Investigating the effect of plants on PAHs dissipation and bioaccessibility in brownfield contaminated soils (3 and 6 months cultures).

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Introduction

The main objective of the study was to investigate the effect of plants on polycyclic aromatic hydrocarbons (PAHs) dissipation and bioaccessibility on an aged-contaminated soil. The tested plants were *Medicago sativa* L. (MS) and *Trifolium pratense* L. (TP) and were compared to unplanted control soil samples (C). The soil originated from a brownfield in Charleroi (Belgium) and the experiment was carried out outdoors. Bioaccessible and residual PAHs were quantified using High-Performance Liquid Chromatography with Fluorimetric Detection (HPLC-FLD).

Part 1: Desorption kinetics

The first step was to adapt a bioaccessibility measurement protocol, using Tenax® beads, to the studied contaminated soil. PAHs desorption kinetics were established for 15 PAHs and described by site distribution models (equation 1).

Site Distribution Model (Equation 1)

$$\frac{S_t}{S_0} = \left(\frac{\beta}{\beta + t}\right)^\alpha$$

S_t/S_0: sorbed fraction
t: Ténax ® extraction time
α and β: model parameters

Example of PAH Desorption Modelling
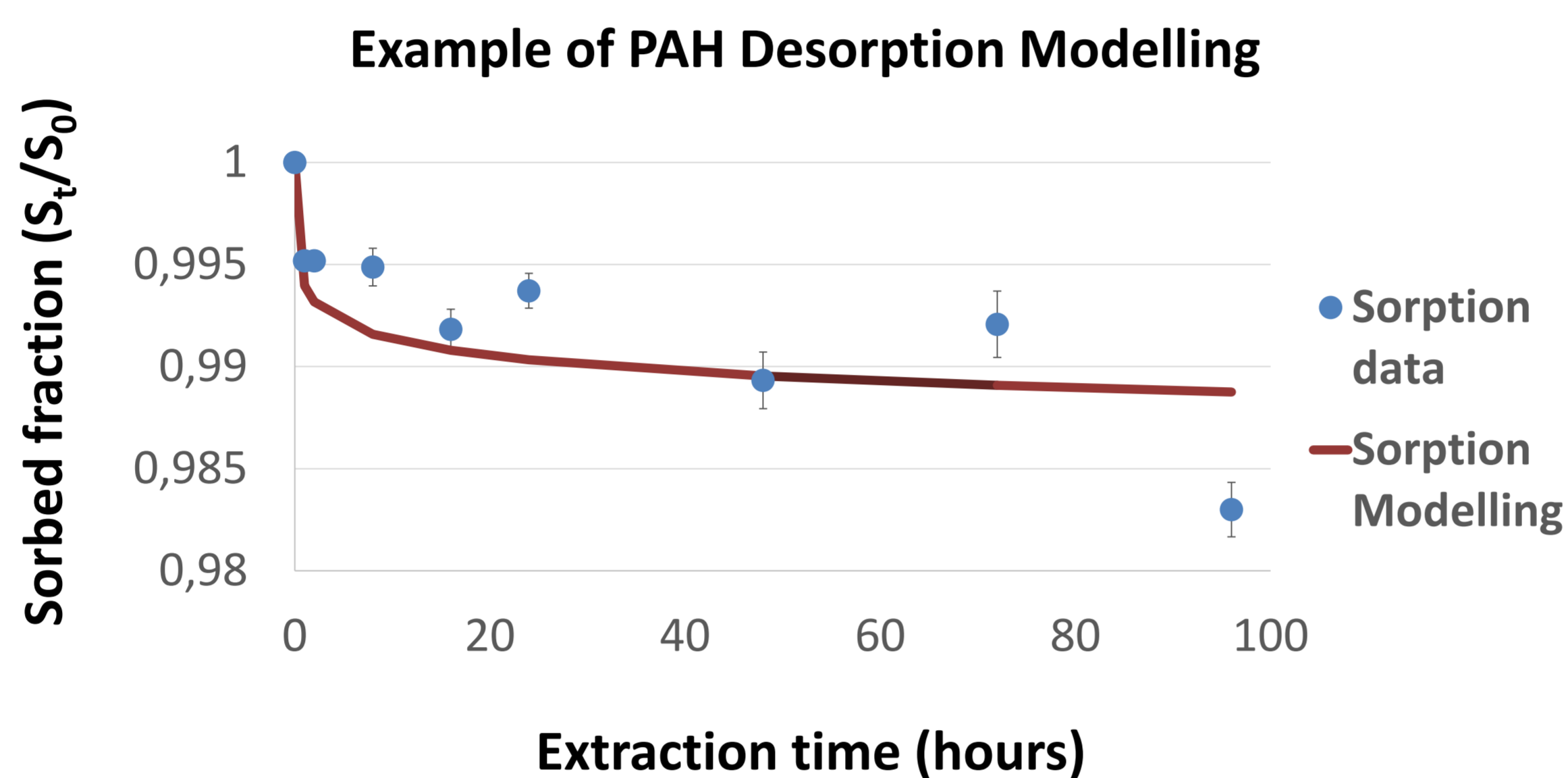
→Minimal extraction times were calculated for all PAHs and ran from 3 to 24h.

