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AN ASSESSMENT OF THE EFFECTS OF ATMOSPHERIC PRECIPITATION ON WATER QUALITY IN OUTDOOR SWIMMING POOLS

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BACKGROUND

2.5%

of the world's water is freshwater

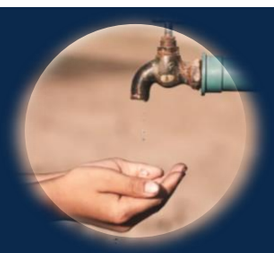
38% of the EU population is affected by water scarity

70%

of the world's freshwater is in ice form or snow cover on mountains

URBAN WATER CRISIS

The increasing water scarcity and urban floods in urban areas pose significant challenges for sustainable water management. Addressing this issue effectively demands a comprehensive approach that takes into account innovative and adaptable solutions.



WATER SCARITY

The amount of water available worldwide is limited. As cities grow, they use more and more water, which means there isn't enough clean water for everyone. This leads to not having as much clean water as we need and to competition for the clean water that is available.

URBAN FLOODS

Climate change leads to more extreme weather events, resulting in urban flooding that damages infrastructure and disrupts lives.

ALTERNATIVE SOURCES

Cities are seeking solutions to tackle water scarcity by considering alternative water sources. Rainwater harvesting not only helps in conserving water but also serves as a valuable tool for protecting urban areas from floods.

RESEARCH AIMS AND OBJECTIVES

An extensive study assessed the impact of precipitation on water quality in two public outdoor swimming pools in Poland over three summer months. This research lay the groundwork for integrating rainwater as a primary water source in public pools, replacing tap water usage.

Tab. 1. Characteristics of the tested facilities

Location	Basin Type	Symbol	Water Surface [m^2]	Water Volume [m^3]	Water Treatment Processes
A	Sport Pool	AS	1000	1850	No water circulation; Dilution, Disinfection
	Recreational Pool	AR	200	150	
	Paddling Pool	AP	150	67.5	
B	Sport Pool	BS	1000	2000	Water circulation in a closed circuit; Coagulation, Filtration, Disinfection
	Recreational Pool	BR	700	735	
	Paddling Pool	BP	48	14.4	

KEY FINDINGS

Rainwater entering the pools during rainfall did not have a detrimental effect on the quality of the pool water.

The pool water consistently met the required microbiological and physicochemical standards both before and after the rain.

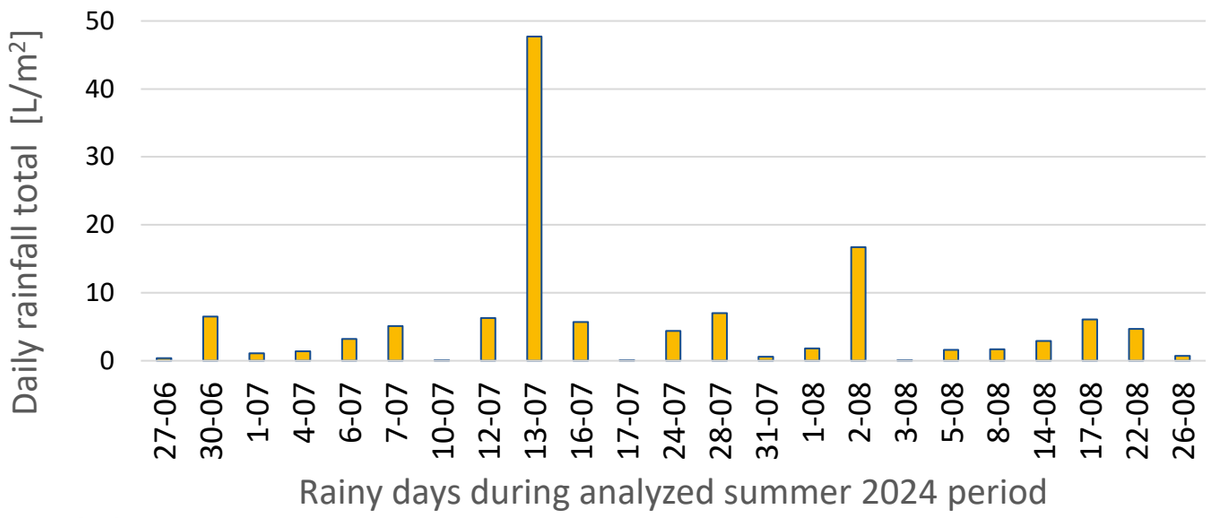
However, post-rainfall, changes in pH, chlorine concentration, and turbidity were observed in the tested swimming pools.

Notably, the facility lacking a water circulation system experienced a significantly greater impact of precipitation on pool water quality.

The variations in water parameters were found to be contingent upon the volume of precipitation entering the pool, the surface area of the water, and the pool's water volume.

RAINFALL STRUCTURE

There were 23 rainy days during the analyzed period, with a maximum rainfall of 47.7 mm and an average of 5.5 mm.



AIR QUALITY ANALYSIS

The air quality in the analyzed period was fair according to the European Air Quality Index.

Tab.2. Air contamination during analyzed summer 2024 period

Value during rainy days	PM10 1-hour µg/m^3	Ni(PM10) ng/m^3	IP(PM10) ng/m^3	PM10 µg/m^3	BjF(PM10) ng/m^3	PM2.5 µg/m^3	SO2 1-hour µg/m^3
Min	0.0	0.2	0.0	0.5	0.1	0.3	0.4
Max	34.6	7.0	25.5	36.5	12.4	25.4	5.7
Average	19.4	2.6	3.4	18.9	1.7	10.6	3.8

SWIMMING POOL WATER ANALYSIS

The pool water quality was evaluated based on:

- ✓ the primary requirements outlined in the Polish Journal of Laws 2015 item 2016
  - 5 microbiological parameters,
  - 13 physicochemical parameters,
- ✓ additional water quality indicators, including TOC, IC, COD, absorbance, conductivity, metals and nutrient concentration, among others.

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