EcoPackLab: a new laboratory for the development of new active food packaging

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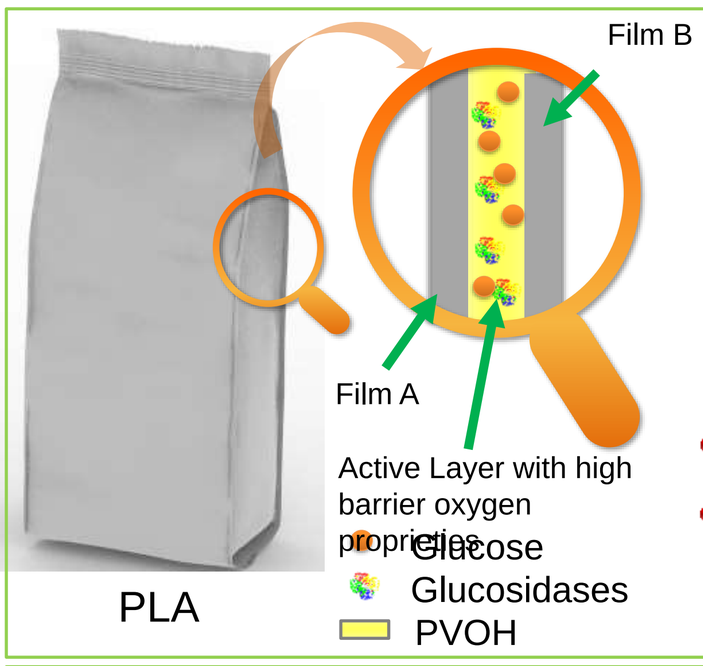
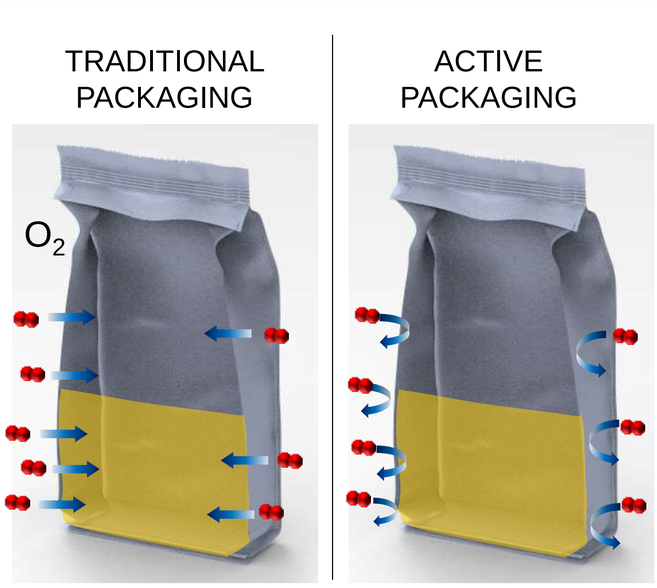
Introduction

The development of new bio-compostable materials has attracted much attention in the field of food packaging. However, the main drawback of biodegradable films is the low barrier they offer against external agents that can quickly degrade foods, limiting their use to a small number of products. In order to produce/obtain an eco-friendly and active packaging with high oxygen barrier properties, we developed EcoPackLab, a Laboratory dedicated to the design and production of new food packaging. The main facility that we are implementing is an industrial machine able to produce a multilayer film, which consists of two layers of a biodegradable polymer (es. PLA) with in between a thin active gel able to catalyze the absorbed oxygen. The machine is set up with an in-line cold plasma source, pivotal for the realization of homogeneous coating and multilayer coupling.





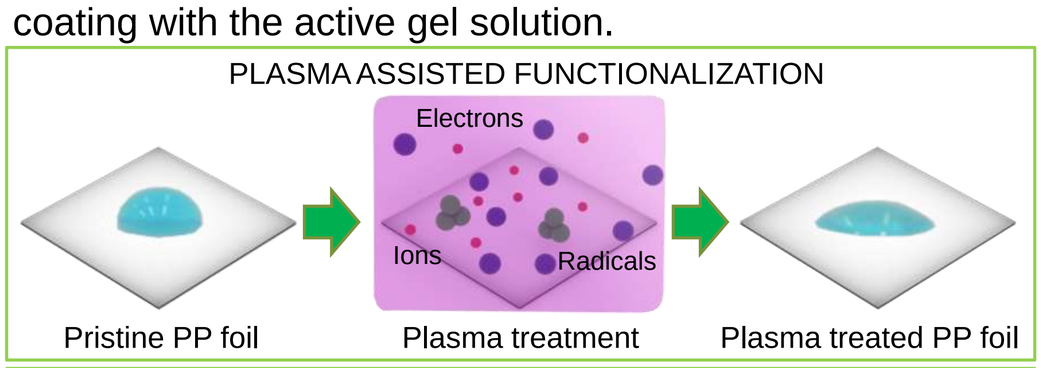
The oxygen scavenging activity is obtained by including in the multilayer film system a layer of glucose and glucosidases that catalyzes the oxygen absorption. Both the molecule and the enzyme are dissolved in a PVOH matrix and deposited on a PLA film, previously subjected to an appropriate plasma treatment in order to increase the film hydrophilicity.

