

MOTIVATION

Most publications are about synthetic water disinfection using electrohydraulic discharges, including spark discharge. There are only a few papers on surface water purification however, nothing about spark discharge.

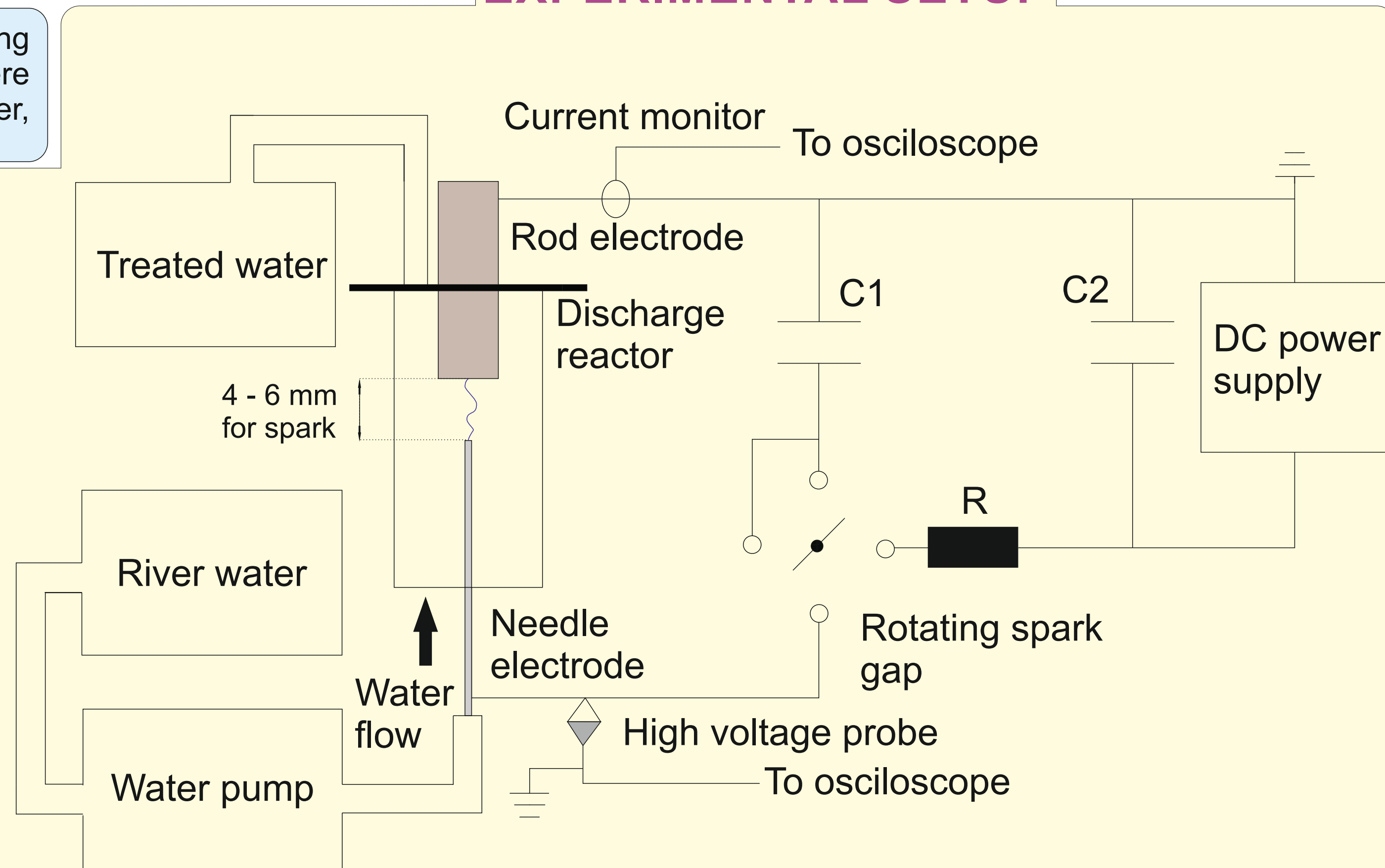
REACTORS

- Cylindrical reactors made of PTFE
- Inner diameter: 15 and 25 mm
- High voltage electrode -> Stainless steel hypodermic needle, inner diameter: 1.6 mm, outer diameter: 2 mm
- Grounded electrode -> Stainless steel rod, diameter: 5 mm
- Gap between the electrodes: from 4 to 6 mm
- Water flow: 30 ml/min

