

# Purification and dilution reduce risk of fish being injured by hormone-disrupting compounds

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In a dissertation at the Department of Applied Environmental Science (ITM), Stockholm University, Maria Pettersson has examined whether purified wastewater from municipal purification plants and cellulose factories in Sweden contains hormone-disrupting compounds in such amounts that they are affecting fish. She has also studied how the levels of these compounds can be reduced in wastewater.

"The results indicate that the problem of hormone-disruption in fish is not as widespread in Sweden as in many other European countries. This is probably due to the fact that Swedish purification plants use purification techniques that reduce the amount of hormone-disrupting compounds, or that dilution of wastewater in recipient containers is greater than in many other countries. However, this is not to say that Swedish water is entirely free of the problem. We have seen hormone-disrupting effects occur locally in recipient containers with low-level dilution and the emission of insufficiently purified wastewater," says Maria Pettersson.

The estrogen ethinylestradiol in contraceptive pills that women secrete via urine and feces is not always degraded in purification plants and can leak into ambient water with purified wastewater. Since there are many similarities between the hormone systems in humans and other vertebrates, fish, for example, can be affected by the estrogens that humans secrete. Moreover there are industrial chemicals that have been

shown to impact the hormone system of fish, such as nonylphenol and bisphenol A. Emissions from cellulose factories have also been shown to contain compounds that can affect the hormone system of fish.

"We have been able to show that male fish that are exposed to municipal wastewater in certain cases begin to produce an egg yoke substance that normally only occurs in sexually mature females. We have also managed to detect the natural estrogens, the contraceptive pill estrogen ethinylestradiol, and the estrogen-like chemicals nonylphenol and bisphenol A in purified wastewater. The same estrogen substances were also found in gall fluid from fish that had been exposed to wastewater, which shows that fish take up the substances from water," says Maria Pettersson.

By comparing various types of municipal purification plants, Maria Pettersson and her colleagues were able to determine that the amount of time spent in the biological purification stages is a key factor when it comes to reducing the amount of estrogen compounds in wastewater and that a sand filter contributes to a further reduction.

To investigate the occurrence of hormonal disturbances in wild fish, Maria Pettersson and her colleagues carried out a field study along the coast of the Baltic Sea. No clear hormonal effects could be observed in fish in the recipient containers studied, neither outside municipal purification works or outside cellulose factories.

"It's probably a result of good dilution of the wastewater in the recipient containers. But the problems cannot be dismissed entirely since hormone-disrupting effects can still occur locally in recipient containers with a low level of dilution and emissions of insufficiently purified wastewater," says Maria Pettersson.

Source: Swedish Research Council

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