

Supplementary Information

Matrix driven environmental fate and effects of silver nanowires during printed paper electronics end of life

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Supplementary information S1

Batch incubation of silver-nanowires printed paper electronic (AgNWs-PPE) in water

A batch incubation was carried out for 21 d with fragmented AgNWs-PPE in water at static conditions. Physical-chemical parameters such as light irradiation, temperature and water chemistry (Volvic® water) were the same used for the mesocosm experiments. Briefly, the experiment took place in 250 mL glass beakers, filled with 200 ml water. Dosing was carried out with a single addition of fragmented AgNWs-PPE at day 0 to match the final dose used in AgNWs-PPE mesocosms ($50 \mu\text{g}[\text{Ag}].\text{L}^{-1}$). The samples were incubated in triplicate and compared with blank controls (no AgNWs-PPE added). The aim of the batch experiment was to: I) monitor the Ag release from the AgNWs-PPE in simplified and abiotic conditions in order to be compared with more complex and biotic mesocosm systems and II) to collect aged AgNWs-PPE fragments, which could not be recovered from the mesocosm experiment due to interaction with sediment matrix and biota.

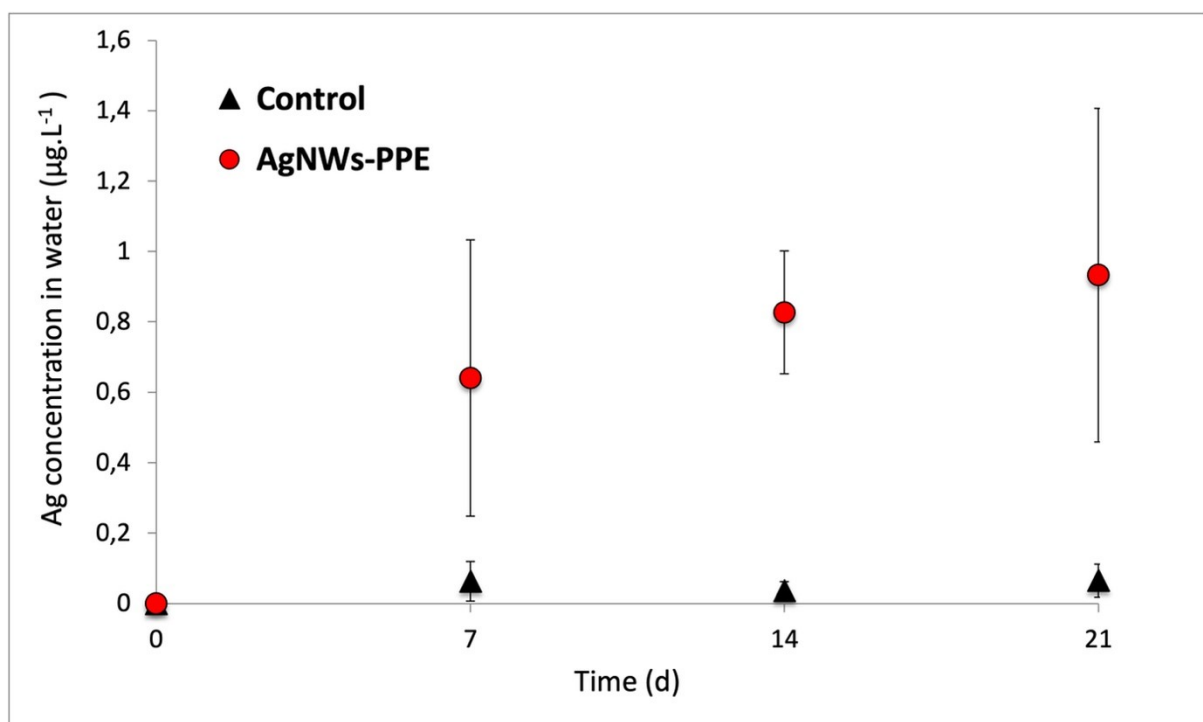


Figure S1. Ag concentration in water during the abiotic batch incubation in Volvic® water at static conditions. The error bars represent the standard deviation between sample of the same treatment ($n=3$), either AgNWs-PPE at $50 \mu\text{g}[\text{Ag}].\text{L}^{-1}$ (red circle) or non-amended controls (black triangles). The concentration of Ag in water increased to $0.64 \pm 0.39 \mu\text{g}.\text{L}^{-1}$ at day 7, and remained essentially stable until the end of the experiment ($0.93 \pm 0.47 \mu\text{g}.\text{L}^{-1}$) at d21.

