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Pharmaceutical Pollutants: Impacts on Ecosystems and Human Health

Mari Lehtonen*

Department of Chemistry, University of Helsinki, Helsinki, Finland

Introduction

Pharmaceutical pollutants are chemicals that are released into the environment as a result of the production, use, and disposal of pharmaceuticals. These pollutants can have harmful effects on aquatic and terrestrial ecosystems, as well as on human health.

Pharmaceuticals are used to treat a wide range of human and animal diseases, and they are one of the most widely used types of chemical products worldwide. Pharmaceuticals are also found in personal care products, such as shampoos, lotions, and sunscreens. The widespread use of pharmaceuticals has led to the presence of these chemicals in the environment. Pharmaceuticals can enter the environment through several pathways, including direct discharge from wastewater treatment plants, leaching from landfills, and runoff from agricultural fields. Once in the environment, pharmaceuticals can persist for long periods of time and can accumulate in the tissues of aquatic and terrestrial organisms.

Pharmaceutical pollutants can have a wide range of harmful effects on aquatic and terrestrial ecosystems. These effects can include changes in the behavior, growth, and reproductive success of organisms, as well as changes in the composition of aquatic and terrestrial communities. For example, some pharmaceuticals have been shown to cause feminization of fish, resulting in a skewed sex ratio in aquatic populations.

In addition to the effects on ecosystems, pharmaceutical pollutants can also have harmful effects on human health. Some pharmaceuticals can accumulate in the tissues of fish and other aquatic organisms that are consumed by humans, resulting in exposure to these chemicals. Exposure to pharmaceutical pollutants has been linked to a range of health problems, including endocrine disruption, developmental abnormalities, and cancer.

Description

The environmental impact of pharmaceuticals has led to increased concern among regulators and the public. In response to this concern, regulatory agencies have developed guidelines and regulations aimed at reducing the release of pharmaceuticals into the environment. For example, the U.S. Environmental Protection Agency (EPA) has developed a strategy for reducing the environmental impact of pharmaceuticals, which includes the development of guidelines for the proper disposal of unused medications and the promotion of the use of environmentally friendly pharmaceuticals.

In addition to regulatory measures, there are also steps that individuals can take to reduce the environmental impact of pharmaceuticals. One of the most important steps is to properly dispose of unused medications. Many pharmacies and healthcare facilities have programs in place to collect and dispose of unused medications. If such a program is not available, medications can be disposed of in the trash, but they should first be placed in a sealable container and mixed with an undesirable substance, such as coffee grounds or cat litter.

Overall, the results showed that nanocellulose based cryogels can be functionalized and crosslinked with LNPs or cLNPs. LNPs added to the cCNF based cryogels increased adsorption, not only of the anionic aromatic pharmaceutical diclofenac but also of the aromatic cationic Metoprolol (MPL), Tramadol (TRA), and neutral aromatic carbamazepine, despite a decrease in the overall positive surface charge. Despite the decrease in the net negative surface charge, the addition of cLNPs to TCNF based cryogels increased MPL and TRA adsorption. Other than electrostatic attraction, modes of removal other than hydrophobic interactions brought about by the addition of LNPs or cLNPs were responsible for the improved adsorption. These modes of removal could be the aromatic ring. Nonetheless, critical improvement was possibly found if the proportion of LNPs or cLNPs to nanocellulose was 0.6:1 or higher and with round lignin nanomaterials. The LNPs or cLNPs had an effect on the rheological behavior of the gels as crosslinking agents, increasing firmness and decreasing water holding capacity of the corresponding cryogels. Crosslinking also made the cryogens more resistant to disintegration when exposed to water. This made it possible for the cryogels, particularly the TCNF based one, to be regenerated and used again for five cycles of the adsorption-desorption experiment for the model pharmaceutical MPL. As a result, this study opened up new opportunities to use LNPs to provide additional functional groups to nanocellulose based adsorbents, which were previously only possible through stringent chemical modifications and simultaneous crosslinking of the nanocellulose network.

***Address for Correspondence:** *Mari Lehtonen, Department of Chemistry, University of Helsinki, Helsinki, Finland, E-mail: Lehtonen3@vtt.fi*

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Conclusion

Another important step is to use environmentally friendly pharmaceuticals whenever possible. Some pharmaceutical manufacturers have begun to develop products that are more environmentally friendly, such as those that degrade more quickly in the environment. By choosing these products, individuals can help to reduce the environmental impact of pharmaceuticals. Pharmaceutical pollutants are a complex and growing problem that requires a multifaceted solution.

By working together, regulators, manufacturers, and individuals can help to reduce the environmental impact of pharmaceuticals and protect the health of both ecosystems and humans.

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