INITIAL WATER CHARACTERISTICS

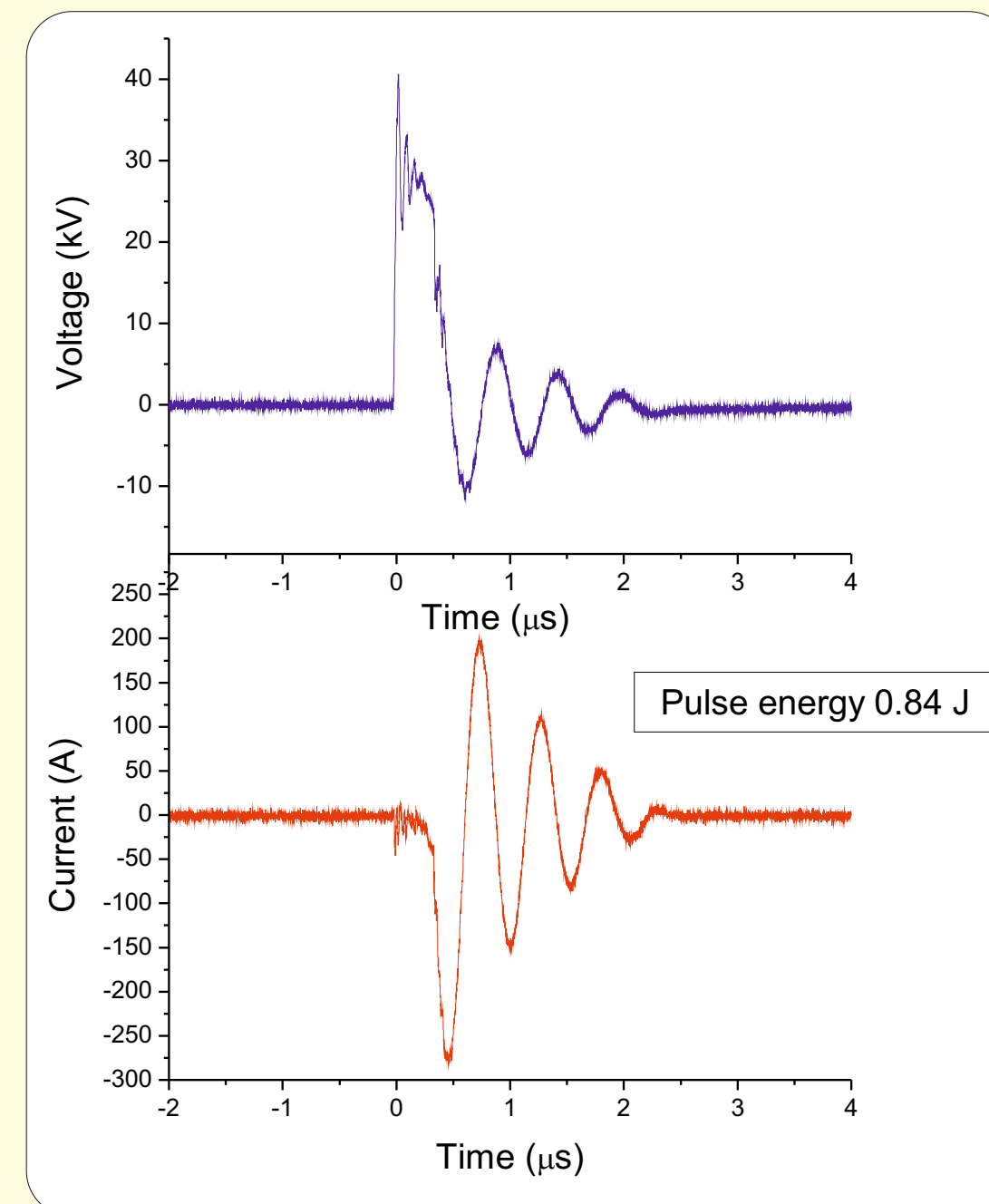
- Water from the Strzyża river in Gdańsk,
- Temperature: 21°C,
- pH: 8.4,
- Conductivity: 573 μ S,
- Total number of *coli* bacteria: 144 cfu/ml,
- Number of *E. coli*: 53 cfu/ml,
- Total number of microorganisms at 36°C: 1452 cfu/ml
- Total number of microorganisms at 22°C: 1042 cfu/ml

