

MSc Thesis Project Idea

Waste water treatment and waste management of the research stations in the Southern Ocean and on Antarctica

Background

The research stations on the Antarctic continent, cruise ships and fishing vessels in the Southern Ocean unintentionally release MP in the form of fibers and fragments via their waste water treatment plants (WWTP). All research stations and vessels are obliged to have WWTP, according to the Antarctic treaty¹. About 100 research stations are registered in Antarctica, hosting between 100 (winter season) and 5000 people (Summer season) (SCAR Antarctic Digital Database) and several vessels are cruising in the Southern Ocean, south of 60°.

While the most recent surveys on the treatment plants and their technological standards are 18 years old by now, most likely wastewater treatment strategies have evolved, along with the development of new technologies and emerging environmental concerns (Stark et al. 2016). Knowledge is scarce, which was very clear by the quote from Perfetti-Bolaño et al. (2022): *“Information regarding wastewater treatment systems tends to be inaccessible, but where it exists, it is fragmented, scarce and in some cases outdated. This leads to a partial and unrealistic view of the risk to which the continent is subjected.”*

A recent study on the contribution of research vessels to microplastic pollution of surface and subsurface waters added new knowledge to pollution at Sea (Leistenschneider et al 2021).

Aims

To raise data on the current state of waste water treatment, with special focus on microplastics. Also, the efficiency of treatment technologies should be assessed considering the specific environmental conditions. As a further step, concrete actions for improvement could be suggested if necessary.

Procedure and Methods

Data analysis of data on wastewater treatment plans via the Electronic Information Exchange Services (EIES) or on the COMNAP website (access online). A few studies which provide detailed information on the treatment system of the specific station where their research is being conducted on the Arctowski station treatment plan (Szopinska et al. 2021). Data of stations which did not provide information in these systems have to be contacted directly, e.g. via email.

What we offer

The prospective student is offered close mentoring and inclusion into an interdisciplinary team. The team has a track record in working with plastic pollution (<https://mgu.unibas.ch/en/research/anthropogenic-pollution-of-the-environment/>). Access to necessary facilities, including office space and computer, as well as laboratory will be provided. Depending on the nature of the project and pursued interests, contacts the representative of Switzerland at EDA as well as to various institutions and organizations, are available, due to Prof Holms activity as member of Swiss Commission on Polar and High Altitude Research.

¹ *The Antarctic treaty and MARPOL 73/78 prohibits the dumping of waste, explicitly specifying plastics, into the sea. Also, the dumping of food waste is regulated. One potential source for MP occurrence in the Southern Ocean around Antarctica could be ballast water exchange of cruise and research vessels. This is also regulated and recorded according to MARPOL (MARPOL 73/78). In general, ballast water and sediment exchange should not take place in Antarctic waters (Secretariat of the Antarctic Treaty; Resolution 3 (2006).*

Your profile

You are interested to gain insights in the work of international governmental organizations. You should be communicative and creative in finding access to representatives of member states of the Antarctic treaty.

If your interest is peaked, please contact

Prof. Dr. Patricia Holm (patricia.holm@unibas.ch)

References

EIES Secretariat of the Antarctic Treaty. (n.d.). Electronic Information Exchange System. Retrieved May 7, 2023, from <https://eies.ats.aq/Login?ReturnUrl=%2F>

Leistenschneider, C et al (2021) Microplastics in the Weddell Sea (Antarctica): A Forensic Approach for Discrimination between Environmental and Vessel-Induced Microplastics. *Environ. Sci. Technol.* 55, 23, 15900–15911. doi: 10.1021/acs.est.1c05207

Perfetti-Bolaño, A et al. (2022). Analysis of the contribution of locally derived wastewater to the occurrence of pharmaceuticals and personal care products in Antarctic Coastal Waters. *Science of The Total Environment*, 851, 158116. <https://doi.org/10.1016/j.scitotenv.2022.158116>

SCAR <https://www.scar.org/resources/antarctic-digital-database/>

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Secretariat of the Antarctic Treaty. (April 14, 2022) Waste Management Plans and Contingency Plans: Analysis of the information provided by the Parties in the EIES. Antarctic Treaty Consultative meeting.

Stark, JS, et al. (2016). The environmental impact of sewage and wastewater outfalls in Antarctica: An example from Davis Station, East Antarctica. *Water Research*, 105, 602–614. <https://doi.org/10.1016/j.watres.2016.09.026>

Szopińska, M (2021) First evaluation of wastewater discharge influence on marine water contamination in the vicinity of Arctowski Station (Maritime Antarctica). *Science of The Total Environment*, 789, 147912. <https://doi.org/10.1016/j.scitotenv.2021.147912>