MONITORING OF RESIDUAL PESTICIDES IN COMMERCIAL AGRICULTURAL PRODUCTS IN GYEONGGI-DO, SOUTH KOREA

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Introduction

Human diet is largely based on plants and their products. Parts of which comes from fresh or cooked vegetables. Pesticide residue studies are essential to assess and generate a baseline data not only to face the challenges of food safety but to trade in an international environment and to support policy makers in formulating food laws. Direct human exposure to agricultural products that contain environmental contaminants, including residual pesticides, may induce health risks from crude, unpurified materials. There may be an increase in health risk due to the illegal use of some cultivation pesticides.

Therefore, in order to reduce health risks from residual pesticides in agricultural products must be subject to control. To determine the residue information of pesticides in agricultural products materials, 48 commodities were analyzed for 206 different pesticides. Analysis was performed using the modified pesticide multi-residual analysis method (MRM) No. 83 from the Korean Food Code(KFDA 2006).

Materials and Methods

Total of 4,363 samples consisted with 48 kinds of agriculture products materials were analyzed for 206 different pesticides. Most of the circulationed agriculture products material were purchased in Suwon market that is the largest agriculture products material market in Gyeonggi-do during 2008. Domestically produced, agriculture products material were purchased at large agriculture products material wholesale markets located in Suwon, Gu-ri, Anyang and Ansan.

Two hundred and six pesticide standards above the purity 95% were purchased from ChemService, INC(West Chester, PA, USA), Dr. Ehrenstofer(Augsburg, Germany) and Wako pure chemical Industries (Osaka, Japan). Each pesticide standard was dissolved in acetone as a stock solution (1,000 mg/L) and preserved under the -4C within 3 months. The working solution mixtures of pesticides were prepared in acetone as a concentration range of 0.5, 1.0, 5.0 and 10 mg/L. The pesticide analysis grade acetonitrile and acetone were ordered from Wako(Osaka, Japan). And all other chemicals were purchased from Junsei Chemical Corp. (Tokyo, Japan). To determine the limit of detection (LOD), each group of pesticides from 0.001 to 1 mg/L were prepared. For the quantitative analysis, standard mixtures of 0.01, 0.1, 1, 5 and 10 mg/L were analyzed to make a calibration curve. Any positively identified peaks were confirmed by GC-MSD and/or quantified by GC-*u*ECD or NPD.

Results and Discussion

A Total of 4,363 samples of 48 different types of agricultural products were analyzed by GC/MSD, GC/-*u*ECD, GC-NPD, HPLC/UV and HPLC/FLD. Two hundred and six pesticides were analyzed for LOD and recovery from agriculture products material. LOD values for target pesticides with pesticide standard solutions ranged from 0.001 to 0.04 mg/L. The modified pesticide multi-residual analysis method (MRM) No. 83 from the Korean Food Code, most the proposed methods satisfied criteria of the analytical method for residues, which covered 70~120% recovery range, less than 10% of relative standard deviations, and higher sensitivity than from

half of MRL(maximum residue limits) to one tenth of MRL.

No residual pesticides were detected in 3,997 of the samples (93.1%), and the residual pesticide levels in 256 samples (5.9%) were lower than the Korea MRLs, the residual pesticide levels in 45 samples (5.9%) were above than the Korea MRLs, indicating that 99% of the samples were relatively safe. Table 1 and Figure 1 gives the Perper leaves and red mustard detected pesticide residue in more than 20%. For the Perper leaves, 9 among the 15 analyzed samples contained pesticide residue, and 3 samples exceeded the Korea MRLs. For the red mustard, 2 among the 8 analyzed samples contained pesticide residue, and 3 samples exceeded. Endosulfan was found in lettuce as 6.4 mg/kg that was 64 times of MRL 0.1 mg/kg, Procymidon was found in spinach as 7.7 mg/kg that was 154 times of MRL 0.05 mg/kg, Chlorpyrifos was found in sesame leaf as 0.3 mg/kg that was 37 times of MRL 0.01 mg/kg and Fludioxonil was found in chicory as 0.5 mg/kg that was 10 times of MRL 0.05 mg/kg of agricultural product materials including lettuce in KFDA Food code, 2006.

Endosulfan is a inexpensive cyclodiene insecticide and acaricide used in agricultural and horticultural crops for the control of a variety of insects and mites. It was detected in Oak mushroom, button mushroom, papper leaves, korean cabbage, chicory, Lettuce(leaf), Spinach, Mustard leaf, mugbean and sesame Leaf at concentrations of 0.059 ~ 6.482 mg/kg. There are 57 Korean MRL values (0.1~2.0 mg/kg) of endosulfan for 55 agricultural products and two group MRLs (for other citrus fruits and other cereal grains) (KFDA 2008). The detection and violation rates of endosulfan in 3,095 agricultural products were 4.5% and 0.2%, respectively, according to the 2006 results of pesticide monitoring by Gyeonggi-do regional in Korea (GIHE 2006). To this end, confidential risk assessments of the aforementioned fungicides should be performed due to the high possibility of occurrence in agricutural products and ordinary foods.

