A novel co-monomer based on Ellagic Acid for free radical polymerization of N-vinyl-2-pyrrolidone

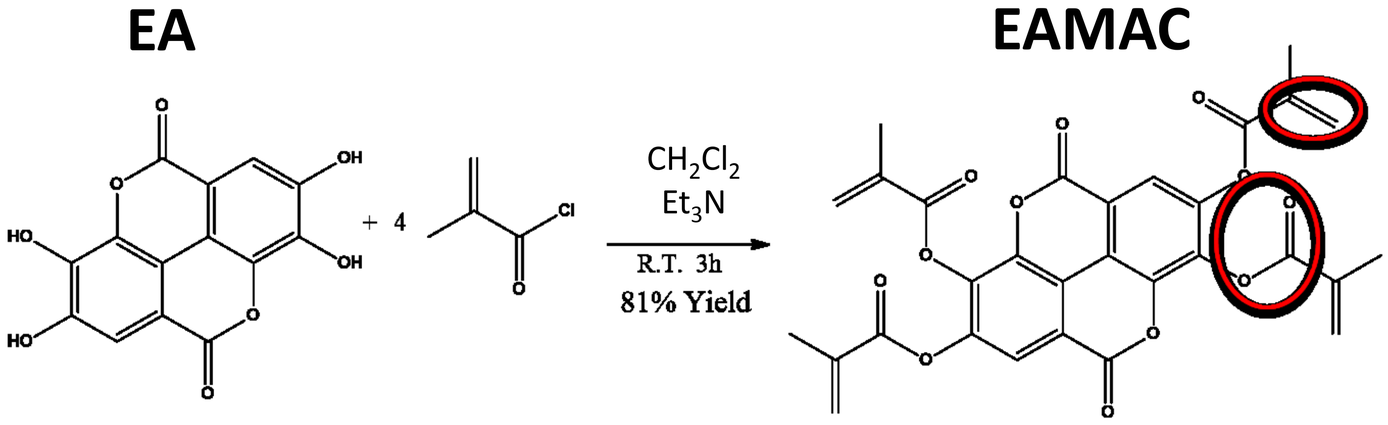
Stefano Antenucci*[a], Marco Aldo Ortenzi[a], Hermes Farina[a], Stefano Camazzola[a], Luisella Verotta[b]

[a] *CRC Materiali Polimerici (LaMPo), Dipartimento di Chimica, Università degli Studi di Milano, Via Golgi 19, 20133 Milan, Italy*

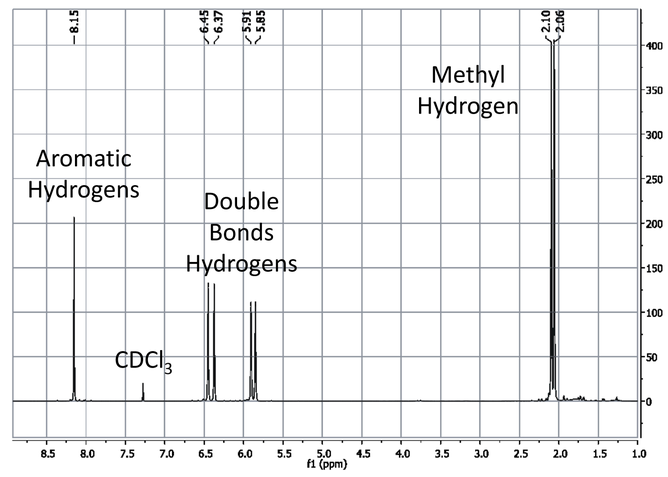
[b] *Department of Environmental Science and Policy, University of Milan, via Celoria 2, 20133 Milan, Italy*

Ellagic Acid (EA) is one of the most abundant and relevant antioxidants present in fruits like berries and pomegranate [1]; on the other hand, its poor solubility both in water and in organic solvents limits its reactivity and its use as food supplements. The aim of the present work is to modify the structure of the EA in order to use it as co-monomer for radical polymerization of N-vinyl-2-pyrrolidone (NVP) achieving two main goals: protection of antioxidant moiety and different release pathway.