EXPERIMENTAL SETUP



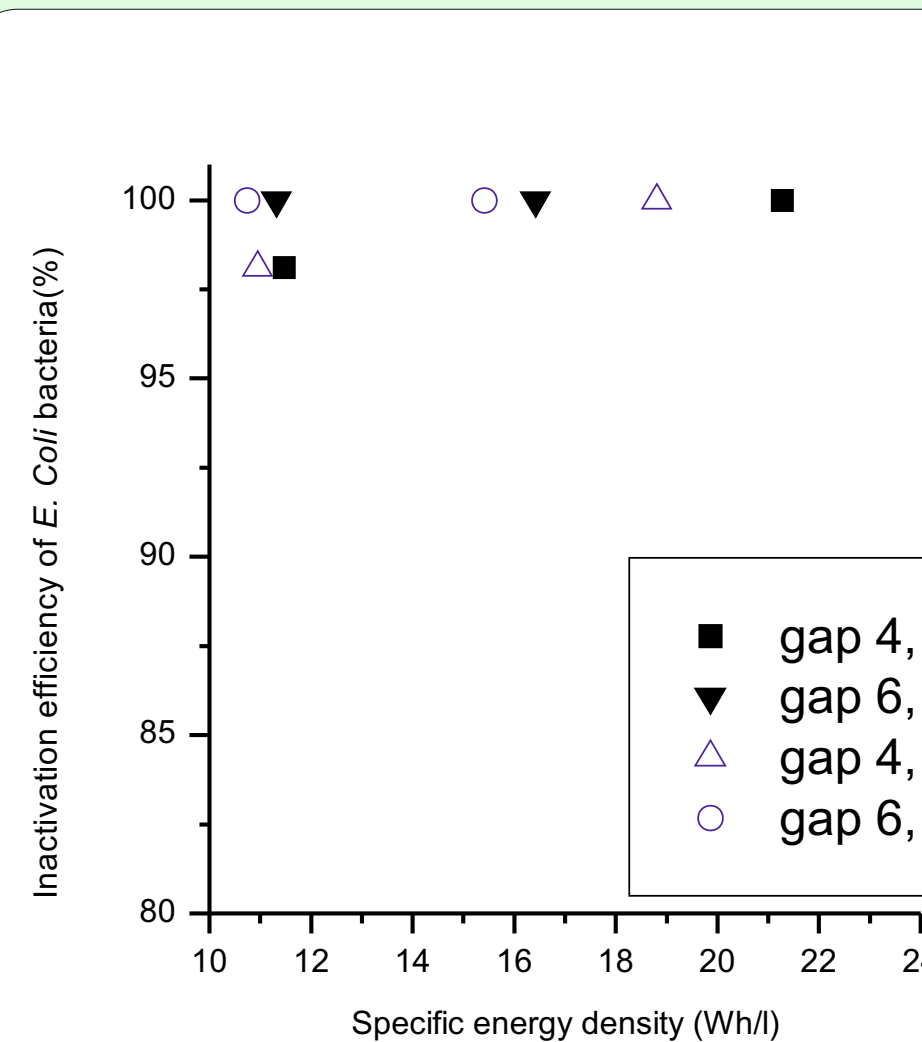
