
YELLOWING, WEATHERING AND DEGRADATION OF MARINE PELLETS AND THEIR INFLUENCE ON THE ADSORPTION OF CHEMICAL POLLUTANTS

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Abstract

Marine microplastics (MPs) are exposed to environmental factors, which produce aging, weathering, surface cracking, yellowing, fragmentation, and degradation of plastic polymers. This degradation also has an influence on the adsorption of persistent organic pollutants over MPs, increasing their concentration with aging.

Degradation state of MPs can be quantified using the yellowness index (YI) and it is related with changes on FTIR spectrum of plastic composition due to the oxidation of chemical compounds. In this study, the degradation state of marine microplastic polyethylene pellets with different aging stages is evaluated and quantified by YI determination and FTIR spectra analysis. A color palette, which is related to the color of the microplastic and the YI, was developed to obtain a visual percentage of this index (downloadable at <https://bit.ly/microplasticYI>).

The proposed quantified color palette allows to obtain an approximate YI value of the MP color for PE pellets. Samples with high YI values also showed a relevant modification on FTIR signals.

Moreover, aging and weathering of MPs over time in the environment are directly related with higher adsorption rate of POPs on these particles. It has been studied in PE pellets for 15 OCPs, 8 PCBs and 6 PAHs. The increase in POP adsorption rate has two different (but related) reasons: the high relative surface/volume value due to MP surface fragmentation and cracking; and the increase in the age of the MPs, which have undergone weathering and yellowing processes due to photo-oxidation of the plastic composition.

Keywords: microplastic, pellets, weathering, FTIR, Yellowness index, persistent organic pollutants.

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