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The occurrence of emerging organic pollutants in a tropical reservoir in Brazil - contributions to the management of Lake Paranoá

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Introduction

Study area

- Federal district with Lake Paranoá situated within Brasilia, capital of Brazil
- Inhabitants 2.5 Mio (IBGE 2010)
- Population growth rate 2.8%
- Elevation ~1100 m
- Tropical savanna climate, MAP: 1600-1700 mm (WMO)
- Dry season from May to September

Lake Paranoá

- Surface area: 38 km²
- Mean depth: 12 m
- Volume: 4.98.10⁸ m³
- Retention time: ~300 days
- 4 main tributaries

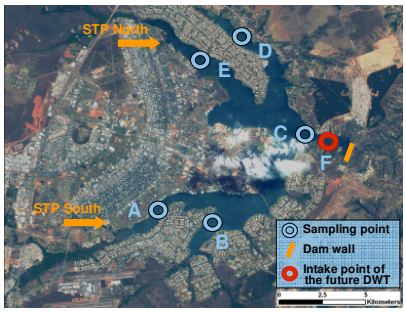


Fig. 1: Lake Paranoá with sampling points

Problem description

- Increasing drinking water demand driven by population growth and income changes
- Political decision to use Lake Paranoá as future drinking water reservoir
- Lake Paranoá as receiving reservoir for effluents of two sewage treatment plants (tertiary treatment)
- Lack of information about the occurrence and fate of organic micropollutants in the lake
- Need of efficient measures for pollutant avoidance and water treatment

Aim

Characterization of the water quality regarding organic micropollutants as a base for sustainable use of Lake Paranoá as part of an IWRM for the Federal District (DF).

General Approach

Lake Paranoá
- Limnological points
- Rainy and dry season

Sewage treatment plants
- STP South (effluent)
- STP North (effluent, affluent)

Raw water & drinking water
- DWTP Descoberto
- DWTP Brasilia

Org. micropollutants/ Non-target screening
- Pharmaceuticals, toxins, sweeteners,.. (>80 compounds)

Sum parameters
- SAC, AOX, TOC/DOC, LC-OCD, EEM, ..

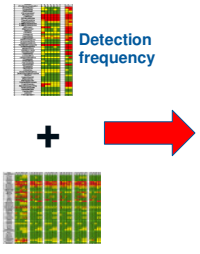
Physical parameters
- pH, dissolved oxygen, temperature, ..

Data evaluation
- Physico-chemical parameters (data set starting 1976)

-Contributions to IWRM for the Federal district (definition of relevant parameters and key compounds)
-First conclusions regarding monitoring, drinking water treatment and upgrade of existing sewage treatment plants

Results

- Generation of a data matrix to visualize sampling results (see table 1, right)
- Matrix as guide for planning of DWT-plant and selection of appropriate treatment technology
- Use of the matrix for the definition of key compounds for monitoring and upgrade of existing sewage treatment plants
- Comparable low concentrations of organic micropollutants in Lake Paranoá despite relatively high inputs (STP South/STP North, ng/L-range, data not shown)
- Decrease in concentrations within the lake based on yet unknown processes
- Several compounds occurring in European/North American Waters not detectable (Lake Paranoá, STPs)



Number of compounds (n=46)	*No relevance**	*Low relevance**	*Medium relevance**	*High relevance**
Lake Paranoá	13	17	8	8
STP effluent	16	4	13	21
Examples	**Saxitoxins, microcystins**, fluoxetine, aspartame	Sotalol, paracetamol, diclofenac	Iopromide, iopamidol, carbamazepine	Atenolol, sulfamethoxazole, tolyltriazole

Table 1: Matrix generated based on measured concentrations and detection frequency of 46 compounds during 5 sampling campaigns for Lake Paranoá and STP South and STP North (*based on measured data/concentrations)

Conclusion

- Data matrix as a useful tool to guide IWRM by refinement of the sampling strategy, definition of key parameters and selection of appropriate treatment steps
- More data points needed; additional sampling campaigns for tributaries and urban runoff
- Inclusion of additional parameters (f.e. persistence, toxicological data) could further enhance the usefulness of the matrix

Contact and information

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