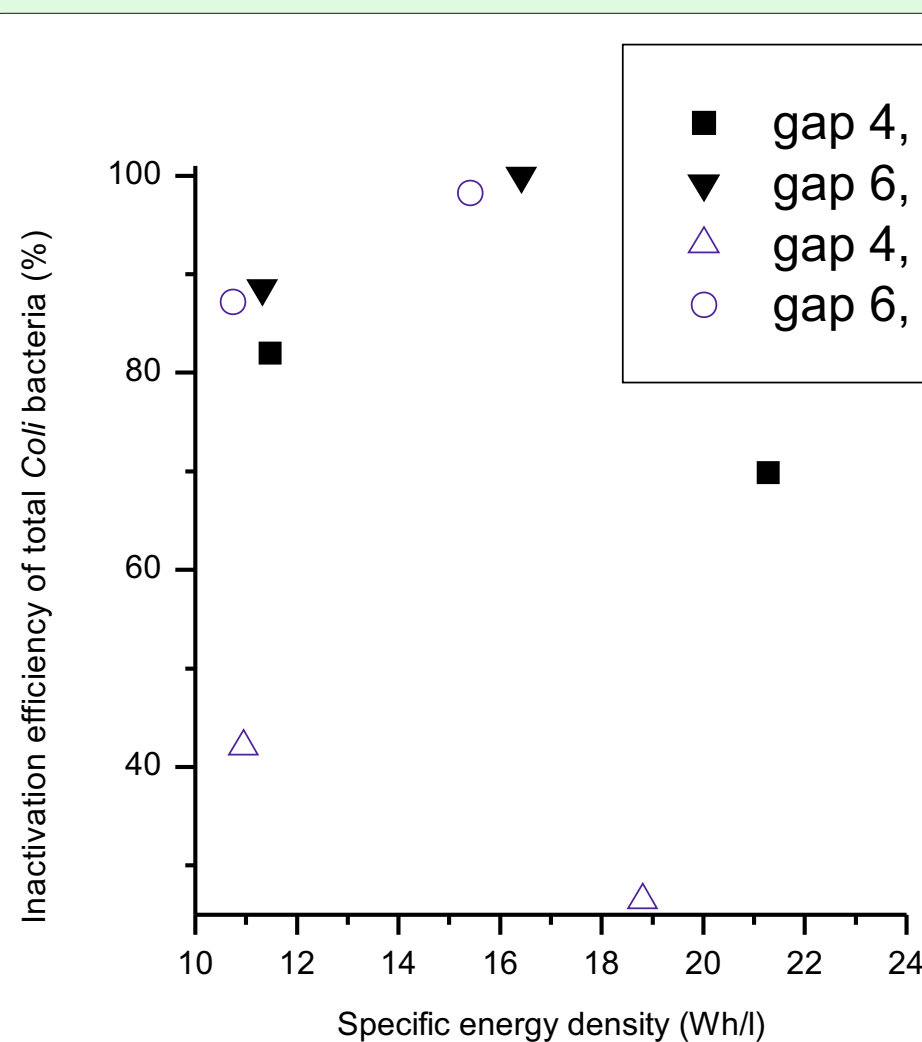
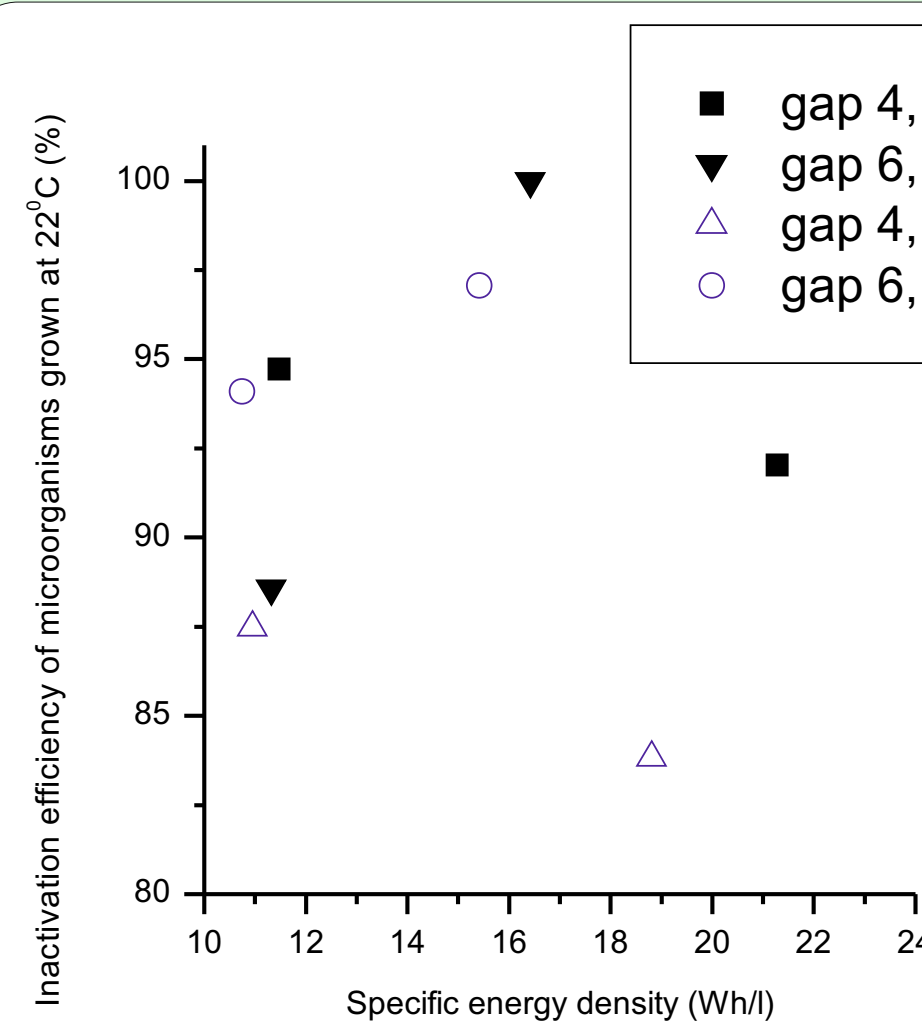