S2.1 Total organic carbon (TOC) in mesocosm water

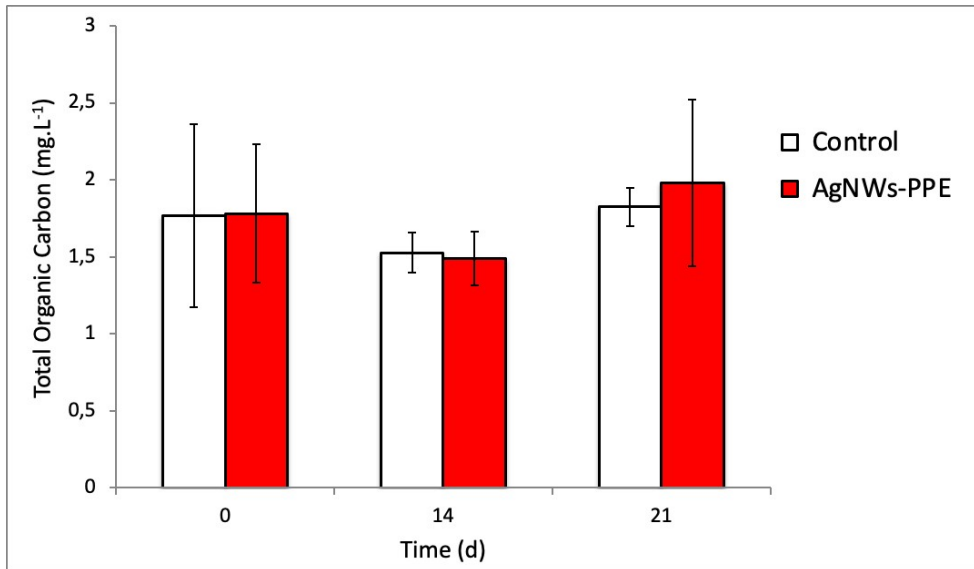


Figure S2.1. Total organic carbon (TOC) measured in mesocosm water samples collected from AgNWs-PPE (red) and non-amended controls (white) treatments.

S2.2. Chlorophyll content in mesocosm water

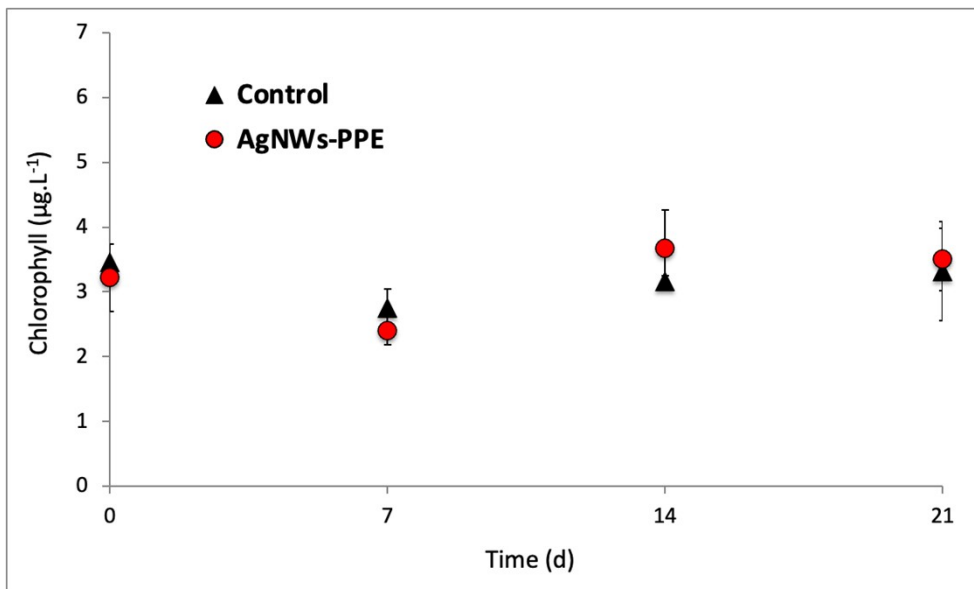


Figure S2.2. Chlorophyll content measured in mesocosm water samples collected from AgNWs-PPE (red circles) and non-amended controls (black triangles) treatments.

