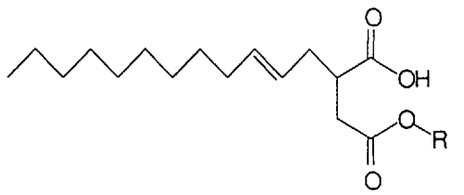
CHIMIA 48 (1994) Nr. 9 (September)



Dodecenyl succinic acid half ester
(Irgacor L 12)

ther oxidized by oxygen to ferrous(III) hydroxide: rust.

For rust inhibition, preferred compounds are those containing a highly polar group with a long alkyl chain. Structures of this type have a strong affinity for metal surfaces and can form dense hydrophobic protective films.

In addition to the simple fatty acids, the half ester and half amid form of dodecenylsuccinic acid (*Irgacor L 12*) have been widely accepted as rust inhibitors.

4. Conclusions

Today, there is increasing pressure on paint manufacturers to phase out solvents and heavy metals from all types of paint. Accordingly, new corrosion inhibitors are required in order to give water-borne paints the same performance as solvent-based coatings. To fulfill these requirements, a new class of environmentally acceptable corrosion inhibitors for aqueous paint systems is under development.

The demand for lubricants with extreme maximum load and extended life time, as well as increasing legislation and control in the environmental area in recent years, has put pressure on lubricant formulators to considerably improve the quality of their products. This in turn stimulates *Ciba*'s additive research and development efforts to fulfill the needs of their customers.

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[1] D. A. Jones, 'Principels and Prevention of Corrosion', Macmillan Publishing Comp., New York, 1992.
[2] J. S. Robinson, 'Corrosion Inhibitors Recent Developments', Noyes Data Corp., New Jersey, 1979.
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Light Stabilizers

Gerhard Rytz*, **Jean-Luc Birbaum**, and **Alfred Steinmann**

Abstract. Current trends in the light stabilization of polymers and coatings are summarized, with emphasis on UV absorbers and free-radical scavengers.

1. Introduction

Light and oxygen cause photo-oxidative reactions in polymer materials and, as a consequence, a change of their visual aspect and of their physical and mechanical properties. Light stabilizers (photostabilizers, UV stabilizers) are additives which retard or prevent such detrimental processes [1][2]. Their technical and economical significance is impressive, since they do not only improve the quality of most polymer products, but also contribute to new applications and technologies. Depending on the inherent light stability of the substrate to be stabilized and its application, light stabilizers are applied in concentrations between 0.05 and 2%. The light stabilizers are selected from the following classes:

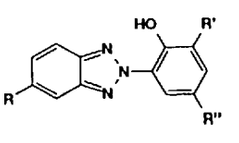
- UV absorbers and light screeners
- free-radical scavengers
- hydroperoxide decomposers
- quenchers

Light-stabilizer research at *Ciba* in Marly contributes to provide new solutions to industry problems by synthesizing novel photostabilizers, and by investigating theoretical and practical aspects of photodegradation and photostabilization of polymer materials under different conditions. Running projects are summarized below.

2. Synthesis and Characterization of Novel UV Absorbers

The most commonly used UV absorbers are 2-(2-hydroxyphenyl)-1,2,3-benzotriazoles (HBT) **1**.

A wide range of commercial HBT is available. Collaboration with the University of Stuttgart (Prof. *H.E.A. Kramer*) has recently broadened theoretical insight into protection mechanisms of HBT [3]. The absorption of an UV photon leads to a singlet excited state undergoing an intramolecular proton transfer which is of fundamental importance. Internal vibrations



1

R = H, CH_3, Cl
R', R'' = (un)substituted alkyl

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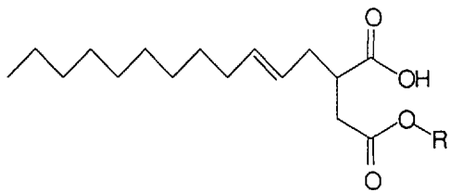

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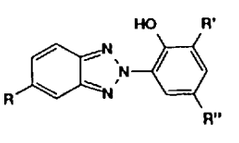

