Plastic particles derived from 3D printed objects induced early biomarkers of cell transformation

Adriana Rodríguez-Garraus[1,2], Mari Venäläinen[1], Jussi Lyyränen[1], Hanna Pulli[1], Apostolos Salmatonidis[3], Davide Lotti[4], Josefa Domenech[1], José F. Fernández[5], Jesús Guzmán-Mínguez[5], Alberto Katsumiti[6], Isabel Rodríguez-Llopis[6], Socorro Vázquez-Campos[3], Marie Carriere[7], Julia Catalán[1]

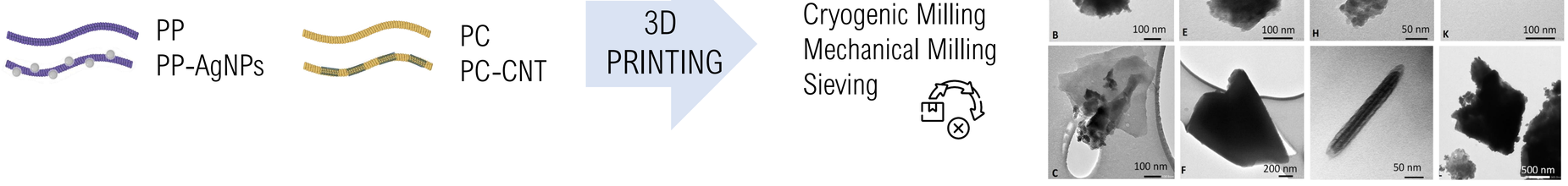
Humans are continuously exposed to micro- and nanoplastics (MNPs) originated from the breakdown of larger plastic waste. MNPs accumulation in tissues and organs raises concerns about their potential impacts on human health, particularly the induction of cancer. Validated carcinogenic studies conducted with rodents present economic and ethical dilemmas. Alternatively, in vitro cell transformation assays (CTAs) enable to simulate the in vivo initiation and promotion stages of carcinogenesis.

OBJECTIVE

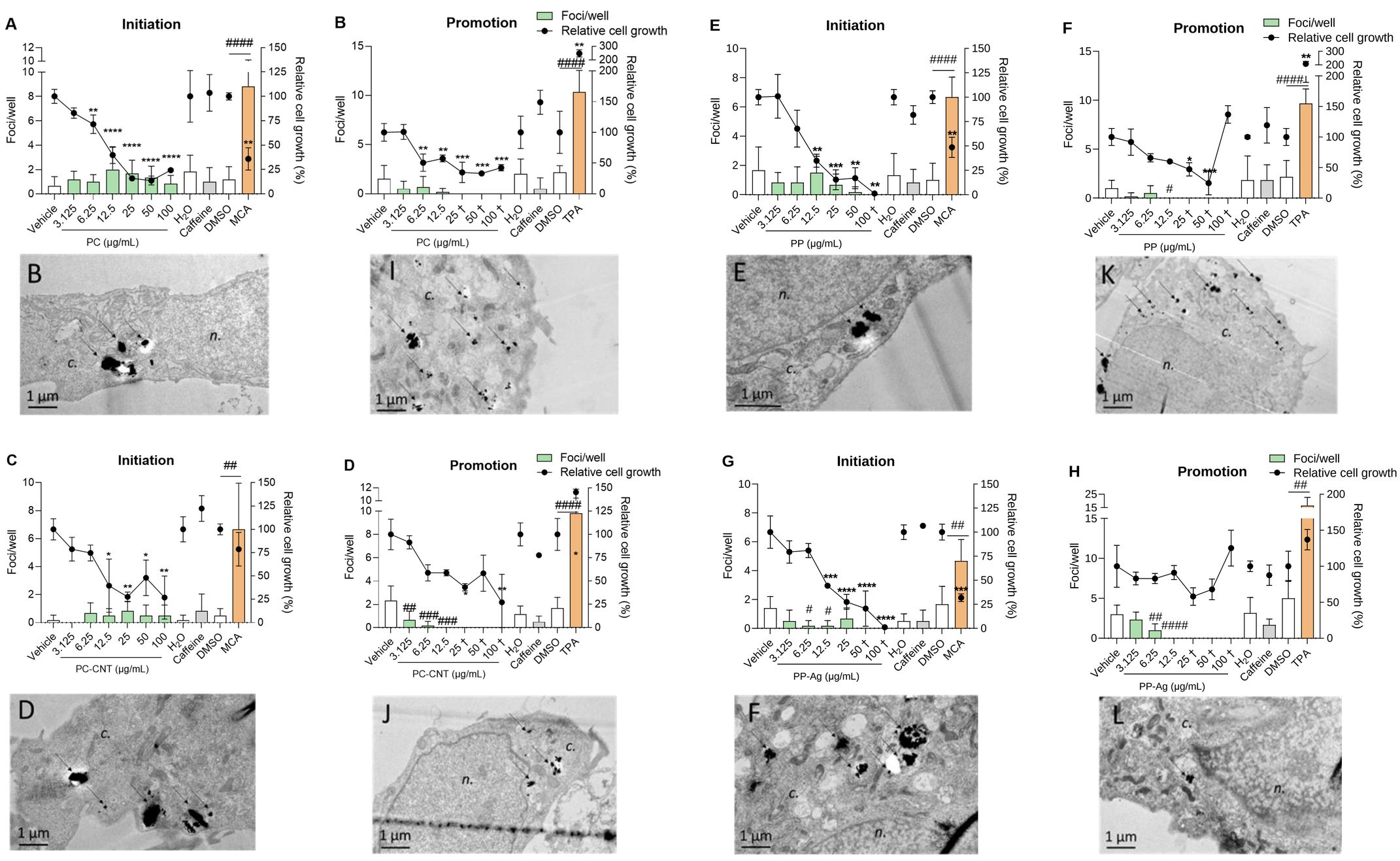
Evaluation of the cell-transforming potential of MNPs produced during the breakdown and degradation of 3D printed objects at the end of the lifecycle, through the validated Bhas-42 CTA.

