

Rainwater Harvesting & Treatment: From Roof to Reuse

Contaminants, collection systems and sanitation technologies — including real water-quality results from the MAURICE Nový Bydžov pilot

Frequent

microbial contamination (e.g. *E. coli*) is commonly found in untreated roof runoff

20–30 s

typical UV contact time to disinfect harvested rainwater, chemical-free

99.9 %

of bacteria & viruses removed by coagulation + sand filter + ultrafiltration

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WHERE
CONTAMINATION
STARTS

- Roof runoff** is mainly microbial — bird droppings, leaves, insects; it may also contain **trace amounts of metals**: Zn, Cu, Pb
- Road & car-park runoff** carries suspended solids, heavy metals, oil residues and microplastics — far lower quality than roof water
- The **"first flush"** — the first minutes of a rain event — carries far more pollutants than the water that follows, and **must be diverted away**
- Atmospheric input (SO₂, CO₂, dust, pollen) still leaves rainwater naturally **soft and slightly acidic** at the source

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COLLECTION &
PRE-TREATMENT

- Pre-treatment for roofs** — covered gutters, a first-flush diverter, and inlet screens or filters before storage
- Pre-treatment for road / unpaved surfaces** — light-liquid separators, sand filters or bioretention for heavier loads
- Storage** — an appropriately sized tank, based on local rainfall patterns and demand
- Depending on use: pair long-term storage with **sanitation**, or send surplus water to **infiltration**

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SANITATION
COMPARED

- UV disinfection** — chemical-free, ~20–30 s contact, ≈ €0.5–1/m³, but no residual protection after treatment
- Chlorination** — cheap, lasting residual protection; rainwater has little organic matter, so **by-product risk is low**
- Ozonation** — strong oxidation, ≈ 0.3 kWh/m³, higher cost, may form bromate in bromide-rich water
- Coagulation + sand filter + ultrafiltration** — removes up to 99.9 % of bacteria & viruses, ≈ €1–2/m³

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QUALITY OVER
TIME

Nový Bydžov Winter Stadium — roof water stored at 12–13 °C, UV-disinfected after 1 month of storage

Sampling stage	<i>E. coli</i>	Coliform bact.	Total 22 °C	Total 36 °C
Week 3 of storage	0	52	>5000	4590
Week 4 of storage	0	420	>5000	2440
After UV treatment	0	0	820	720
2 weeks after UV	0	0	>5000	>5000

CFU/100 ml (*E. coli*, coliforms) · CFU/ml (total counts)

Key takeaway: after sanitation, rainwater contains no pathogenic microorganisms.

This is not pathogenically dangerous and opens up a much wider range of possible uses. Water still carrying pathogens stays limited to drip/trickle irrigation only, without aerosol contact.