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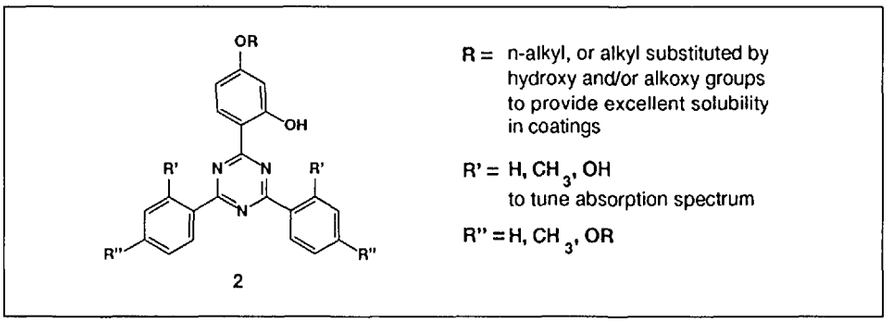

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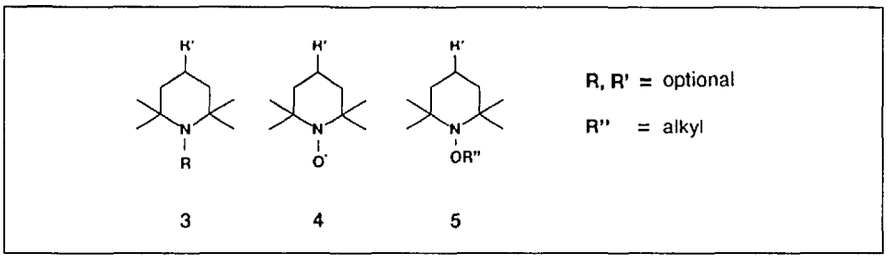

3 4 5

and torsional modes of the molecule are responsible for the extremely rapid and effective radiationless deactivation.

Another promising new class of UV absorbers, the 2-(2-hydroxyphenyl)-1,3,5-triazines **2** [4] is being investigated and developed for application in coatings, plastics, and color photographic paper.

Such UV absorbers exhibit very high performance and thermal stability. They can be made liquid by appropriate choice of the substituents R, R', and R''. The liquid form is preferred for automotive coatings.

3. Adjustment of New Hindered Amine Light Stabilizers (HALS) to Future Technologies

HALS compounds have been known for more than 30 years. Commercially available HALS are based on 2,2,6,6-tetramethylpiperidine (**3**, R = H, R' = H).

HALS **3** (R = H, CH_3) as well as its nitroxyl radical **4** and the *N*-alkoxyamine **5**, both produced from **3** during photo-oxidative degradation of polymers, are all extremely effective free-radical scavengers [5] and stabilizers for plastics and coatings. Compatibility and long-term retention are obtained by adjustment of R'.

Migration of post-added traditional HALS **3** amd attachment of functionalized new HALS (*e.g.* R, R' = unsaturated groups) to the polymer are both subjects of current investigations. In the latter case copolymerization or grafting techniques are applied, *e.g.* grafting during extrusion ('reactive processing'). Polymer-bound photo-stabilizers outperform traditional products in special new applications such as polymer blends or systems in extractive environments.

4. Conclusion

Polymers and coatings of extended lifetime require light stabilizers of increased performance. New products offer better protection due to their superior efficiency and their ability to remain in the substrate.

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Recent Developments in Radical Photoinitiator Chemistry

Allan F. Cunningham, Vincent Desobry, Kurt Dietliker*, Rinaldo Hüsler, and David G. Leppard

Abstract. Radiation curing is an established technology used in many industrial manufacturing processes. New applications and technical specifications stimulate the continuous development of tailor-made photoinitiators which can efficiently meet specific requirements. A new class of radical photoinitiators, bisacylphosphine oxides (BAPO), give four initiating radicals per photoinitiator molecule and undergo photobleaching of the low-energy absorption band. These features make the compounds highly efficient for radiation curing of highly opaque white pigmented systems, thick coatings, or fiber-reinforced formulations.

1. Introduction

Light-induced polymerization is the basis of important advanced technologies, since it is among the most efficient methods capable to achieve fast and extensive curing of multifunctional oligomers and monomers. Highly reactive systems are cured within a fraction of a second upon exposure to intense UV radiation or laser beams, transforming the liquid resin into a strongly cross-linked solid polymer without the need of additional heat [1].

These features translate into technical advantages which made radiation curable coatings one of the most rapidly develop-

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