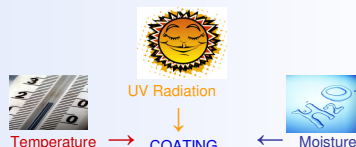


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### INTRODUCTION:

The combined action of UV radiation, heat and moisture can cause changes in the chemical structure of a polymer. Such chemical changes influence the physical properties of coatings and consequently lead to failure (cracking, gloss loss, blistering, etc.) and reduction of life-time.



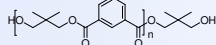
### AIM:

To improve weathering resistance of polymers by discovering and understanding the critical degradation mechanism of this material.

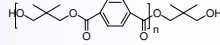
### EXPERIMENTAL PART:

> Materials: 12 μm coatings of:

Poly(neopentyl isophthalate) PNI



Poly(neopentyl terephthalate) PNT



> Degradation

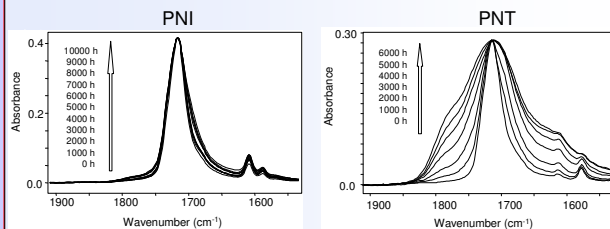
- Laboratory - Suntester XXL+, (xenon lamp, λ > 300 nm) (PNI and PNT)
- Outdoor (PNI)

> Analytical techniques.

- ATR-FTIR - Infrared spectroscopy
- SEC - Size exclusion chromatography
- MALDI-ToF MS - Matrix assisted laser desorption ionization time of flight mass spectrometry

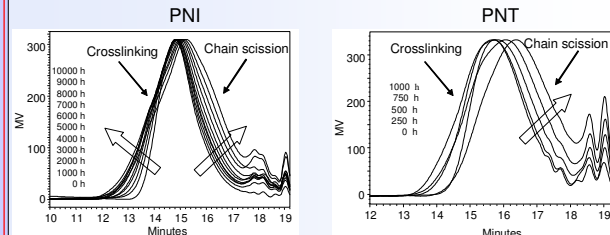
### RESULTS AND DISCUSSION:

ATR-FTIR (-C=O) spectroscopy was used to monitor the formation of carbonyl groups at the polymer surface during photodegradation in the Suntester XXL+



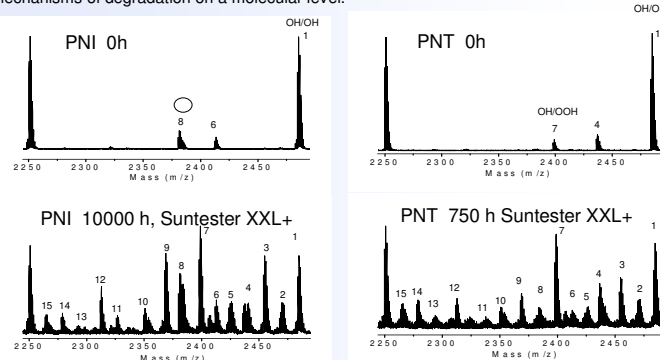
Extensive formation of carbonyls in PNT and only minor in PNI.

SEC was performed to determine changes in molecular weight of polyesters during photodegradation in the Suntester XXL+



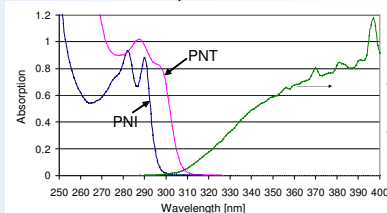
Photodegradation leads to chain scission and crosslinking of PNT and PNI. The extent of both reactions is much higher for PNT as compared to PNI in the same amount of time

MALDI-ToF MS provides highly informative data about the molecular structure of the degradation products of the very first reactions taking place. This allowed us to study the mechanisms of degradation on a molecular level.

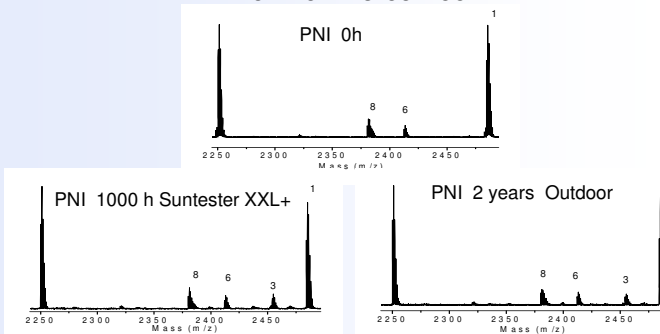


UV exposure of PNI and PNT leads to the same products, which confirms common mechanism both photolysis and photooxidation.

UV absorption of PNI and PNT and Spectral Power Distribution of Suntester lamp

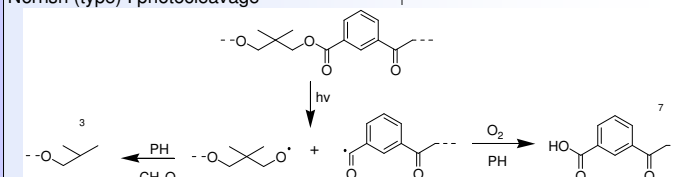


### LABORATORY VS. OUTDOOR



UV exposure of PNI under laboratory (Suntester XXL+) and Outdoor conditions leads to the same products in the initial stage of degradation.

### Norrish (type I) photocleavage



Although Norrish type I photocleavage can take place at three positions of the ester group, it has been established that the bond between oxygen and the carbonyl of the ester group is cleaved primarily.

### CONCLUSIONS:

- 1) PNI is much more UV stable than PNT (common mechanisms of degradation was established).
- 2) Chain scission and crosslinking takes place simultaneously under UV.
- 3) MALDI-ToF-MS analysis provides detailed structural information on products formed during degradation.
- 4) Norrish (type I) photocleavage takes place primarily between oxygen and the carbonyl of the ester group.
- 5) The same products are formed in the initial stage of degradation under Laboratory and Outdoor conditions.