Identification and level of organochlorine insecticide contamination in groundwater and iridology analysis for people in Upper Citarum cascade

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Abstract. Organochlorines are the main pollutants in the class of persistent organic pollutants which are types of pollutants that are being questioned worldwide due to chronic persistence, toxicity and bioaccumulation. Human around the Citarum River are still using groundwater as a drinking source. It is very risky for people health that consume groundwater because in 2009 the application of organochlorine still found in the Upper Citarum watershed rice field and had potential to contaminate groundwater. Groundwater was analyzed with nine species belonging to the organochlorine pollutants Organic Persistant types. 7 types of organochlorines Aldrin was detected with an average concentration of 0.09 ppb, dieldrin with an average concentration of 0.24 ppb, heptaklor with an average concentration of 0.51 ppb, with concentrations of endosulfan on average 0.73 ppb, DDT with average concentration of 0.13 ppb, Lindan with an average concentration of 1.2 ppb, endrin with an average concentration of 0.03 ppb. Types with the highest concentration of organochlorine a lindan and endosulfan. Residues of aldrin, dieldrin and heptaklor in groundwater already exceeds the quality standards for drinking water Permenkes 492/2010. Based on the iridology analysis obtained several systems are expected to nervous, immune and reproductive system disorders and toxin deposits under the skin.

1. Background
Pesticides can be defined as a mixture of chemicals used to prevent, eradicate animal/plant with the aim of human welfare [1]. Among various types of pesticides, there are some which use is prohibited because of their toxic and persistent nature. Pesticides are one of the pollutants that come from agricultural activities. One of them is organochlorine insecticide. Some organochlorine insecticides belong to persistent organic pollutants (POP’s) which is a type of pollutant at issue all over the world due to its chronic, persistent and bioaccumulative character. Organochlorine pesticides such as DDT, Aldrin, Dieldrin, Endrin, Chlordane, Hexachlorobenzene, MIREX, Toxaphene, Heptachlor are persistent insecticides [2].

The Upper Citarum River Watershed is an area with landuse that dominated by agricultural areas [2]. Furthermore, 80% of the community use groundwater as drinking water for their daily life which have high health effect risk if the groundwater was contaminated by organochlorine. Therefore research about the level and distribution of organochlorines in the groundwater of Upper Citarum River Watershed needs to be conduct based on the habits of the population that use groundwater for drinking source and sanitation.
2. Material and methods

2.1. Groundwater sampling
Thirty groundwater samples were collected from field site. Groundwater is taken from well that surrounded by the agricultural area. Fifteen samples taken from opened well and the other fifteen samples taken from closed well. Sample is taken by water sampler. The sample bottles were rinsed with groundwater sample and then refilled in a softly for minimized aeration. The sample collection bottles were transported in cool box with blue ice and subsequently stored in a refrigerator at 4°C until further analysis. Sampling points in this research shown in figure 1.

2.2. Laboratory analysis
Laboratory analysis of organochlorine residues in samples divided into two stages, samples preparation of samples and analysis of organochlorine residues. All samples were analyzed using liquid-liquid extraction (LLE) methods. This method was adopted and developed based on Indonesia National Pesticide Commission. At laboratory, 100ml of water samples with 50 ml n-hexane-dichlormethan 85:15 v/v was shaken using separated funnel for three minutes. The lower layer will be extracted twice more with the same procedure clean up the final solution using sodium anhydrate and fluorisil. The filtrate evaporated using rotary evaporator until the volume 1 ml, elute with the acetone until the final volume 10 ml. In the other hand, 25 gram of each sediment sample was shaken with 100ml acetone using vertical shaker for 20 minutes for 3 times. Filter the filtrate using butchner funnel and flask. Evaporate the filtrate by rotary evaporator, clean up using florisil and sodium anhydrate and elute with n-hexane 50ml, evaporate again until the volume 1ml then elute with acetone until final volume 10 ml [3].

Samples were analyzed using Varian 450 Gas Chromatograph fitted with ECD detector with coulomb VF 1701 (30m x 0.25 mm x 0.25 μm) and VF-5 (30m x 0.25 mm x 0.25 μm). Injector and detector temperature were 240°C, column temperature 230°C. Nitrogen gas was used as carrier gas with velocity 40ml/min, with speed recording 5mm/min and sensitivity 102. Recovery analysis was 90-92% for organochlorine pesticide. Water samples resulted in µg/L unit [4]. Organochlorine types that analyzed in this study are aldrin, dieldrin, DDT, heptachlor, endrin and endosulfan.