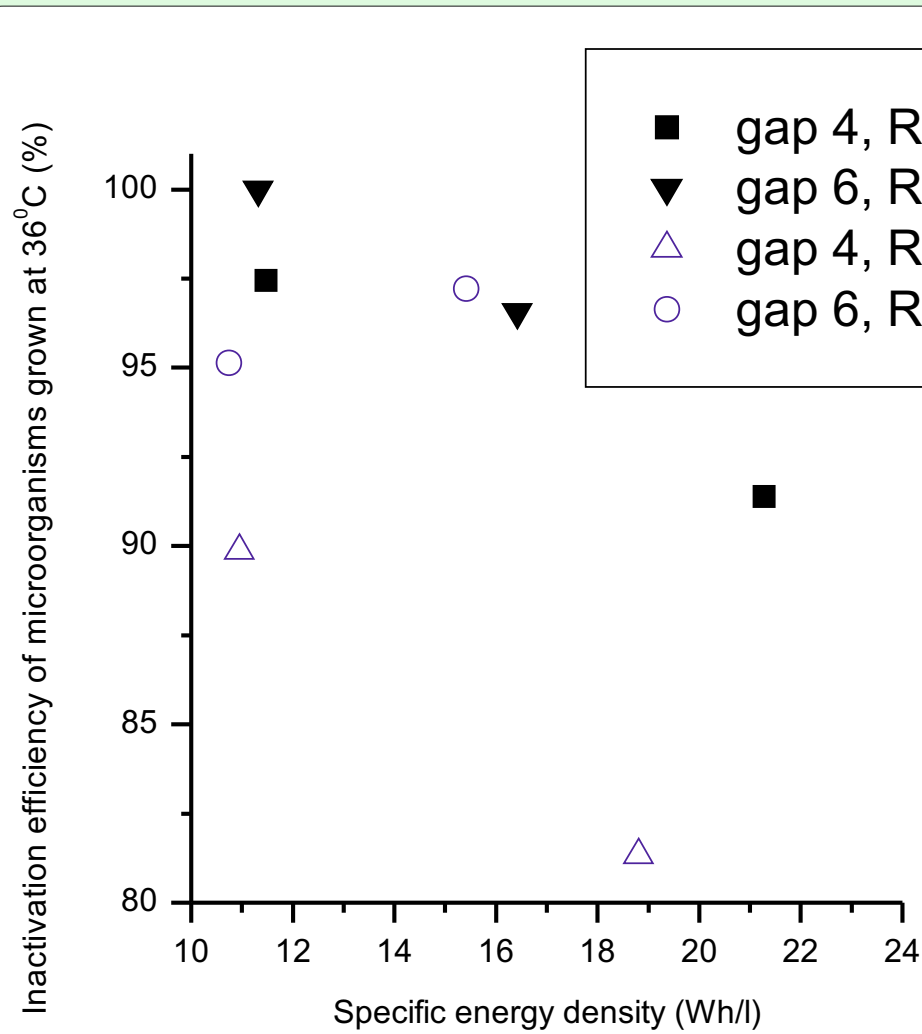
DISCHARGE

