ECO-TOXICOLOGICAL RISK ASSESSMENT OF E-WASTE SOIL POLLUTION

Biljana Balabanova

Faculty of Agriculture, Goce Delcev University, Stip 2000, Republic of North Macedonia

E-mail: biljana.balabanova@ugd.edu.mk

DATA OVERVIEW

Electronic waste on a global scale is cluttered with a rate of 40 million tons per year. E-waste is delayed by three times the usual rate waste. In one landfill, electronic waste is responsible for 70% of toxic chemicals like lead, cadmium and mercury [1].

The electronic industry is characterized, on the one hand, by rapid technological advancement, and on the other, there is an increasing phenomenon that manufacturers fail to design goods on some of the ways that take into account the effects that these products would have on the whole of their lifecycle, including the period when they become waste. The consequence of this are devices that are incredibly complex design and composition, and include a palette breathing material, some of which are dangerous and it is not easy to handle them when they become waste [2].

Supply of raw materials for the production process also has its negative impacts. Raw materials used in the production of electronic equipment are primarily supplied by mining, which requires a large area of land and large the amount of energy, also a large amount of harmful gases is generated. For example, 10,000 tons of carbon dioxide is released into the atmosphere to produce one tons of gold, palladium or platinum [3].

It has been estimated that 44,700 kt of e-waste were produced globally in 2016, with an expected growth rate of 3–4% per year. The amount of chemical products used for the production of these key components is enormous - only one semiconductor can contain 500-1000 different chemicals ingredients and several analysis estimated that production a 2 g of microchip can create up to 26 kg of waste, from which part is very toxic [4].

More than 40 different chemical elements can appear in the process of recycling EE waste, some of which have a high degree of soil pollution. Electronic waste processing systems have matured in recent years, following an increase in regulatory, public and commercial initiatives in proportion to the growth of transitory interests. Part of this evolution caused the development process of electronic and electrical waste from energy intensive processes, unlike conventional recycling, where the equipment was based on forms of raw materials.

CRITICAL ISSUES on soil pollution: There are toxic substances that are built into your TVs that can seriously pollute soil surface environment if it is deposited in landfills. Old TVs with cathode ray tubes (CRT) contain between 2-4 kg of lead that can leak into the soil if it comes to the landfill damage and decomposition, and thus pollute groundwater sources. New liquid crystal displays (LCDs) contain live lamps to illuminate the screen. Each LCD uses microgram live. Metal is however so toxic that only one gram of living mercury is released per year at minimum area of 1.61 ha. It is estimated that from the total annual consumption of mercury to around 22 % worldwide is used in production electrical and electronic devices.

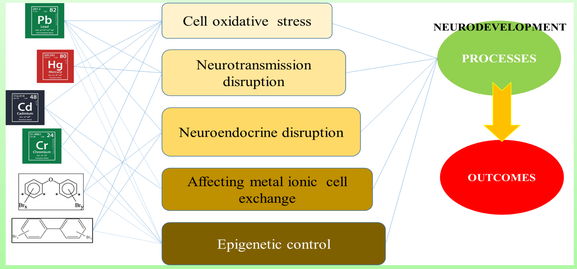

Fig. 1. Generalized toxicological processes indicated from toxicants released from e-waste

MOVES FORWARD:

European Green Deal: Commission adopts new proposals to stop deforestation, innovate sustainable waste management and make soils healthy for people, nature and climate [5]. It provides the overarching framework for the necessary green transition.

Evidence of exposure

Typical contamination scenarios for creation of the e-waste are:
a) dumping sites at/or near the riverbanks and agricultural areas;
b) villages situated along rivers that receive e-waste;
c) manually disassembling and repairing;
d) open burning the e-waste to extract valuable metals
e) final disposal sites or landfills.

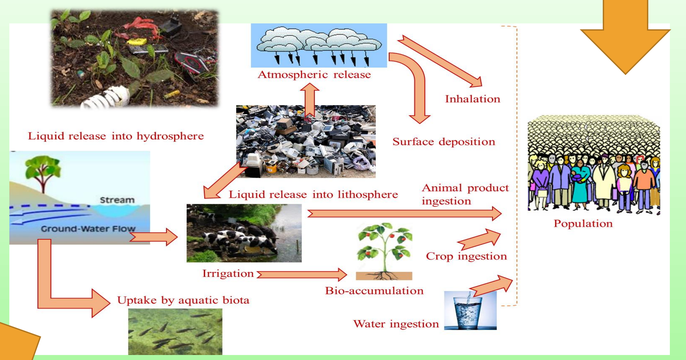

Fig. 2. Exposure pathways of toxic substances contained in e-waste

Several heavy metals, PBDEs, PAHs, and possibly SCCPs can be found at concerningly high concentrations in dumpsite soils, with the majority of the burden originating from the handling and dumping e-waste and other waste materials. Some of those pollutants (Cu, Pb, Ni, Sb, Cd, Ag, Hg, octa-tech BDEs and highly chlorinated PCBs) are closely linked to burning and may be reduced by replacing burning as a method to isolate valuable metals [6].

The main challenges regarding the management of new industrial chemicals POPs are: a) a lack of a system for informing and delivering data from households, public administration and the commercial sector, waste collectors, carriers and operators for e-waste management and the transport sector, b) low stakeholder awareness and capacity for the content of the components in consumer products / vehicles / electrical and electronic equipment, as well as the potential risks of POPs-PBDE on human health and h votnata environment, c) lack of collection centers and processing and treatment of vehicles at the end of their lives and collection centers and treatment and processing of e-waste[6, 7].

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