→A common Tenax® beads extraction time (24 h) was established as a comparison basis for PAHs bioaccessibility assessment in future samples.

Part 2: Plant culture

C   MS   TP   X 3 and 6 months   X 5 repetitions

Bioaccessible PAHs content   Residual PAHs content
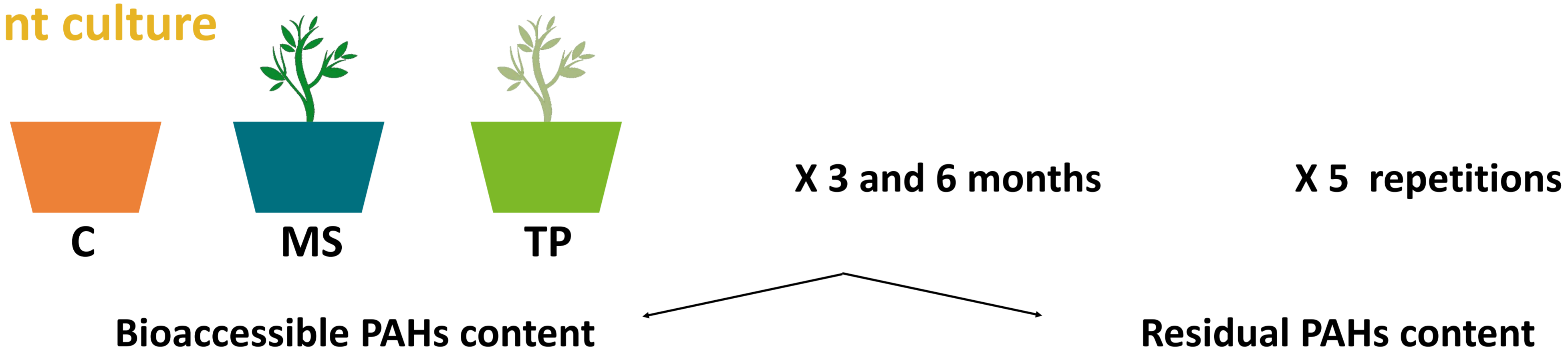
3 and 6 months results

Statistical analysis of variance was performed on total residual content (after log transformation) and on total bioaccessible content. Graphs show mean values ± intervalle of confidence (α=0.05). On each graph, groups with different letters are statistically different (p=0.000).