S2.3. Bacteria counting in mesocosm water

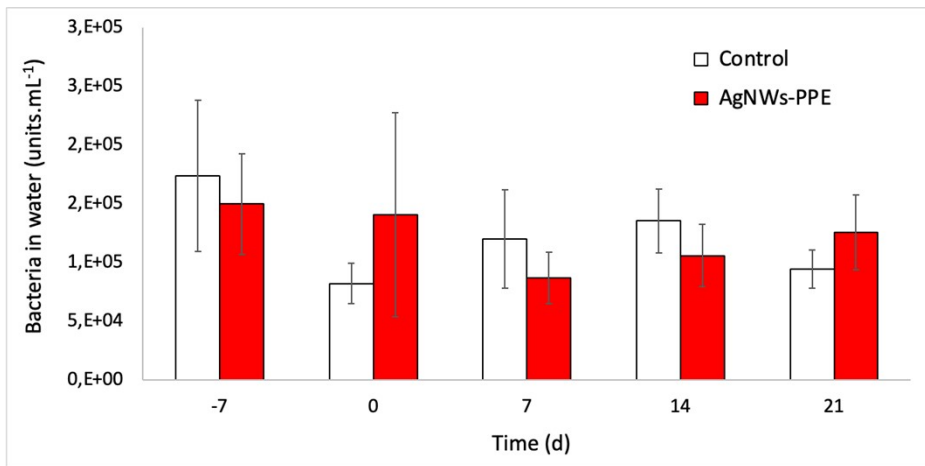


Figure S2.3. Bacteria counting analysis performed in mesocosm water samples collected from AgNWs-PPE (red) and non-amended controls (white) treatments.

