MONITORIZATION OF HEXANAL AS LIPID OXIDATION INDICATOR IN A PROCESSED MEAT PRODUCT PACKAGED WITH POLY(LACTIC ACID)/CLAY NANOCOMPOSITE FILMS

Fernanda Vilarinho[1], Giovanna Buonocore[2], M. Amelia Stanzione[2], M. Fátima Vaz[3], Ana Sanches Silva[1,4]

[1] Department of Food and Nutrition, National Institute of Health Dr. Ricardo Jorge, I.P., Lisbon, Portugal; [2] Institute for Polymers, Composites and Biomaterials (IPCB-CNR), Portici (NA) – Italy; gbuonoco@unina.it; mariamelia.stanzione@gmail.com

[3] IDMEC, Instituto Superior Técnico, Departamento de Engenharia Mecânica, Universidade de Lisboa, Lisbon, Portugal; [4] Centro de Estudos de Ciência Animal (CECA), University of Porto, Porto, Portugal. * fernanda.vilarinho@insa.min-saude.pt

INTRODUCTION

One of the most detrimental processes in fatty foodstuffs is lipid oxidation, which occurs during production and storage, and influences food composition and safety. Through the analysis of volatile lipid oxidation products we can have an insight into the oxidation, and some volatiles, such as hexanal, can be markers of undergoing oxidation processes (Wen *et al.*. 1997).

Hexanal is formed when fatty acids are oxidized and is one of many well-documented aromatic components that contributes to flavour and aroma in common food products containing fatty acids (Fig. 1).

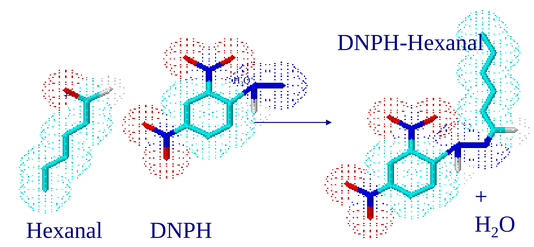

Fig. 1 Reaction of hexanal with 2,4-dinitrophenylhydrazine (2,4- DNPH).

The presence of MMT Cloisite Na⁺ can lead to materials which generally exhibit properties' enhancements, mainly due to its intercalation or exfoliation into the polymer chains (Tongnuanchan *et al.,* 2014). In this work natural MMT Cloisite Na⁺ was incorporated in PLA.

MATERIAL AND METHODS

PLA/Cloisite® Na⁺ films

The PLA/Cloisite® Na⁺ films were prepared through a two-step process. In the first step, PLA pellets were fed into a co-rotating laboratory twin-screw extruder at 170 °C and 50 rpm for 2 min. Subsequently, Cloisite® Na⁺ powder (5%, w/w) were added and mixed. After melt mixing, the melted matter was then pressed with a P300P hot press at 170 °C and 100 bar to obtain the PLA/Cloisite® Na⁺ films (PLA-OMMT film) (Fig. 2).

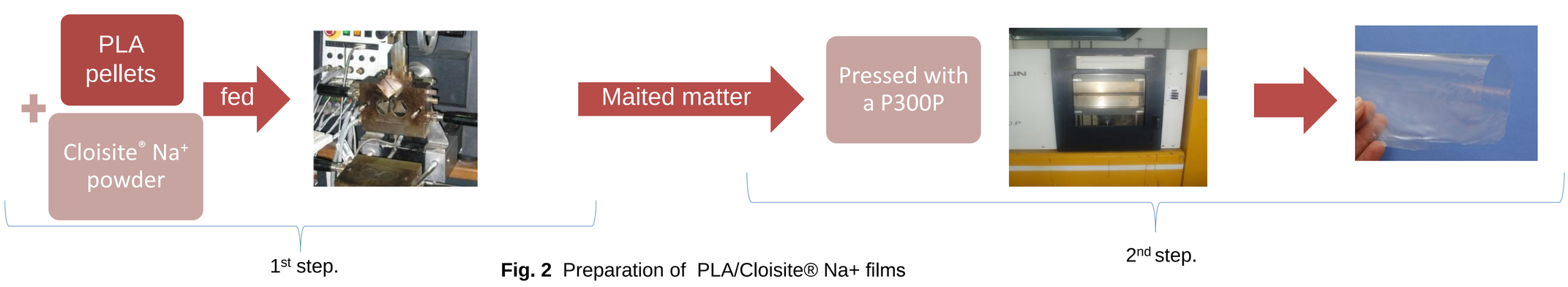

Fig. 2 Preparation of PLA/Cloisite® Na+ films

Quantification of Hexanal by UHPLC-DAD

The hexanal derivatization was performed in a solution of 2,4-dinitrophenylhydrazine in sulfuric acid during 4 h in the dark, and the hexanal extraction was performed with n-hexane and evaporation till dryness. The residue was dissolved in methanol, filtered and analysed by Ultra Performance Liquid Chromatograph (UPLC® ACQUITY™) coupled with Diode Array Detector (DAD) (Waters, Milford, MA, EUA). (Fig. 3).