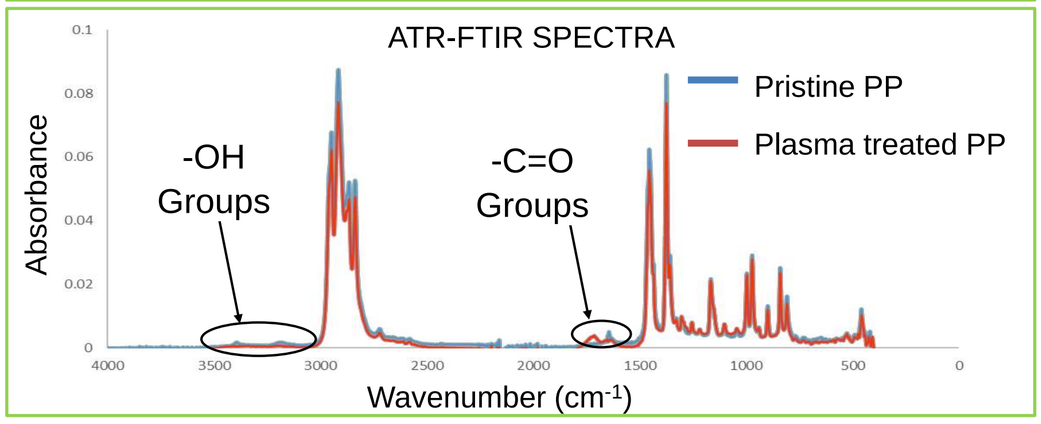
Glucosidases

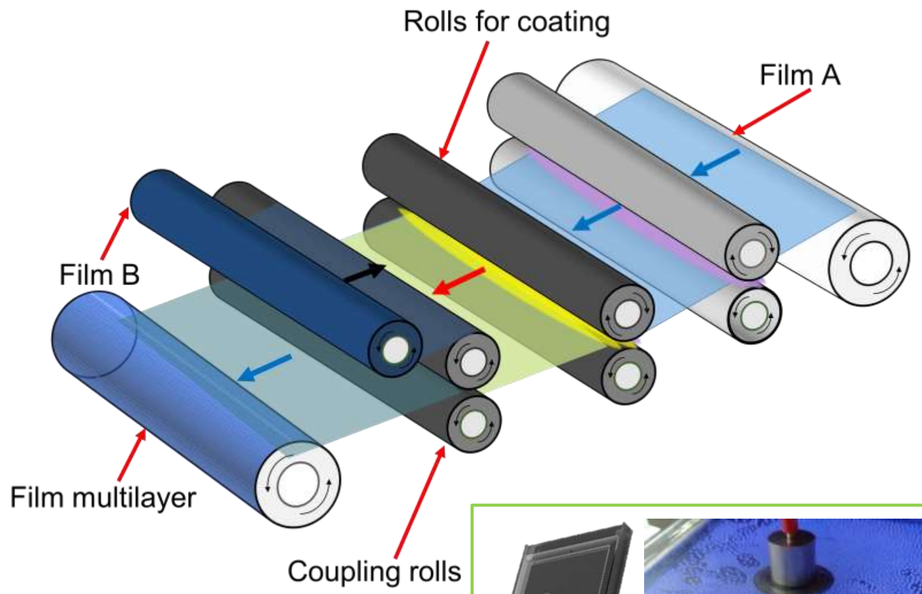
Glucosio + O_2 ⟶ Gluconolactone + H_2O_2

Biodegradable ***Compostable***

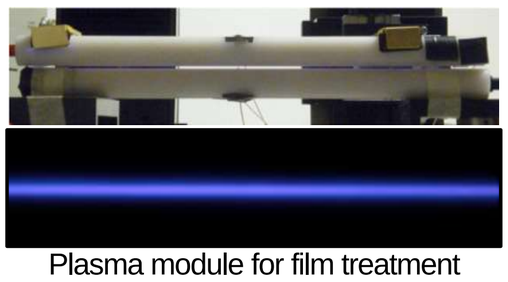
The plasma treatment is included in the film-forming process and it is performed in air with an in-line dielectric barrier discharge plasma source operating at atmospheric pressure. The main effect is to increase the number of alcohol and methyl groups on the surface of the film, enhancing the contact angle and guaranteeing a perfect coating with the active gel solution.







DBD plasma source


Plasma module for film treatment


The plasma module is driven by AlmaPULSE, a high voltage pulse generators

Conclusion

The EcoPackLab is an innovative laboratory where new biodegradable and biocompostable films for active food packaging can be developed. We demonstrated the possibility to produce eco-friendly multilayer films able to prolong the shelf-life of food products, acting as oxygen scavenger. The new active packaging consists of two layer of biodegradable PLA films coupled by means of a cold plasma treatment with an active coating based on glucose and glucosidase enzyme dispersed in PVOH matrix. The final multilayer of PLA, with high oxygen barrier, being totally biodegradable, can perfectly implement a "green" food packaging.

POR FESR EMILIA-ROMAGNA 2014/2020

Regione Emilia-Romagna