Total bioaccessible PAHs content
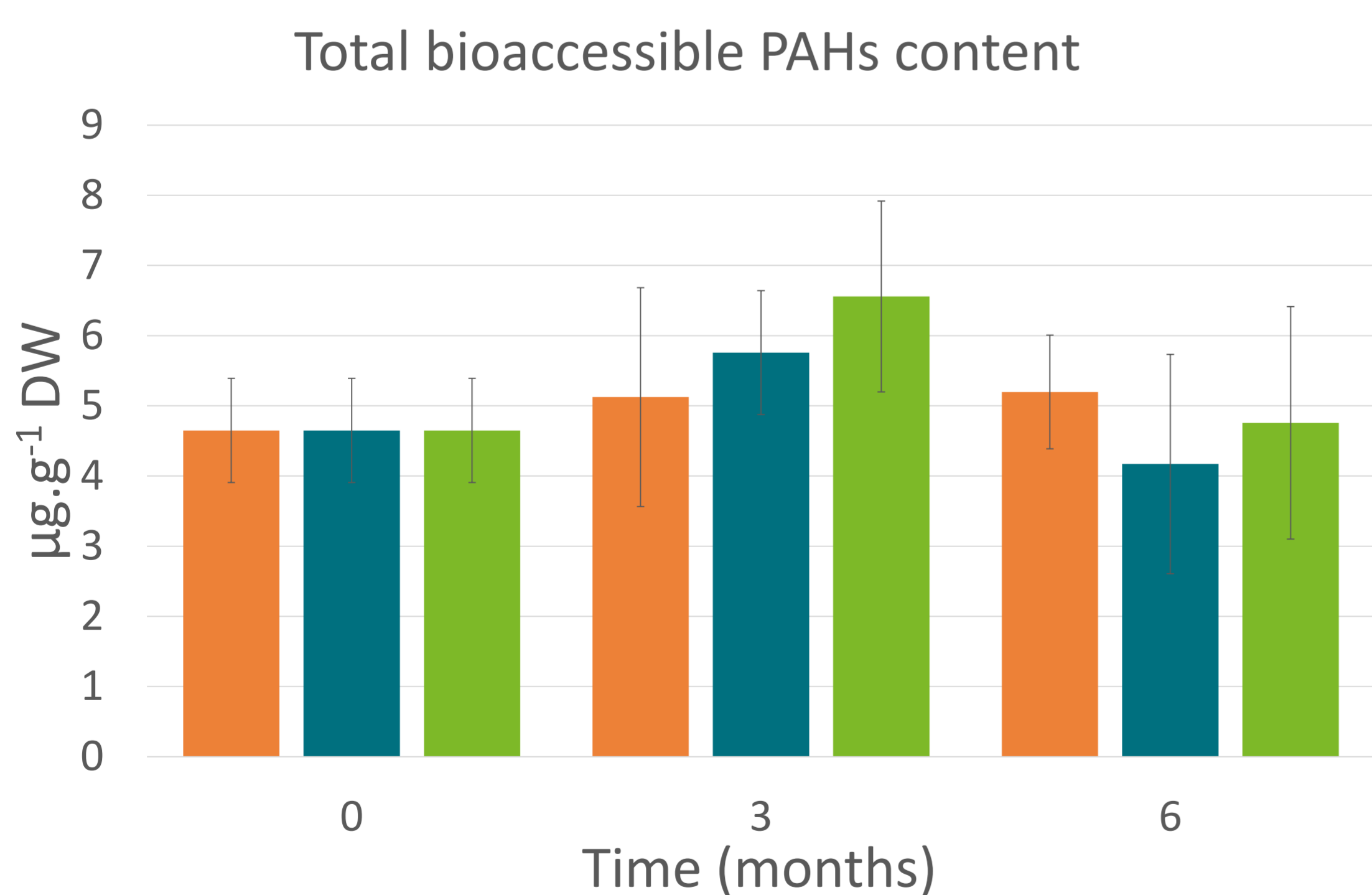
→No effect of time nor plant presence.