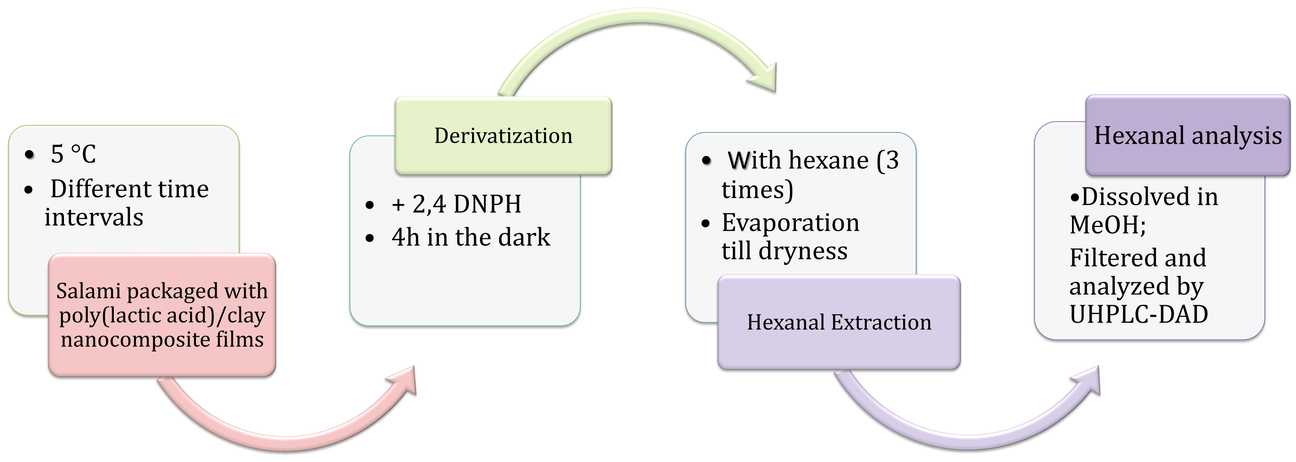

Fig. 3 Quantification of hexanal by UHPLC-DAD.

RESULTS AND DISCUSSION

- Hexanal tends to decrease until 60 days of storage. In this period of time the hexanal content of the salami packaged with the PLA/Cloisite® Na⁺ films was lower than the salami packaged with control film, except after 15 days of storage, where there was no difference between the two films.

- After 90 days of storage, the amount of hexanal in the samples increased, although it was higher in the samples packaged with control film (94.7 ± 6.02 µg/100 g salami) than in salami packaged with PLA/Cloisite® Na⁺ films (65.1 ± 6.12 µg/100 g salami) (Fig. 4).

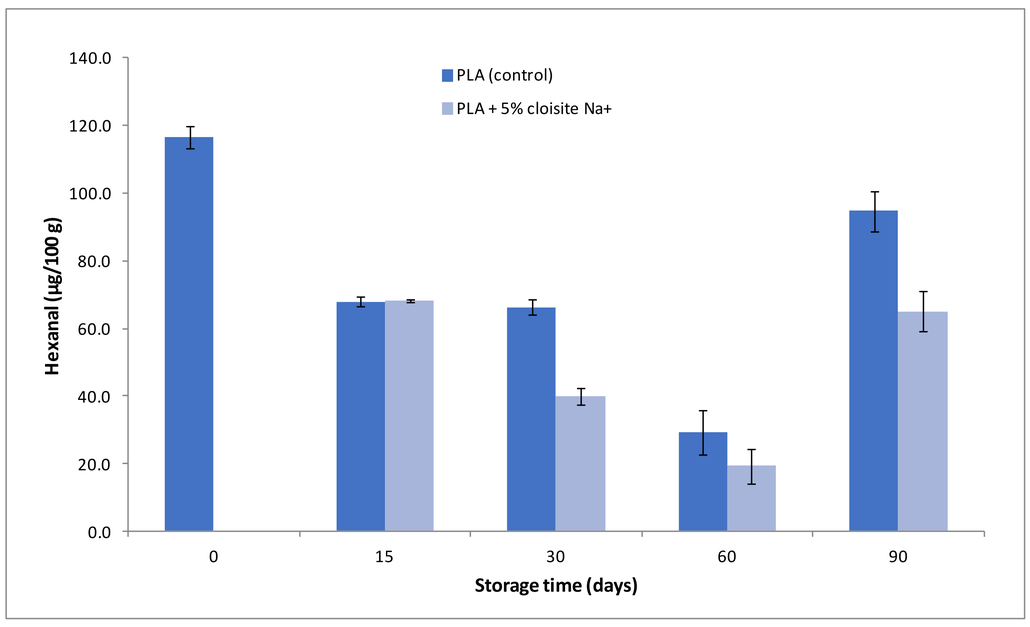

Fig. 4 Results of the hexanal determination in salami samples packaged during 90 days with a PLA film containing 5% nanoclays and a control film (PLA).

CONCLUSIONS

The developed films were evaluated regarding their effectiveness against lipid oxidation. The presence of MMT in the PLA film can reduce the lipid oxidation of processed meat products, extending their shelf life. Further studies to evaluate differences between PLA and the nanocomposite (PLA-5%Cloisite®Na+) in what regards to the mechanical and barrier properties would be valuable..

BIBLIOGRAPHY

Wen J, Morrissey PA, Walton J, Sheehy PJA. Irish J Agr Food Res 36 (1997) 75-84.;

Tongnuanchan P, Benjakul S. J Food Sci 79 (2014) R1231-R1249.

ACKNOWLEDGEMENT

This work was supported by the research project "Labelling and tracking of nanoclay from food packaging nanocomposites: a food safety issue – NanoPack4Food" (2014DAN1019) under the Cooperative Programme of the Agreement on Scientific Cooperation between National Research Council of Italy (CNR) and Foundation for Science and Technology of Portugal (FCT).