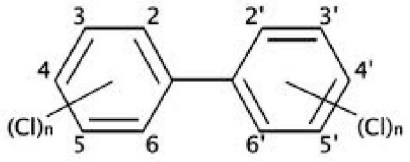
RADIOLYSIS OF THE ETHANOL AND HEXANE SOLUTIONS OF POLYCHLORINEBIPHENYLS

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Polychlorinebiphenyls (PCBs) are substances consisted of two benzene nucleus inter-connected with C-C bond and chlorine atoms from 1 up to 10 replacing hydrogen atoms in the benzene nucleus.



Depending on the number of chlorine atoms and their position in benzene nucleus, there are 209 individual isomers of the PCBs. PCBs are mainly used as thermo-carrier and dielectric liquid in transformers and capacetors. The industrial production of these substances started in 1929 for the first time. The conducted researches have revealed that the PCBs have high toxic and cancerogene properties and very small doses may badly affect live organisms (maximum allowable concentration is 1 ug/m^3 in the air, 1 ug/l in the water, 0,1 ug/kg in the soil [1]).

PCBs were included to the list of international organizations as persistent organic compounds, as well as to the priority pollutants list adopted by the European Union in 1982, also to the list of the Stockholm Convention on Persistent Organic Pollutants, and their industrial production was prohibited in 1986. But more than 2 million tones of PCBs have been produced by that time. At present, utilization of transformer oils containing PCBs is one of the urgent problems.

During the inceneration process used for PCBs utilization, more toxic substances - dioxins are generated [2]. The effectiveness of the decontamination process by burning the PCBs must not be less than 99.9%. Modern burners can be used for this purpose. However, this equipment is expensive (30-60 mln. USD) and difficult to install and exploitation. Also, a strict control over the environmental monitoring is required. The cost of utilization using the mentioned equipment is 3-4.5 thousand USD per tonne.

Using catalytic hydrogenolysis for PCBs decontamination is considered one of the promising methods [3]. In the result of this process, the organohalogen compounds can transform to nontoxic raw material for other processes. But generation of quite active and stable catalysts and generation of hydrogen chloride accelerating the corrosion in the result of the process limits the practical use of this method. Palladium is considered the most effective catalyst for this method, but its wide scale usage is limited by it being a precious metal. Also, the efficiency of the catalyst is decreased after reuse.

And one of the chemical methods used for PCBs utilization is to transform PCBs to hydroxy- or alkoxy-derivatives by replacing chlorine atoms in the molecule, and to use the generated products as raw material for polymerization and polycondensation processes [4]. In the result of reaction of PCBs with dimethyl sulfoxide, ethanol and potassium-hydroxide first etoxy-, then hydroxyl-derivatives are generated. However, in this case too, a full replacement of chlorine atoms in the molecule is not achieved and the replacement becomes difficult as the number of chlorine atoms in the molecule decrease during the replacement process.

The purpose of the work is to comparatively study the affect of various solvents – ethanol (polar solvent) and hexane (non-polar solvent) – to the radiolysis process. For this purpose, the

radiolysis processes of the 50 ug/l concentration solutions of PCBs in ethanol and hexane have been conducted.

A standard containing 12 PCB samples (CEN PCB Congener Mix 1, 10 ug/ml in heptane, Supelco) has been used to prepare model solutions. The PCBs identification has been conducted using a Gas Chromatography (Agilent Technologies 7820A). Transformation degrees (%) in 13,8 Mrad dose during the radiolysis of PCB solutions in ethanol and hexane are presented in the Table 1.

Table 1. *Transformation degrees of Polychlorbiphenyls.*

Polychlorbiphenyl	Transformation degree of the polychlorbiphenyls with 50 ug/l concentration in etanol solution in 13,8 Mrad adsorbed dose, %	Transformation degree of the polychlorbiphenyls with 50 ug/l concentration in hexane solution in 13,8 Mrad adsorbed dose, %
PCB 18 (2, 2', 5-trichlorbiphenyl)	55,8	21,5
PCB 28+31(2, 4, 4'-trichlorbiphenyl + 2, 4', 5-trichlorbiphenyl)	72,5	54,4
PCB 52 (2, 2', 5, 5'-tetrachlorobiphenyl)	30,1	3,2
PCB 44 (2, 2', 3, 5'-tetrachlorobiphenyl)	68,7	50,1
PCB 101 (2, 2', 4, 5, 5'-pentachlorobiphenyl)	42,1	4,1
PCB 118+149((2, 3', 4, 4', 5-pentachlorobiphenyl + 2, 2', 3, 4', 5', 6-hexachlorobiphenyl)	76,4	27,3
PCB 153 (2, 2', 4, 4', 5, 5'-hexachlorobiphenyl)	79,3	18,1
PCB 138 (2, 2', 3, 4, 4', 5'-hexachlorobiphenyl)	83,1	54,8
PCB 180 (2, 2', 3, 4, 4', 5, 5'-heptachlorbiphenyl)	87,0	32,3
PCB 194 (2, 2', 3, 3', 4, 4', 5, 5'-octachlorobiphenyl)	94,3	37,6
Total	68,9	30,3

As seen from the Table 1, during the radiolysis of 50 ug/l concentration PCB solutions in ethanol in 13,8 Mrad dose 68.9% is transformed, and in hexane 30.3% is transformed. Among PCBs, PCB52 and PCB101 undergo more difficult transformation under used doses.

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