PHYTOTOXICITY OF SOME ORGANIC POLLUTANTS

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People use persistent organic pollutants (POPs) for different purposes, especially health care, etc. (Megson et al., 2016). Pharmaceuticals, personal care products and detergents are often persistent organic pollutants. So lot of these substances are not degradable by biological organisms. Pharmaceuticals and its metabolic products enter to sewage with blackwater from toilets. Personal care products and detergents are components of greywater.

Decentralized wastewater treatment systems (constructed wetlands, biopoinds, infiltration fields) become more and more popular in rural areas (Capodaglio et al., 2017). In case of these systems different microorganisms and plants remove pollutants from water, but POPs are non-biodegradable and some of them are toxic for plants and microorganisms.

Separation of wastewater is other popular trend of modern wastewater management, especially in countries with significant deficit of water resources (Shafiquzzaman et al., 2018). According to the main principle of this trend, greywater and blackwater are divided and greywater can be used for plants watering.

Thus, study of phytotoxicity of pharmaceuticals, components of personal care products and detergents is very actual in the context of decentralized biological treatment and graywater reuse.

For experiment we choose amoxicillin (Amoxil), ibuprofen (Nurofen), dequalinium chloride (Dequadol), syrup Bronho-plus and shampoo Faberlic. Phytotoxicity of components was tested by germination experiment. Seeds of chard and pumpkin were placed in sections of the container. In each section of container different solutions were poured. Distilled water was used as blank solution.

Solutions of amoxicillin (1 g/l), ibuprofen (1 g/l), syrup Bronho-plus (1% solution), shampoo Faberlic (1% solution), decvalinium chloride (1 mg/l) were used in germination experiments.

Syrup contained willow extract, echinacea extract, sage extract, ascorbic acid, sugar, purified water, menthol, sodium benzoate, vitamin C (1.5 grams per 100 grams of product).

Shampoo contained aqua, sodium laureth sulfate, cocamidopropyl, betaine, PEG-4, rapeseedamide, glycereth-2 cocoate, polyquaternium-10, macadamia seeds oil, PEG-40 hydrogenated castor oil, coconut oil, etc. Amoxicillin, ibuprofen, syrup and shampoo had very big influence on the germination of seeds (Table 1).

Table 1 – Germination of chard and pumpkin seeds

Pollutant name		**Plant**	**Germination of seeds, %**				
			3 days	**4 days**	**7 days**	**11 days**	**25 days**
Distilled water		Chard	33	33	66	66	66
		Pumpkin	66	66	66	66	66
Amoxicillin		Chard	0	0	0	0	0
		Pumpkin	0	0	0	0	0
Ibuprofen		Chard	0	0	0	0	0
		Pumpkin	0	0	0	0	0
Dequalinium chloride		Chard	33	33	33	66	66
		Pumpkin	66	66	66	66	66
Syrup Bronho-plus		Chard	0	0	0	0	0
		Pumpkin	0	0	0	0	0
Shampoo Faberlic		Chard	0	0	0	0	0
		Pumpkin	0	0	0	0	0

In case of dequalinium chloride daily dose for adults is significantly less (1.5-3.0 mg of dequalinium chloride) than daily doses of amoxicillin (750-3000 mg, 6000 mg in very difficult cases) or ibuprofen (600-1200 mg). That's why for germination experiment solution of dequalinium chloride had significantly lower concentration than solutions of amoxicillin or ibuprofen. Solutions of dequalinium chloride didn't have effect at concentration 1 mg/l, but this component also could have phytotoxic properties at higher concentrations. According to the Table 1 other substances was very phytotoxic. Mold grew in sections with the solution of Bronho-plus due to presence of the sugar and other nutritious components in this syrup.

Thus, at high dosages main part of studied organic substances demonstrated significant phytotoxicity.

But experiments with different concentration of pollutants would be very important and could help to determine non-phytotoxic concentration of these POPs.

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ADSORPTION PROPERTIES OF SOME FERRIC-BASED MATERIALS IN THE CONTEXT OF POTENTIOMETRIC TITRATION

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Iron(III)-based absorbents are effective in context of dissolved phosphates and arsenates removable to formation of insoluble iron(III) phosphate (Zeng, Li and Liu, 2004) or iron(III) arsenate (Siddiqui and Chaudhry, 2017). Also iron(III)-based adsorbents also can remove different other pollutants, especially selenates (Peak and Sparks, 2002), organic matter (Gao et al., 2017) etc.

Iron(III)-based absorbents may be used in different forms, especially nanoparticles (Cao et al., 2016), different composite and polycomponent materials (Mezenner and Bensmaili, 2009) etc.

Potentiometric titration gives information about amount of ion exchange groups on the surface of adsorbents. It is very important in adsorption studies. Thus, this titration is very simple and cheap method of determination of adsorbent properties.

We placed 0,25 g of adsorbent sample (iron(III) oxide or iron(III) hydroxide) and 200 ml of KCl solution with concentration 0,01 M in glass beaker. For potentiometric titration we used solutions of