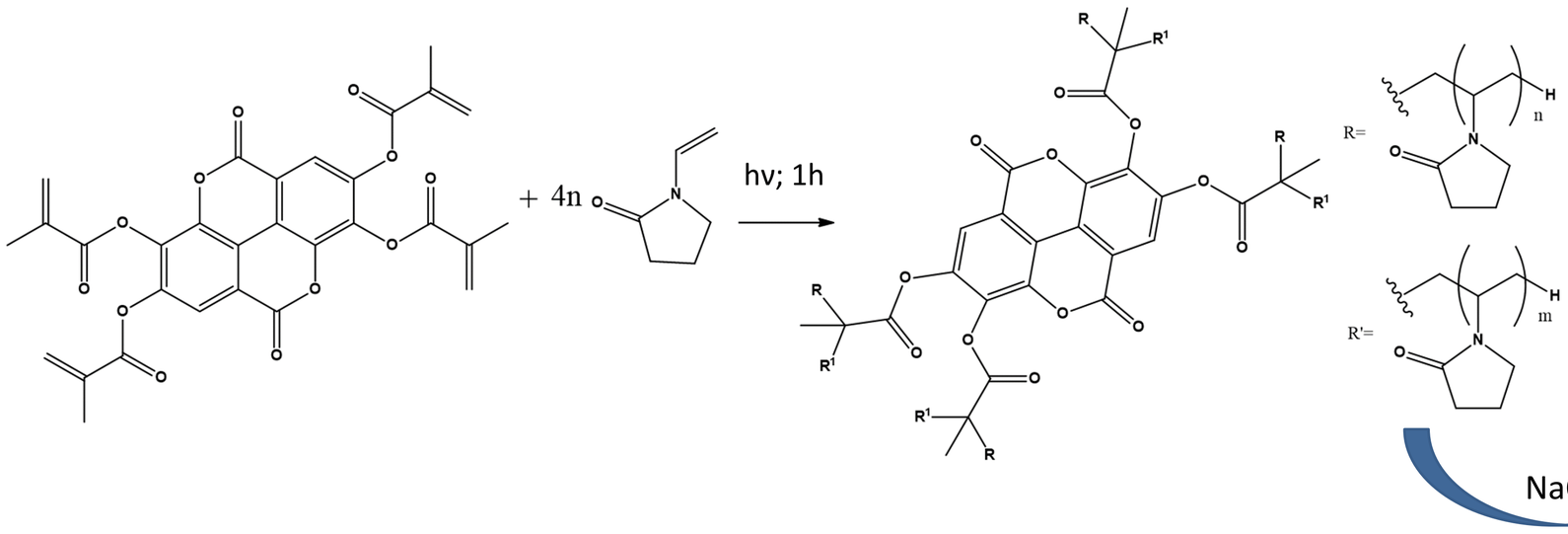
EA → EAMAC

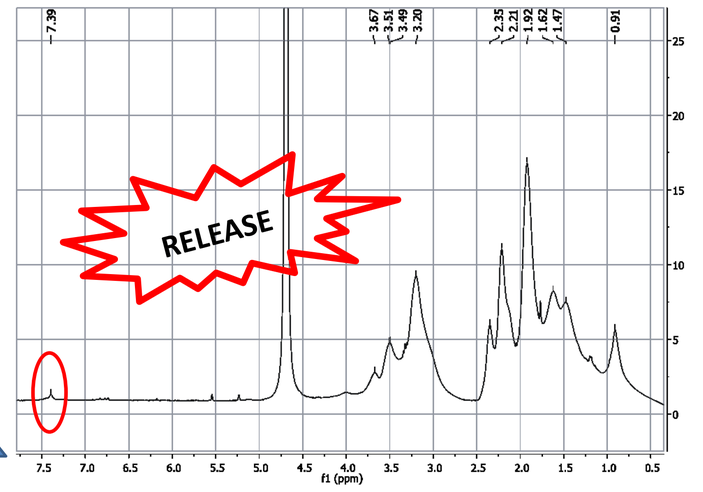


1H-NMR

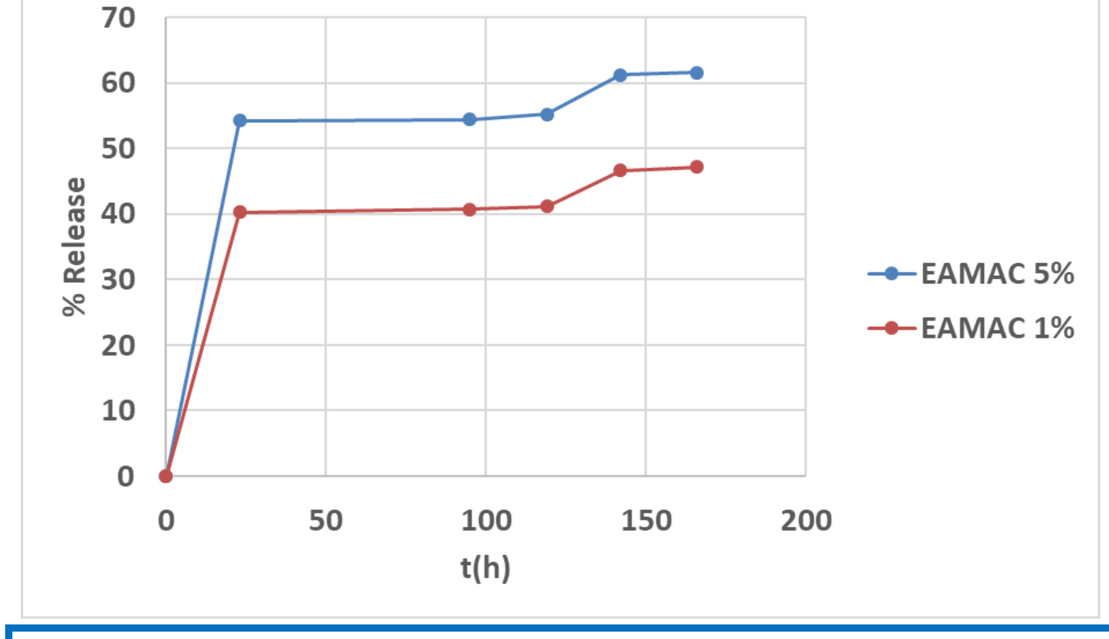


The reaction proceeds in heterophase enhancing the yield and simplifying the purification (HCl quenching); moreover the product (EAMAC) is soluble in organic solvents (CH_2Cl_2, CH_3CN). The core structure of ellagic acid is not modified; on the other hand, the reaction with acryloyl chloride gives a new reactivity to EA. In this way, Ellagic Acid can be used as multifunctional co-monomer for free radical polymerization.





Modified EA can be polymerized with NVP obtaining a cross-linked material: a highly water compatible web that, in hydrolytic conditions, is able to release the EA. In this way EA can be released slowly and, at the same time, PVP chains can be solubilized and consequently eliminated.
The release of EA from PVP-EA cross-linked polymer were also assessed using mild conditions: the assay was performed at 37°C in phosphate buffer with molar strength



- Burst release in the first 24h of almost 50% of EA followed by another release of EA after 120h in PBS at 37°.
- It is possible to assume that at first EA released is ascribable to partially reacted EAMAC whether later EA released is ascribable to the completely reacted EAMAC.
- Both polymer are not completely solubilized → EA still bonded to PVP chains.
- Continues release can be achieved for a very long time

A new approach for the release of Ellagic Acid was pursued: a relatively simple modification of EA permits to use it as co-monomer for free radical polymerization obtaining a highly UV-sensible molecule able to act as chain initiator. Ellagic acid can be released in PBS solution for a prolonged time.

(1) [1] Verotta, L.; Panzella, L.; Antenucci, S.; Calvenzani, V.; Tomay, F.; Petroni, K.; Caneva, E.; Napolitano, A. Fermented pomegranate wastes as sustainable source of ellagic acid: antioxidant properties, anti-inflammatory action, and controlled release under simulated digestion conditions. Submitted to Food Chemistry, 2017

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