conditions were completed in 12 tea producing provinces in China. The results are summarized in Table 4.

Table 4 Results of the chlorfenapyr, indoxacarb and tolfenpyrad from field trials in China

Pesticides	HL_{50} on fresh tea leaves(day)	Processing factor (%)	Brew factor (%)	Water solubility (mg/L)	Recommended MRL(mg/kg)	PHI (day)
Chlorfenapyr	5.6	54	0.15	0.12	20	7
Indoxacarb	2.3	34.5	6.2	0.02	5(China,CAC,EU)	10
Tolfenpyrad	3.6	41.6	0.2	0.087	20	5

Chlorfenapyr and indoxacarb were registered in China in 2012 and 2013 respectively. We have completed the bioassay and field trials of tolfenpyrad in 2013. The MRL of chlorfenapyr is issued at 50 and 40 mg/kg in EU and Japan, respectively. Chlorfenapyr was almost unextractable from dry tea into tea brew due to its very low water solubility (almost insoluble in water), so chlorfenapyr poses relatively low risk to consumers from the view of brewing factor. Indoxacarb is a pesticide manufactured by DuPont. The MRL of indoxacarb in tea was set at 5 mg/kg in China, CAC and EU. Tolfenpyrad was introduced by Japan, and the MRL in tea was set at 20 mg/kg in Japan and USA.

In 2016, tolfenpyrad has been registed in China. The MRLs is 20 mg/kg. In order to unify the international MRLs of tolfenpyrad, data collection is needed.

Around 24,000 hactares of tea garden were applied with chlorfenapyr, indoxacarb and tolfenpyrad to control the most serious tea pests in Chinese tea industry including the tea leafhopper (*Empoasca vitis*), tea geometrid (*Ecrotropis obliqua*) and tea thrip (*Dendrothrips minowai*), satisfied results were obtained.

6. Submission of policy document *Guidance Document on Risk Assessment Using Brew Factor for Fixation of MRLs of Pesticides in Tea* to the CCPR

In 2010, a policy document entitled “Assessment of MRLs for pesticide residues in tea” was prepared by the Working Group on MRLs in Tea Brew, and submitted to the 43rd CCPR Meeting. In 2011, another Document entitled ”Assessment of MRLs for Pesticide in Tea” was prepared by the Working group on MRLs in Tea Brew and submitted to the 44th Session of the CCPR (April, 2012, Shanghai, China) via China delegation and India delegation.

As discussed and agreed at the 43rd and 44th Session of CCPR, two conclusions were recorded as follows:

“160. The Committee emphasized the need for processing studies to refine the dietary risk assessment of tea and supported the comments of the FAO JMPR Secretariat.” and “178. The Committee supported the current procedure of JMPR in the establishment of MRLs for pesticides in tea and encouraged countries to submit relevant data/information on brewing factors and standard methods to JMPR for consideration in estimation of MRLs for pesticides in tea.”

In 2015, WG on MRLs decided to submit the policy document *Guidance Document on Risk Assessment Using Brew Factor for Fixation of MRLs of Pesticides in Tea* prepared by Indian and Chinese delegations to next CCPR to persuade regulators to accept residues in the brew as the basis for risk assessment and MRLs setting. In April in 2016, policy document has been submitted and discussed in the 48th Session of CCPR, held in April in China. JMPR require to include information of pesticide level in tea brew when the MRLs data packet is

submitted.

II. ACTION PLANS

1. Suggest WG on MRLs to establish the General MRLs of pesticides in tea

The MRLs of pesticides in tea are largely different between regulatory countries or international organizations. It is difficult to conduct the pesticide management in such a largely different MRL system in tea producing countries. We suggest to establish the General MRLs of pesticides in tea step by step in the name of IGG. The General MRLs of pesticides will first apply to tea producing countries, and then submitted to JMPR to be world-wide standards.

2. Advance ceasing application of imidacloprid and acetamiprid on tea in China

Imidacloprid and acetamiprid have been paid great attention to in China. Representing reverse effect and export problem, imidacloprid and acetamiprid were advised not to use in tea plantation in China. In the following years, besides collecting the data on residue on tea and toxicity, measures to decrease the amount of imidacloprid and acetamiprid applied in tea plantation will adopt, until zero application.

3. Generate field trial data of tolfenpyrad for MRL fixation

Tolfenpyrad has been registered in China in 2016. The MRLs of tolfenpyrad is 20 mg/kg in China, Japan and USA, while default 0.01* in EU. It is necessary to unify the MRLs of tolfenpyrad in different countries and organizations. Relevant work will be done in China to collect data in field trial and it is suggested to include tolfenpyrad to the priority list of chemicals.