ADAPTED METHODOLOGIES FOR SSBD ENVIRONMENTAL HAZARD EVALUATION OF NANOFORMS EMBEDDED IN PAINT FRAGMENTS – SABYNA PROJECT

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BACKGROUND

The aim of the EU-project SAbyNA is to develop tools and methodologies for Safe by Design (SbD) purposes, enhancing the SbD framework to be followed by industrial companies. Within this project, several case studies from different industrial sectors have been evaluated, such as the paint industry, in which different nanoforms (NFs) have been included in their formulations during recent years. The specific structural characteristics of the NFs such as their size, shape, and greater surface area allow modifying the properties of the newly generated paints (NEPs: nano-enabled products) which can enhance their quality, durability, functionalization, etc.

CASE OF STUDY

As one of the paint case studies of this project, mixed metal oxide (MMO) nanoparticles (NPs) were considered by CNRS/CEREGE as an efficient, valuable, and safer alternative to titanium oxides-based materials, currently incorporated in paints to enhance their solar reflectance. These MMO NPs embedded in polymeric paint matrixes developed by CNRS/CEREGE in collaboration with ALLIOS SAS will be the focus of environmental toxicity evaluation. We have adapted different standardized methodologies to evaluate environmental toxicity in aquatic compartments for this specific NF and NEP.

MERGED METHODOLOGIES

Microbial respiration inhibition

OECD 209 + OECD 301F + EN ISO 14851:2019

Acute aquatic toxicity assays

OECD 202

OECD 201

Daphnia magna Feeding rate assay

Microbial Toxicity control

PF + **MC**

PF-NEP + **MC**

MMO NPs + **MC**

M110 (ZnO) + **MC**

BD%

MC

&

PF

PF-NEP

LEACHATES

Aquatic Toxicity

MMO NPs

PF

PF-NEP

ONGOING…

SAMPLES

Acrylic Paint fragments (**PF**)

Mixed Metal Oxide (**MMO**) nanoparticles (NPs)

MMO NPs embedded in Acrylic Paint matrix fragments (**PF-NEP**)

Zinc Oxide reference material (**M110**) from JRC

Microcrystalline cellulose (**MC**) as reference material

RESULTS

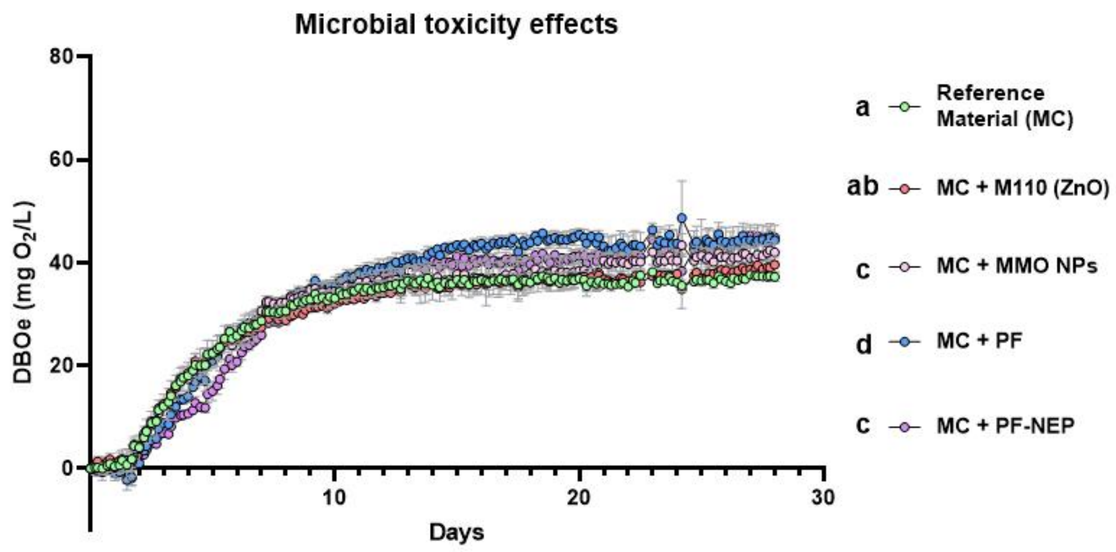

Figure 1. Microbial toxicity effects of the acrylic Paint fragments and nanoforms studied. Represented as the effective biological oxygen demand (DBOe) of the mixtures containing the reference material (MC).

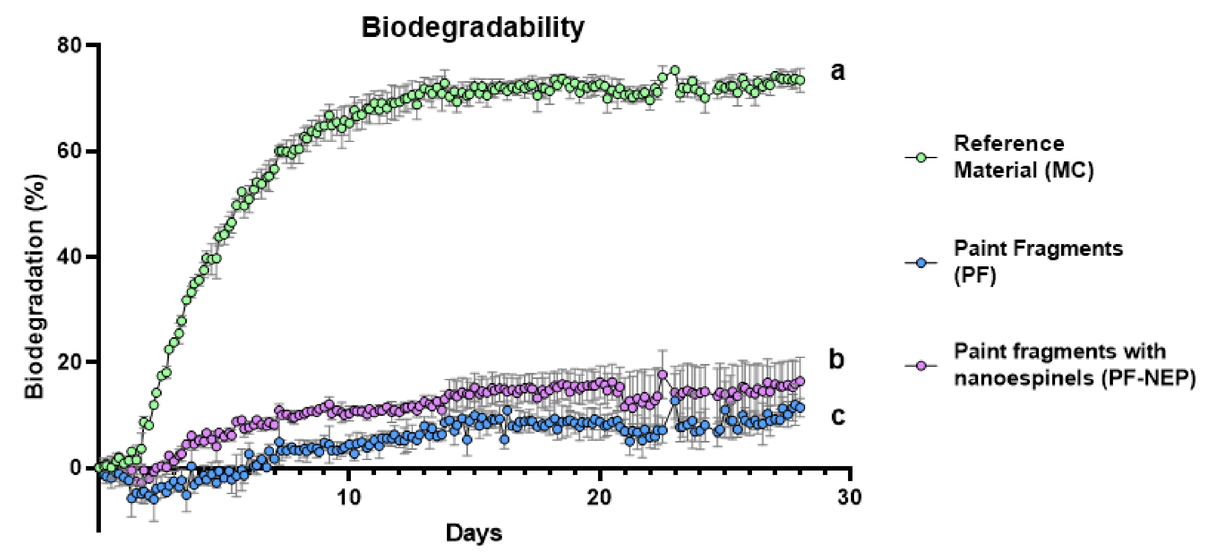

Figure 2. Biodegradation rates (%) of the Paint fragments with and without NEPs compared to a polymeric biodegradable reference material (MC).

DISCUSSION

No inhibitory effect over the microbial community activity was observed for any of the materials studied (Figure 1).

Paint fragments with and without NEPs were not found to be readily biodegradable, with an associated biodegradation percentage of 14 and 11 % respectively (Figure 2).

In summary, the addition of MMO NPs to the acrylic paint improved its biodegradation, with an increase of 3%.

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