IS THE SOIL TYPE INFLUENCING THE ABOVE-GROUND DEGRADATION OF OXO-DEGRADABLE POLYETHYLENE THIN FILMS?

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In some applications, such as agricultural crop propagation films, it is necessary to control the rate of degradation of the film above ground to enable a healthy crop growth. Several studies have investigated the photo- and/or thermo-oxidation of polyethylene (PE) in sunlight [1,2] and buried in soil or compost [3,4]. The rate of PE degradation can be influenced by the grade of polymer as well as the concentration or type of pro-degradants and also by environmental factors, such as type of soil [5], UV spectral irradiance and dose, air temperature and humidity. Evaluation of the impact of all these environmental factors including the effect of soil type on the above-ground degradation of PE has not previously been addressed and needs to be defined to allow the development of PE films with predictable and reliable above-ground degradation.

The above-ground degradation of oxo-degradable PE thin films containing TiO_2 or Fe (II) stearate pro-degradants has been investigated over a range of soils with varying organic matter (OM) concentrations as well as humic and fulvic acids, which are the most active component of the organic matter. The characteristics of the soils used in the study are shown in Table 1. Samples were aged using a Q-Sun accelerated weathering device. This device simulates day & night cycles, whilst controlling the air temperature and humidity. FTIR-ATR was used to measure the extent of oxidation by characterization of the carbonyl index. Films containing TiO_2 were also analyzed by UV-Vis spectroscopy and SEM to monitor changes in film opacity and topology during oxidation.

Table 1: Soil Characteristics

Soil	**OM 4.5**	**OM 6**
Colour	Red Brown	Grey
pH (water)	7.2	7.1
% organic matter	4.5	6

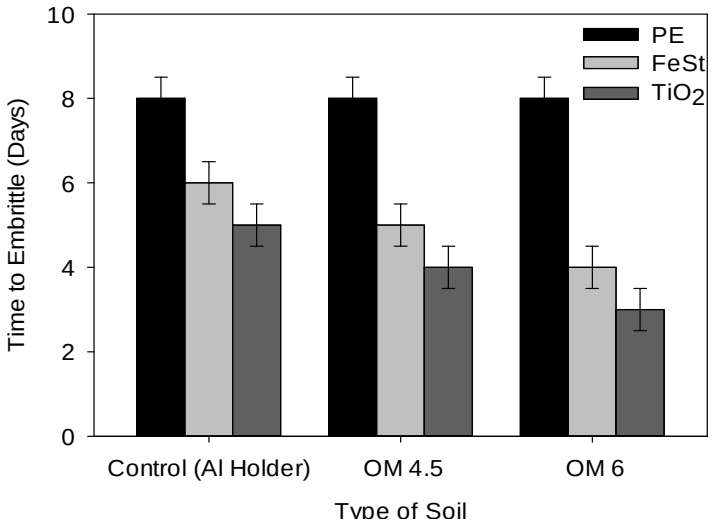

Figure 1. Time to embrittle for oxo-degradable PE films over soil.

Fig. 1 presents the time to embrittlement for all films over soils containing different concentration of organic matter. The rate of degradation of oxo-degradable PE films was increased when the amount of organic matter in the soil increased. These results suggest that organic matter within the soil may impact on the rate of above-ground degradation of PE. From preliminary results, the humic acids present in the organic matter when exposed to the sun are degrading, forming volatiles species [6], that might be responsible for this increase in rate of above-ground degradation of PE. Possible mechanisms and other results will be presented.

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