- Pulsed spark discharge
- Applied voltage: 26-30 kV
- Pulse repetition rate: 50 Hz
- Averaged pulse energy: 0.8 J



RESULTS

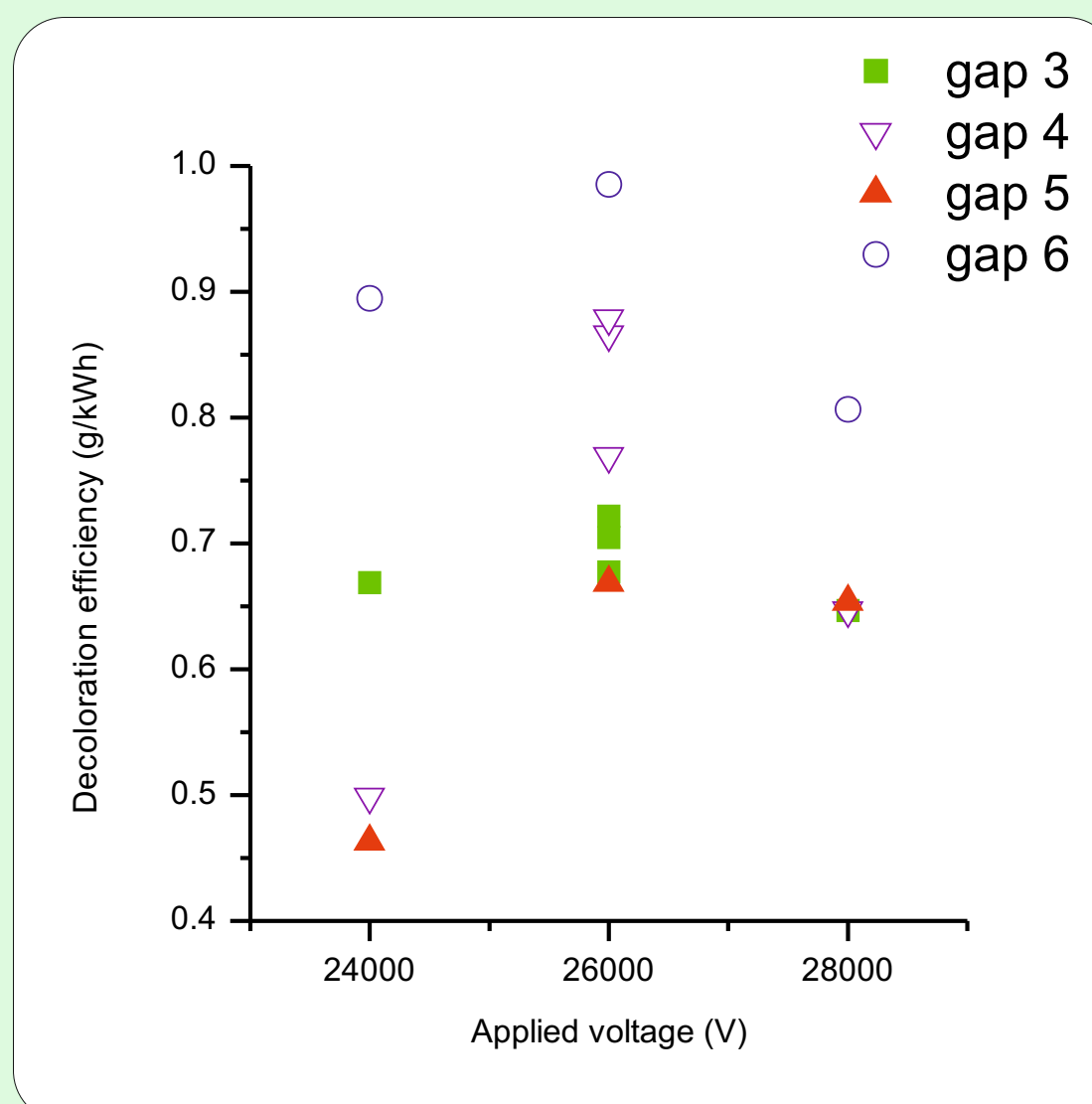
PULSED SPARK DISCHARGE



R1 - reactor of inner diameter 15 mm
R2 - reactor of inner diameter 25 mm

METHYLENE BLUE DECOLORATION

In order to find the optimal oxidising parameters of the discharge, methylene blue decoloration was performed



- Initial Methylene Blue concentration: 5 mg/L
- Water conductivity: 350 μ S
- Water pH: 8.0
- Decoloration efficiency: up to 1 g/kWh

RESULTED OPTIMUM

- Discharge gap: 4-6 mm
- Voltage: >26 kV

CONCLUSIONS

- The pulsed spark discharge is capable of killing 100% of *E. Coli* bacteria and 90% of other microorganisms in river water
- At large discharge gap the reactor diameter does not influence the disinfection efficiency
- Little amount of energy is used - 10 Wh/l for log₂ removal of *E. Coli*. Other researchers: 31 Wh/l for log₂ removal (Oj Lun Li, Workshop on "Progress in new methods of water and waste water cleaning", Gdańsk 2011)