The regular monitoring of pesticide residues by the agricultural poducts will give them a feed back on the presence of residues in their agricultural poducts and also will enable them to adopt safer practices in the usage of plant protection chemicals. They have to incorporate non chemical pest and disease control measures to reduce the pesticide load on agricultural products. The adoption of all these strategies will help the estates to keep the residues of pesticides in their agricultural products, well below their MRL

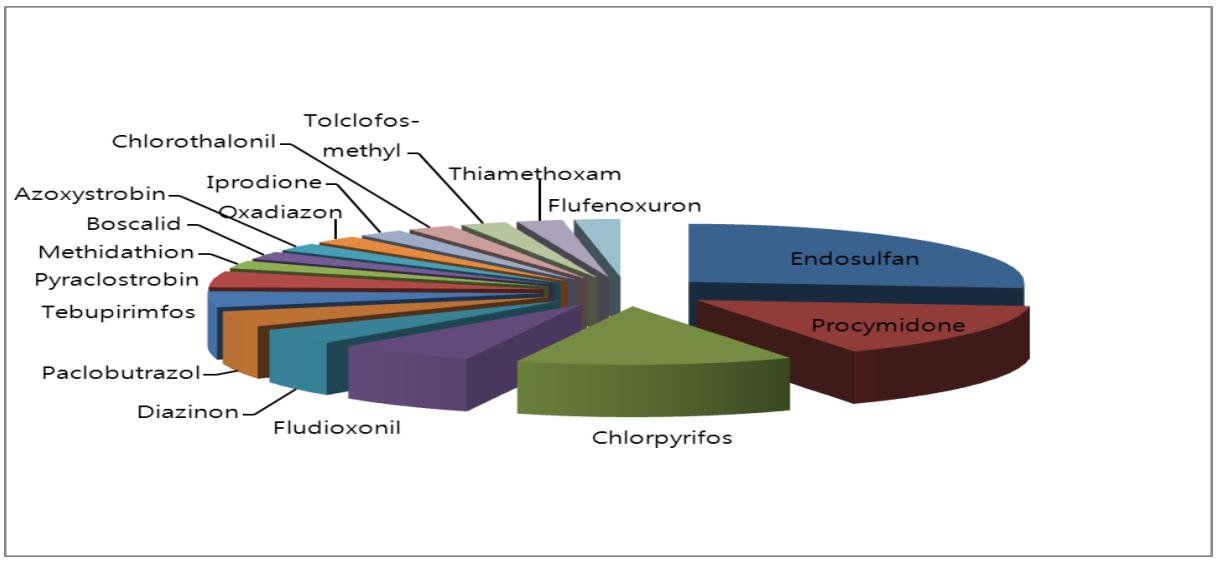

Figure 1. Result of the monitoring program for pesticide residues

Table 1. Monitoring results of the agricultural products and detected pesticides with the diverse pesticide MRLs (unit = mg/kg)

sample	No. of samples analysed	No. of samples without detectable residues	% samples without detectable residues	No. of samples with residues below or at MRL	% samples with residues below or at MRL	No. of samples with residues above MRL	% samples with residues above MRL
Spinach	239	220	92.1	12	5.0	7	2.93
korean cabbage	323	305	94.4	13	4.0	5	1.55
sesame Leaf	56	43	76.8	9	21.4	4	7.14
sedum	13	10	76.9	0	0	3	23.0
papper leaves	15	3	20.0	9	60.0	3	20
Lettuce(leaf)	481	456	94.8	22	4.6	3	0.62
chwinamul	29	22	75.9	4	13.8	3	10.34
Red mustard	8	3	37.5	2	25.0	3	37.5
chmnamul	21	17	81.0	2	9.5	2	9.52
chicory	31	27	87.1	2	6.5	2	6.45
Eggplant	67	65	97.0	1	1.5	1	1.49
Amaranthw	6	4	66.7	1	16.7	1	16.67
Marsh mallow	59	57	96.6	1	1.7	1	1.69
Mustard leaf	12	11	91.7	0	0	1	8.33
Chungyang Red pepper	27	26	96.3	0	0	1	3.7
wild garlic	2	1	50.0	0	0	1	50
Oak mushroom	32	29	90.6	2	6.3	1	3.12
button mushroom	1	0	0	0	0	1	100
mugbean	3	2	66.7	0	0	1	33.33
fresh ginseng	106	76	71.7	29	27.4	1	0.94

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