S2.4. Suspended particles analysis in mesocosm water

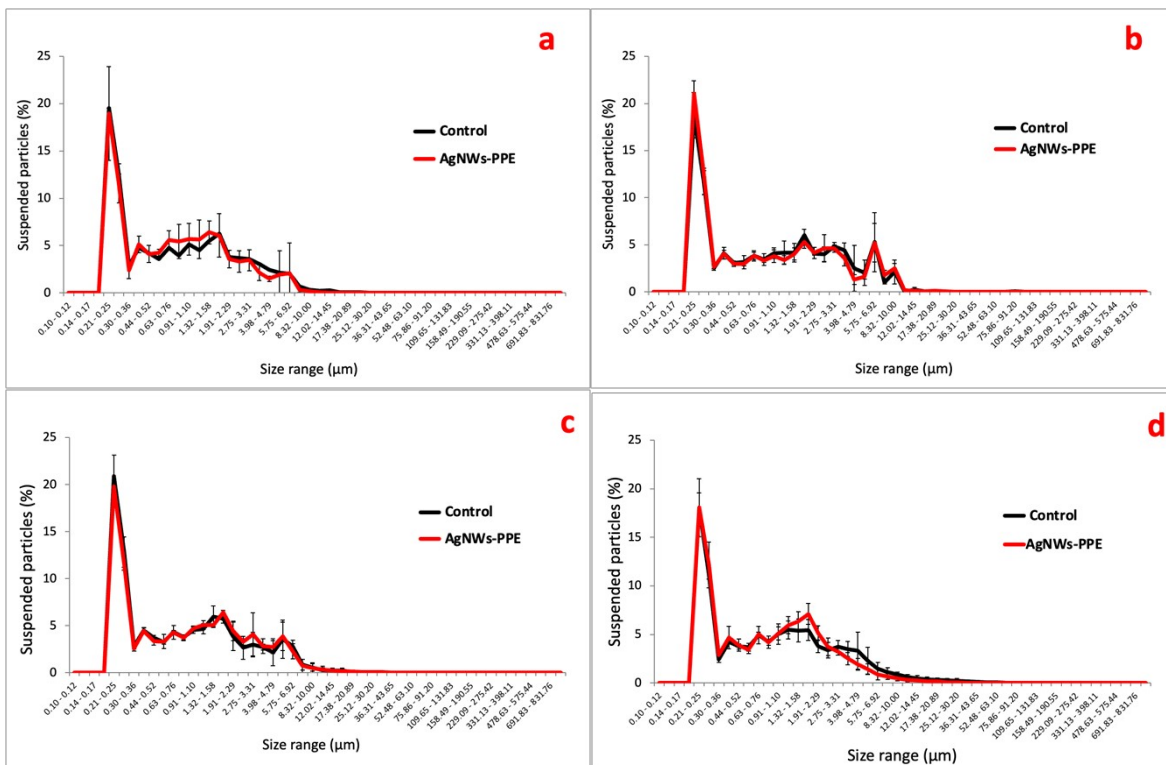


Figure S2.4. Suspended particles size distribution in the mesocosm water at day 0 (a, before contamination), 7 days (b), 14 days (c) and 21 days (d). The suspended particle values are normalized for the total particle number measured in mesocosms water (%). AgNWs-PPE contaminated mesocosm (red lines) displayed size distributions similar to the controls (black lines) at all the time intervals. The error bars represent the standard deviation between mesocosms in each treatment (n=3).