2.3. Iridology analysis
Iridology analysis will be conducted on 10 people for each hazard class. Those to be analyzed must have the following attributes:
- Not work as pesticide sprayers
- Consume groundwater will be analyzed organochlorine residues as a source of drinking water for at least 10 years for adults and five years for children

Subject iridology analysis can be divided into three groups. Children aged 8-15 years. Adults aged 16-55 years and elderly aged over 55 years but not more than 65 years. Iridology analysis result is in the form of a table which consists of the quality of the organs in the body of the subject. The quality of the organs in the body of the subject is presented in the form of a score with a score of 1-5. The interpretation of these values is

1 = normal
2 = acute
3 = sub chronic
4 = chronic
5 = Poor

3. Results and discussion

3.1. Organochlorine pesticide residue in groundwater
Based on the laboratory analysis of organochlorine in groundwater, there are seven types of organochlorine pesticide that detected include lindan, aldrin, dieldrin, endrin, heptachlor, DDT and endosulfan. The average concentration for those organochlorineinsecticide are 0.09 µg/L for aldrin, 0.51 µg/L for heptachlor, 0.241 µg/L for dieldrin, 0.134 µg/L for DDT, 0.731 µg/L for endosulfan,
1.248 µg/L for lindane and 0.03 µg/L for endrin. Lindan is the highest average concentration of organochlorine that found in groundwater samples. The distribution of aldrin, dieldrin, heptachlor, DDT, endrin and endosulfan in each sampling point and the comparison with water quality standard are shown in figure 1.

**Figure 1.** Residues of aldrin (a), dieldrin (b), endrin (c), DDT (d), heptachlor (e), lindane (f) and endosulfan(g) in groundwater at field sit.

3.2. *Iridology analysis for people in Upper Citarum Cascade*
Iridology analysis results in the nervous system are shown in figure 2.
Based on the scores obtained from the nervous system iridology analysis, it was found that the physiological brain damage is part of the nervous system that most major disorder. Organochlorines are neurotoxins on the impulse conduction. Impulse conduction is an activity that is regulated by the brain physiologically.

The nervous system is the primary target of DDT after exposure to acute, subchronic and chronic. Exposure to DDT can cause tremors, convulsions in some of the test animals. The effects obtained from an experiment toxicity tests on rats with a dose of 50-600 mg of DDT/kg/day [4]. Mice who received a dose of 160 mg / kg experienced a disruption of tremor, whereas the dose of 200-600 mg/kg/day cause a disruption in the form of convulsions. DDT is also associated with an increased neurotransmitter. An increase in the metabolite 5-HIAA and serotonin degradation were reported to have a correlation with DDT at a dose of 50 mg/ kg/day. DDT can cause increased elepasan acetylcholine and decreased release of norepinephrine in rats exposed to 400 mg / kg of DDT.

Several small groups of humans who consume contaminated meat aldrin and lindane within 6-12 months experienced some nervous system disorders. The form of myoclonic disorders, auditory and visual disturbances, hyperexcitability and irritability. In some cases, the study subjects experienced a loss of the bond and the other subjects are mentally retarded. Hyperexcitability, kehilangatan memory, persistent headaches also reported as a result of exposure to dieldrin at a dose of 120 mg/kg. The effects of endosulfan on the concentration of neurotransmitters in the brain of mice has been done. The study showed that mice exposed to endosulfan with a dose of 6 mg/kg for 8 days led to changes in the level of noradrenaline, dopamine and serotonin in the central nervous system (the olfactory lobe, hippocampus and cerebellum). Dogs that are exposed to concentrations of endosulfan premises 30 ppm- 54 days, 45 days and 52 ppm-60 ppm for 40 days to experience extreme sensitivity to noise, fear terhada optical stimulation and muscle contraction in the face of extreme and legs.

4. Conclusion
Groundwater was analyzed with nine species belonging to the organochlorine pollutants Organic Persistent types. 7 types of organochlorines: Aldrin was detected with an average concentration of 0.09 ppb, dieldrin with an average concentration of 0.24 ppb, heptachlor with an average concentration of 0.51 ppb, with concentrations of endosulfan on average 0.73 ppb, DDT with average concentration of 0.13 ppb, Lindan with an average concentration of 1.2 ppb, endrin with an average concentration of 0.03 ppb. Lindan is the highest average concentration of organochlorine that found in groundwater samples. Residues of aldrin, dieldrin and heptachlor in groundwater already exceeds the quality standard for drinking water in Indonesia, PERMENKES 492/2010. The contamination levels of organochlorine pesticide in field site showed that the groundwater remediation needs to recover its quality so that it is safe for consumption. Based on the scores obtained from the nervous system iridology analysis, it was found that the physiological brain damage is part of the nervous system that most major disorder.

Pesticides can be defined as a mixture of chemicals used to prevent, eradicate animal/plant with the aim of human welfare [1]. Among various types of pesticides, there are some which use is prohibited because of their toxic and persistent nature. Pesticides are one of the pollutants that come from agricultural activities.

References
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