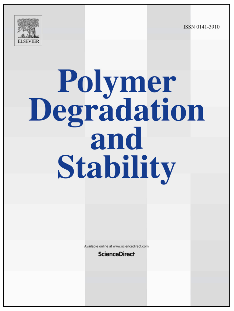

A review on the mechanism of action and applicability of Hindered Amine Stabilizers

Pieter Gijsman

PII: S0141-3910(17)30135-0

DOI: 10.1016/j.polymdegradstab.2017.05.012

Reference: PDST 8231

To appear in: *Polymer Degradation and Stability*

Received Date: 20 March 2017

Revised Date: 4 May 2017

Accepted Date: 17 May 2017

Please cite this article as: Gijsman P, A review on the mechanism of action and applicability of Hindered Amine Stabilizers, *Polymer Degradation and Stability* (2017), doi: 10.1016/j.polymdegradstab.2017.05.012.

A review on the mechanism of action and applicability of Hindered Amine Stabilizers

Pieter Gijsman

DSM Ahead b.v., P.O. Box 18, 6160 MD Geleen, The Netherlands
Tel.: 0031 46 4761538. E-mail address: pieter.gijsman@dsm.com

Key words: UV-stability, long-term heat stability, antagonism, synergisms, HALS, HAS

1 Abstract

Hindered Amine Stabilizers (HAS) are by far the best performing UV-stabilizers and in a number of applications they are the best performing long-term heat stabilizer too. In this paper an overview is given of the different mechanisms proposed that can explain the high activity as well as the applicability of HAS as UV-stabilizer and as long-term heat stabilizer.

2 Introduction

After the introduction of the first hindered amine light stabilizer (HALS) in the 1970ths, they rapidly became the most important UV-stabilizer for the majority of plastics. Due to their high activity they are nowadays in use for the light stabilization of many organic polymers (e.g. polyethylene, polypropylene, thermoplastic polyolefins and elastomers, coatings, styrenic polymers, polyamides, polyurethanes, polyacetals adhesives and sealants). Without the discovery of HALS the outdoor applicability of many polymers would be limited. The good performance of HAS is clearly shown in references 1, 2 and 3.

The invention of HALS was based on the discovery that the 2,2,6,6-tetramethyl-1-piperidinyloxy free radical ((TEMPO) Fig. 1) is a very effective radical scavenger [4,5]. However, due to its physical and chemical properties TEMPO itself cannot be applied. TEMPO is coloured, and thus will discolour a polymer, it is thermally unstable and volatile [5]. It can also react with phenolic antioxidants present in many polymers as processing and/or long-term heat stabilizer. The discovery that compounds in which the N-oxyl functionality was replaced by a N-H functionality also showed good UV