RESULTS

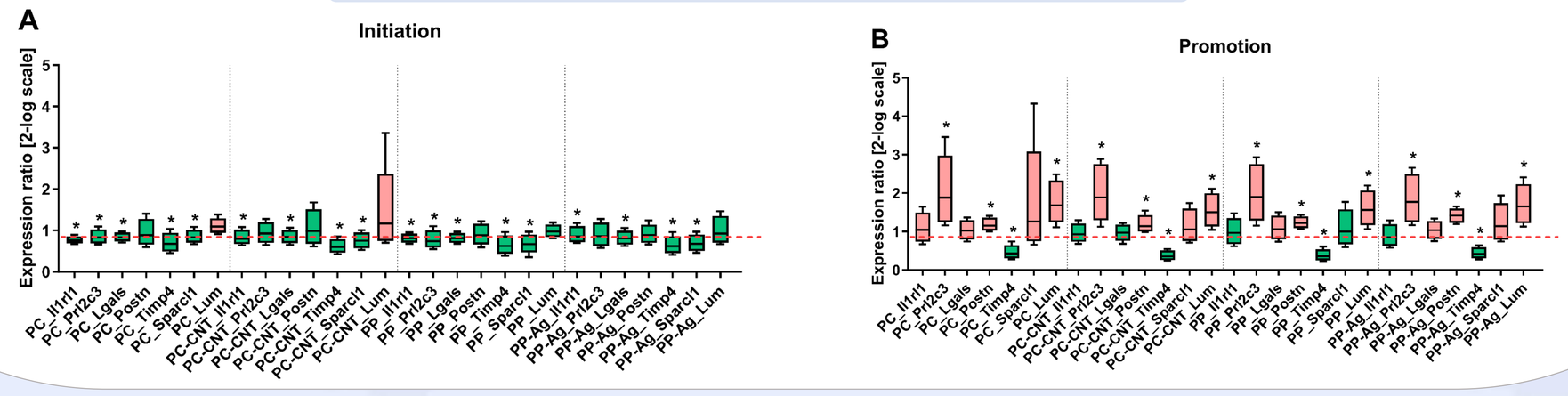
Particles obtention and characterization



In vitro Bhas-42 Cell Transformation Assay and cell internalization



Cell proliferation and cell-cell adhesion gene expression



CONCLUSION

The materials undoped or doped with SWCNTs or silver nanoparticles did not initiate or promote cell transformation in the validated in vitro Bhas 42 assay. However, all materials induced significant dysregulation of the expression of Prl2c3 and Timp4 under promotion conditions, which could indicate early changes that occur before foci formation. Further studies combining in vitro CTAs with analyses of molecular changes are needed to accelerate the assessment of the tumorigenic potential of environmental pollutants, including MNPLs.

This project received funding from the European Union's Horizon 2020 Research and Innovation Program under grant agreement No. 862419 (SAbyNA).

1 Finnish Institute of Occupational Health, 00250 Helsinki, Finland; 2 University of Navarra, 31008 Pamplona Navarra, Spain ; 3LEITAT Technological Center, 08225 Terrassa, Spain; 4 LATI Industria Termoplasti SPA, 21040 Vedano Olona, Italy; 5 CSIC Spanish National Research Council, 28049 Madrid, Spain; 6 GAIKER Technology Centre, Basque Research and Technology Alliance (BRTA), 48170 Zamudio, Spain; 7 Univ. Grenoble-Alpes, CEA, CNRS, SyMMES-CIBEST, 38000 Grenoble, France