



Ecotoxicity of cigarette butts

Info sheet



Discarding a cigarette butt onto the ground is the most accepted form of littering and normal for many smokers. At least one in three cigarettes worldwide is discarded onto the ground after smoking – so that every year 340 to 680 million kilograms of tobacco waste end up in the environment from where they are only partially removed [1]. Cigarette butts thus represent the most frequently collected item during clean-up campaigns around watercourses [2]. But not only the amount of waste is a problem: On the one hand, the filters of cigarette butts are made of plastic and degrade very slowly, thus contributing to environmental pollution with plastic and microplastic. Cigarette butts also contain numerous toxic chemicals that are released into the environment. Studies have shown that harmful chemicals released from cigarette butts are acutely toxic to aquatic organisms.

Ingredients and Environmental Fate

Some pollutants released into the environment via cigarette butts originate from the tobacco itself, tobacco cultivation (pesticides and fertilisers) or cigarette production. Others are generated through combustion during smoking. In total, cigarette butts contain more than 4000 chemicals, more than 50 of which are considered human carcinogens [3]. For example, cigarette butts contain arsenic, nicotine, polycyclic aromatic hydrocarbons and heavy metals [4]. Organic compounds such as nicotine and ethylphenol are probably responsible for most of the toxicity [5]. Through elution of nicotine, a cigarette butt can contaminate 1000 L of water with nicotine concentrations above the Predicted No Effect Concentration (PNEC) of 2.4×10^{-3} mg L⁻¹ [6], i.e. harmful effects on organisms cannot be excluded. The cigarette filters themselves consist of cellulose acetate, a plastic material that is not biodegradable and slowly decomposes into smaller components in sunlight.

Toxicity

Chemicals released from one cigarette butt per litre of water can kill 50% of exposed fish within 96h. This has been shown in experiments with topsmelt and fathead minnow [7]. *Daphnia magna*, a waterflea species, were at least one order of magnitude more sensitive in 48 h exposures, where toxic effects (immobilisation) were observed at concentrations of ca. 0.05 cigarette butts per litre [5]. The higher the tar and nicotine content of the cigarettes, the more toxic they were to daphnia. Extract from cigarette butts had a mutagenic effect on bacteria [8] and led to increased mortality and behavioural changes in marine snails [9]. The activity of marine worms was inhibited by cigarette butt extract (2 cigarette butts L⁻¹), the growth of the worms was slowed down (8 cigarette butts L⁻¹), and they accumulated nicotine in their bodies [10]. Extract from cigarette butts also interfered with the development of Japanese rice fish [11] (0.2 cigarette butts L⁻¹).

Relevance und Measures

Large amounts of cigarette butts are discarded in urban areas and recreational areas close to surface waters. Some cigarette butts are also thrown into the water directly, for example from ships. Most harmful to the environment is the release of nicotine. Every cigarette butt in a river or lake potentially pollutes one cubic meter (1000 liters) of water with harmful nicotine concentrations [6]. Cigarette butts are continuously introduced into the environment and accumulate wherever they are not regularly removed. When it rains after longer dry periods, harmful nicotine concentrations can be reached, especially in small urban waterways. In larger water bodies with higher dilution the risk can be expected to be lower. In cities such as Berlin, which obtains 100% of its drinking water from sources in the city area, drinking water quality may be impaired [6].

The situation could be partially improved by the installation of more ashtrays and more intensive street and beach cleaning. Bringing about behavioural changes through sensibilisation campaigns appears to be more feasible, however. Once people realise how toxic cigarette butts are and that they should be considered as waste, it is more likely that they will dispose of them properly [12]. Information campaigns should therefore focus on the toxicity of cigarette butts and their impact on the environment and drinking water quality.

Literature

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Contact

Dr. Anke Schäfer, phone +41 58 765 5436

Anke Schäfer, August 2019