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# Controlling degradation process on thin layers of conjugated polymers

R. M. Ibiapina[(1)], M. A. S. Rios[(2)] J. M. Guimarães Neto[(1)] and A. A. Hidalgo[(1)*]

(1) Departamento de Física – Centro de Ciências da Natureza – Universidade Federal do Piauí – Brazil - *Campus* Universitário Ministro Petrônio Portella - Bairro Ininga - Teresina – PI - ZIP: 64.049-550.
(2) Departamento de Química – Centro de Ciências da Natureza – Universidade Federal do Piauí – Brazil - *Campus* Universitário Ministro Petrônio Portella - Bairro Ininga - Teresina – PI - ZIP: 64.049-550.
* **Corresponding author**: angel.ufu@gmail.com

**Abstract** – Oxidation of conjugated systems is the primary mechanism of degradation of organic light-emitting devices. Gold nanoparticles have been suggested as quenchers of this mechanism. In this work we compare two promising compounds to reduce the oxidation process and delay completely degradation of thin films of MEH-PPV. We determine the degradation rate of thin films of poly(2-methoxy-5(2'-ethyl)hexoxy-phenylenevinylene) (MEH-PPV) cast on glass substrates with different relative concentrations of technical Cashew Nut Shell Liquid (CNSL). CNSL is of natural origin, and show the best results, achieving almost zero rate of degradation for just 10% on films exposed during 200min to ultraviolet light.

Organic Light-Emitting Diodes (OLEDs) degradation is through photo-oxidative processes, the consequence is the reduction on quantum efficiency of devices, and for long periods of operation, failure of the device [1]. The degradation mechanism is not completely clear, however at the end of the process many carbonyl groups can be observed by FTIR and RAMAN spectroscopy. These groups acts as quenchers of fluorescence and the concomitant conjugation length decrease reduces the carrier mobility. In recent years, the Technical Cashew Nut Shell Liquid (CNSL) contains alkyl-substituted phenolic compounds; important molecules that show antioxidant activity due their structures [2]. Composition of this oil depends on the extraction method, the CNSL obtained by hot oil process entitled technical CNSL, due to the easy thermal decarboxylation of anacardic acid, shows in its composition cardanol and cardols in small quantities. This work shows the potential use of technical CNSL as antioxidant for the development of OLEDs without taking care on the presence of oxygen. Figure 1 and Table I, show the resultant rate of degradation of cast films irradiated with an UV-lamp of 40W. The degradation rate was monitored at 550nm and the plot observed on Figure 1 is $ln(A_t/A_0)$, in other words, the actual absorbance $A_t$ at 550nm is always compared with the initial absorbance $A_0$ at the same wavelength. The resultant plot is non linear, indicating that more than one mechanism of oxidation are acting. The degradation of the pure MEH-PPV sample was complete on around 60 min. Different relative concentrations show that around 80min the degradation reaches a linear behavior and for 10%, the sloop is close to zero (see Table I). This indicates that the reaction of degradation achieves a stable condition where all the oxidative processes initiated by interaction with light are quenched by the presence of the CNSL. The next step will be to produce and test an OLED device using this compound to protect the active layer.

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**Table I:** rate of degradation at different relative concentrations

| Relative concentration Mass % | Rate of degradation (min) |
|---|---|
| 0,0 % | -(0,013±0,001) |
| 1,0 % | -(0,0017±0,0002) |
| 5,0 % | -(0,0007±0,0001) |
| *10,0 %* | -(0,0002±0,0002) |

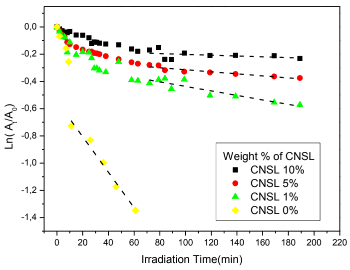


**Figure 2:** Degradation rate at 550nm with different concentrations of CNSL.

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