S2.5 Physical-chemical parameters in mesocosm water

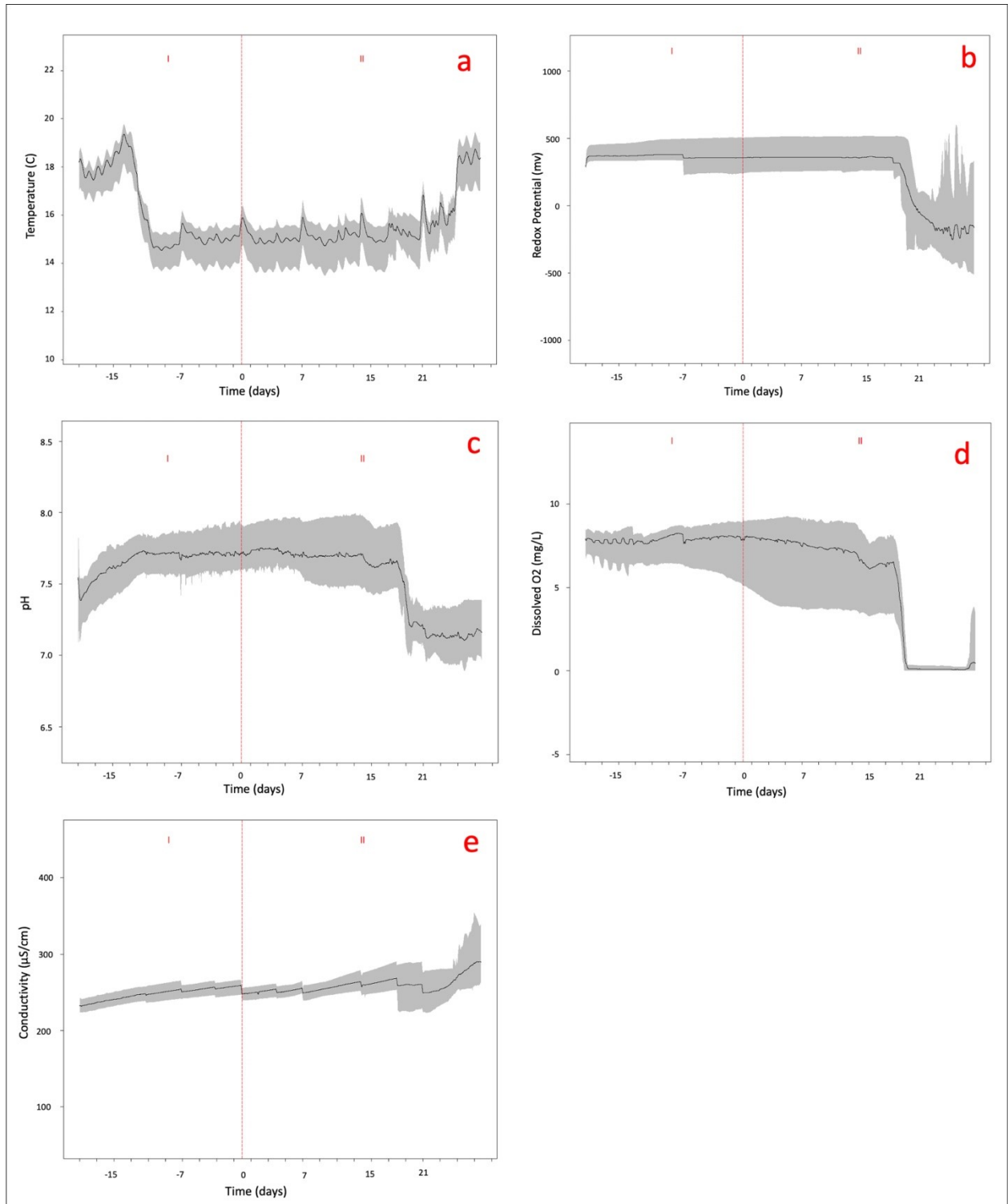


Figure S2.5. Physical-chemical parameters measured in mesocosm water expressed as average value (black line) and standard error between the aquaria (grey area). a) Temperature, b) redox potential, c) pH, d) dissolved O₂ and e) conductivity. The recording was carried out between 19d before and 29d after the first contamination (d0). The red lines (d0), indicate the first contamination and separates the equilibration phase (I) from contamination phase (II).

Supplementary information S3
Bacteria counting in mesocosm sediments

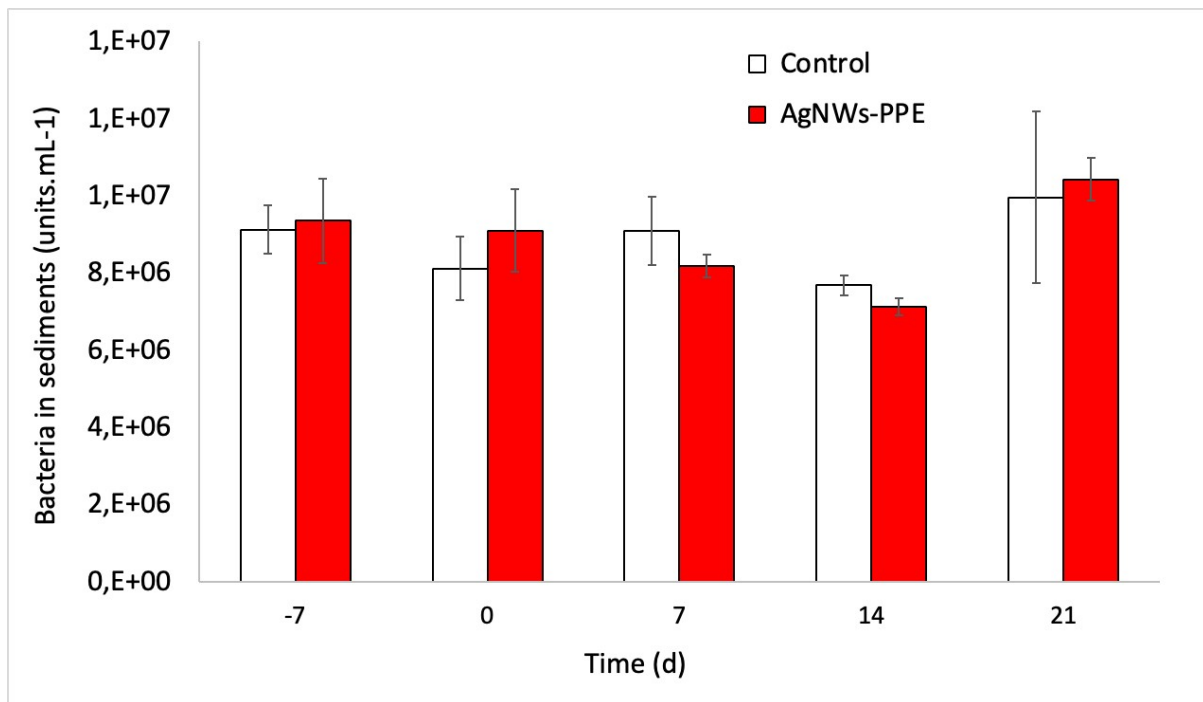


Figure S3. Bacteria counting analysis performed in mesocosm sediments samples collected from AgNWs-PPE (red) and non-amended controls (white) treatments.