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The adverse impacts of chemical wood treatments on the ecosystem

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Introduction

Wood is renewable and can act as a carbon sink, wood preservation has become more popular worldwide in recent years. Wood preservatives, are used to extend the life of wood, wood in its natural state, not particularly resilient and is easily destroyed if left untreated (Changotra et al. 2024). Wood preservation escalades protecting wood from various wood-degrading organisms, such as termites, fungi, incest, bugs, and woodborers (Meena 2022). Copper Azole, Ammoniacal Copper Zinc Arsenate (ACZA), Alkaline Copper Quat (ACQ), Creosote, PCP, and Chromated Copper Arsenate (CCA) are the most often used first and second generation preservative systems.

(Groenier and Lebow 2006). These chemical wood preservatives are extremely detrimental to human health, aquatic biodiversity, soil bacteria, and the environment (Miranji et al. 2022). Many wood preservatives, such as chromated copper arsenate (CCA) and creosote, can leach into the soil and can contaminate groundwater and overland flow water, posing risks to main city water supplies along with water ecosystems. The chemicals released after treating wood can have significant and far-reaching effects on the environment.

One of the primary concerns associated with chemical wood preservatives is soil contamination. Many preservatives contain heavy metals, such as arsenic and chromium, which can leach into the soil over time. This contamination can disrupt soil health by harming beneficial microorganisms and altering nutrient cycling. The long-term presence of these chemicals can degrade soil quality, affecting plant growth and agricultural productivity. According to the US Environmental Protection Agency, wood that has been CCA-treated may provide a risk of arsenic toxicity and exposure, particularly to nearby plants, soils, and workers (Hare et al. 2018). One typical way that arsenic is known to cause cancer is through contaminated soils, plants, and water. As (III), As (V), found in soil flocculants derived from the CCA used in wood treatment are the causes of the pollution that was observed (Buhl 2017). Runoff from treated wood can introduce toxic substances into nearby water bodies, leading to contamination of aquatic ecosystems. The wood preservatives such as creosote and chromated copper arsenate (CCA) can accumulate in sediments and water, posing risks to fish and other aquatic organisms. Contaminated water can also threaten drinking water supplies, impacting human populations and wildlife alike. Research on the impact of CCA on the environment and aquatic ecosystem has revealed detrimental impacts on a number of aquatic species (Weis et al. 1991, 1992). Furthermore chemical wood preservatives can have detrimental effects on wildlife. Numerous chemicals are toxic to fish, amphibians, and invertebrates, among other living creatures.

For instance, exposure to these substances can lead to reproductive issues, developmental abnormalities, and even mortality in sensitive species. As these chemicals move through the food chain, they can cause broader ecological disruptions, leading to declines in biodiversity. Some wood preservatives release volatile organic compounds (VOCs) into the atmosphere. Due to its high vapour pressure, pentachlorophenol readily evaporates off treated wood surfaces; loss can reach 30–80%, although its sodium salt does not evaporate (WHO 1987). The average person is considered to inhale 0.063 mg of PCP per day, while employees at lumber mills and wood treatment facilities are thought to inhale 10.5 to 154 mg per day over 35 mg per day through the skin (ATSDR 1999). These substances may contribute to air pollution, which can result in the production of smog and ground-level ozone, which are harmful to both human and wildlife health.

Long-term exposure to VOCs has been linked to respiratory issues and other health problems, particularly for workers in the wood treatment industry. Certain preservatives can accumulate in the tissues of organisms, leading to bioaccumulation and bio magnification in the food chain. This process can result in higher concentrations of harmful chemicals in top predators, including birds and mammals. As these chemicals build up, they can lead to toxic effects, reproductive failures, and population declines in affected species. CCA treated-wood became a source of human beings and ecosystem exposure to copper, chromium, and arsenic; therefore for these reasons CCA was voluntarily withdrawn from commercial markets in 2004 (Freeman and McIntyre 2008).

Both human health and the environment are at danger when chemical wood treatments are used. Workers involved in the application and handling of these chemicals are particularly vulnerable to exposure, which can lead to serious health issues. Additionally, individuals living near treated wood structures may experience increased exposure to harmful substances, raising concerns about potential long-term health effects. A copper chromate arsenate (CCA) water-borne solution is one example of this type of preservative. CCA residues from impregnated wood pose a concern to both ecosystem and human health when skin contact occurs, which is therefore most nations have limited the chemical product (Morais et al. 2021). Another concerning issue is the potential for pests and fungi to develop resistance to certain wood preservatives. As resistance builds, there is a tendency to use more potent and often more toxic alternatives, exacerbating the environmental impact and creating a cycle of increasing chemical use. The application of chemical preservatives can adversely affect non-target species, including beneficial insects, pollinators, and natural pest predators. This disruption can lead to imbalances in local ecosystems, further complicating the challenges of pest management and conservation.

Conclusion

While chemical wood preservatives play a crucial role in extending the life of wood products, their harmful environmental consequences cannot be overlooked. From soil and water contamination to impacts on wildlife and human health, the use of these chemicals poses significant challenges to sustainability. To mitigate these risks, it is essential to explore safer alternatives, such as natural preservatives and ecofriendly treatments, and to execute sustainable forestry. By doing so, we can protect our ecosystems and encourage a more

sustainable environment for generations to come.

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