Total residual PAHs content
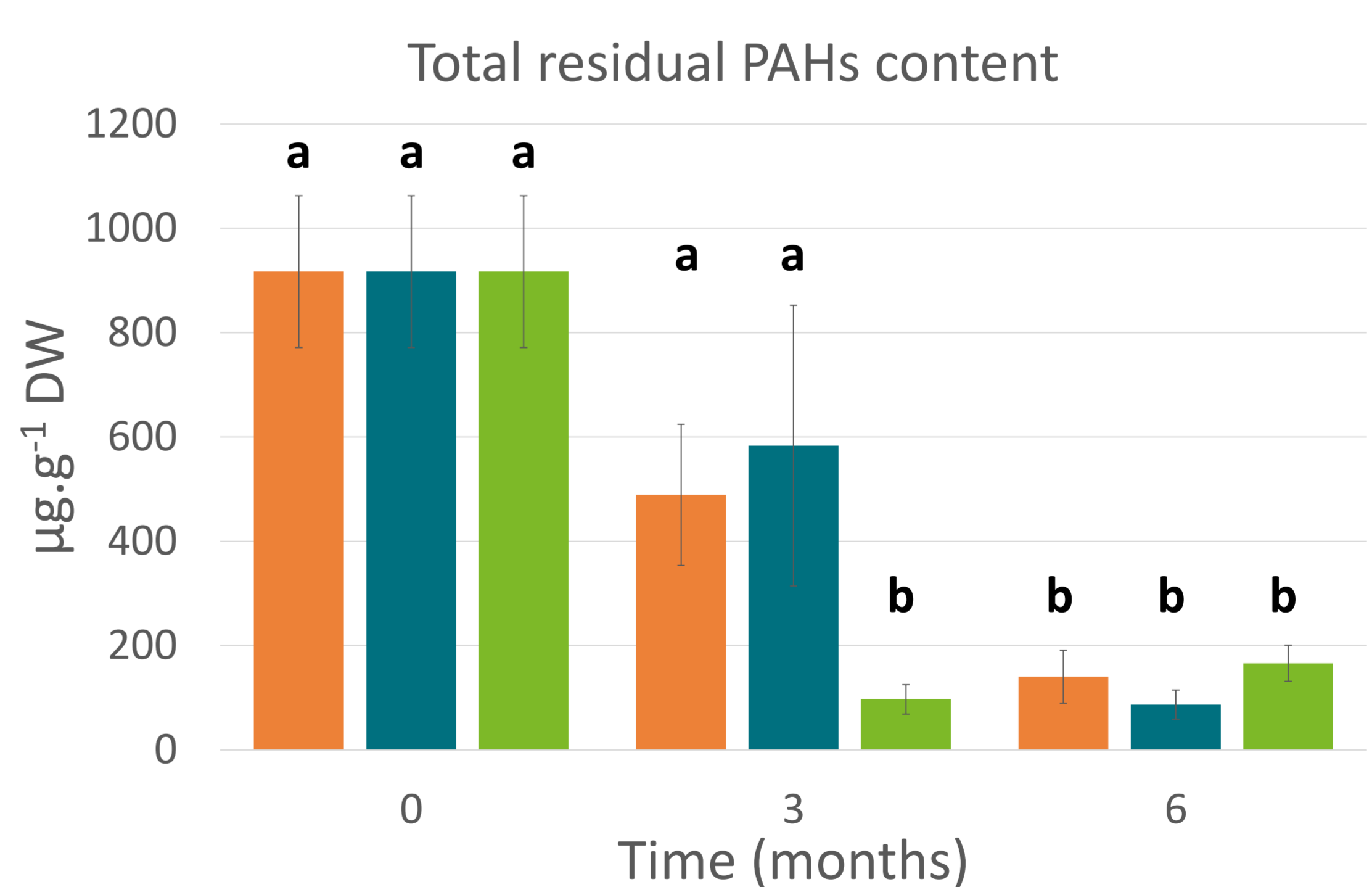
→Significant interaction between time and treatment.
→After 3 months, significant reduction under TP_3months.
→After 6 months, all the treatments reduced the PAHs content in the same proportion.

Perspectives

Longer culture periods (9 and 12 months) will help verify the hypothesis that long-term plant presence does not enhance PAHs dissipation compared to unplanted soil. It will also allow to assess whether plant presence influences bioaccessible contents on the long term.