SELECTPERM

Food packaging materials with O_2 / CO_2 selective permeability

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Context:

→ Rising consumption of fresh fruits is positive for human health and economic growth.

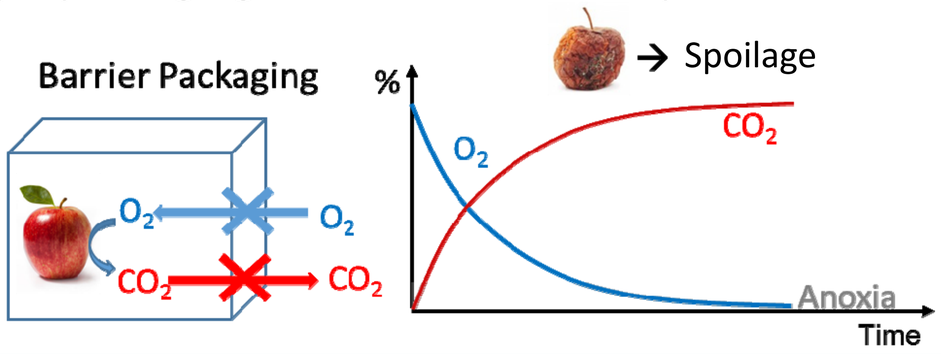
→ The preservation of fruit freshness is challenging with current plastic packaging.

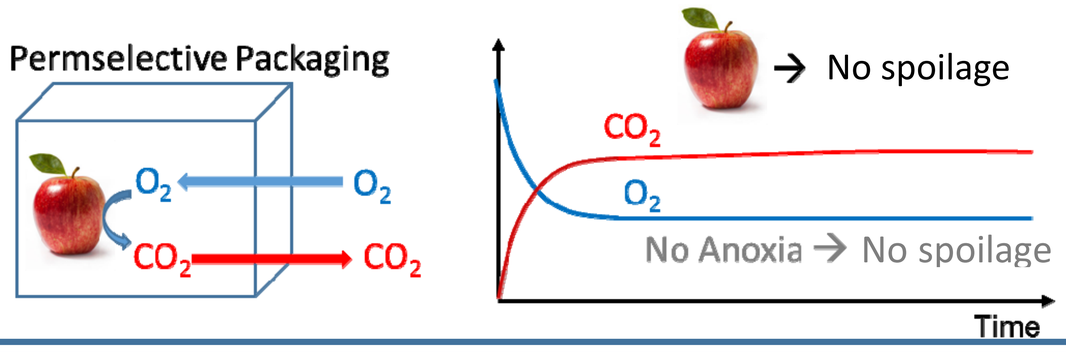
→ The need for optimum atmosphere (O_2, CO_2), gas exchange and breathing is not taken into account.

Objective & Concept:

→Development of a packaging concept for fresh fruits, based on bio-based and biodegradable polymers with selective gas permeability for O_2 and CO_2.

The innovative core of the project is a systematic analysis of how permselective, cost-effective and environmentally friendly a packaging can be when developed and tailored to a target product.





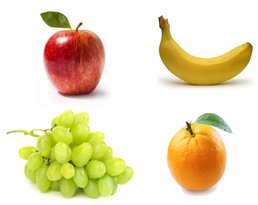
Method:

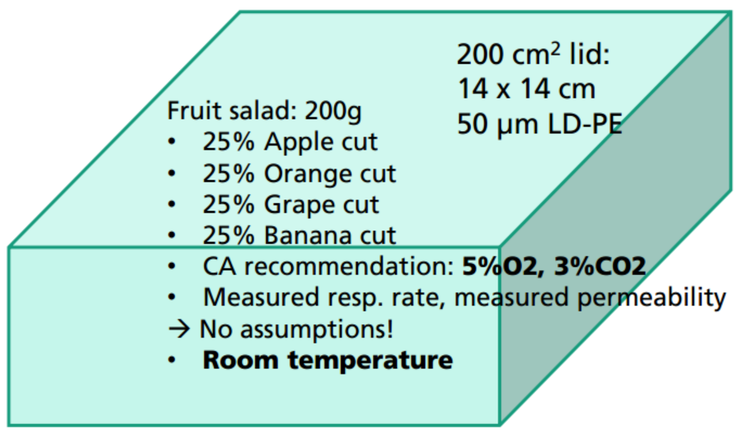
Step 1: Selection and investigation of biopolymers : permeabilities and mechanical properties

Tray materials	pO_2 [cm³.100 µm/m² 24h.bar]	pCO_2 [cm³.100 µm/m² 24h.bar]	pCO_2/pO_2
PLA	195	495	2.5
PHA	53	355	6,7
PBAT	1582	9752	6,2
PLA + PHA (75/25)	137	503	3,7
PLA + PBAT (75/25)	499	1517	2,4
PLA + bentonit (90/10)	2699	8116	3.0
PLA + kaolin (90/10)	175	509	2,9
PLA + micro talk (90/10)	123	344	2.7

Lid film polymers	pO_2 [cm³.100 µm/m² 24h.bar]	pCO_2 [cm³.100 µm/m² 24h.bar]	pCO_2/pO_2
PBAT	807	6212	7,7
PBAT + LLDPE	1510	7675	5,1
PBAT+POE	1758	12102	6,9
EVA+POE	9309	46574	5,0
LLDPE+POE	9134	25173	2,8
PBAT+POE+EVA (1:1:1)	2716	15802	5,8
PBAT+POE+EVA (1:2:1)	5795	25209	5,1

Step 2: Monitoring of respiration rates (O_2 uptake and CO_2 release) of the selected fruit mix to determine the needs of permselectivity.





→ Data computation for a 400 cm² tray, with a 20 µm-thick coating and a 200 cm² lid, containing 200 g fruit mix.

Step 3: Data processing with a mathematical model developed during the project:

→ Target permselectivity and material combinations.

→ Prediction of partial gas pressures evolution over time within a package containing the mix of fresh fruits.

The ideal material (for 200g fruit salad):

- Sealable
- **PO_2** [cm³.100µm/m².24h.bar]: **4510**
- **PCO_2** [cm³.100µm/m².24h.bar]: **29400**
- **Permselectivity** [PCO_2/PO_2]: **6,52**

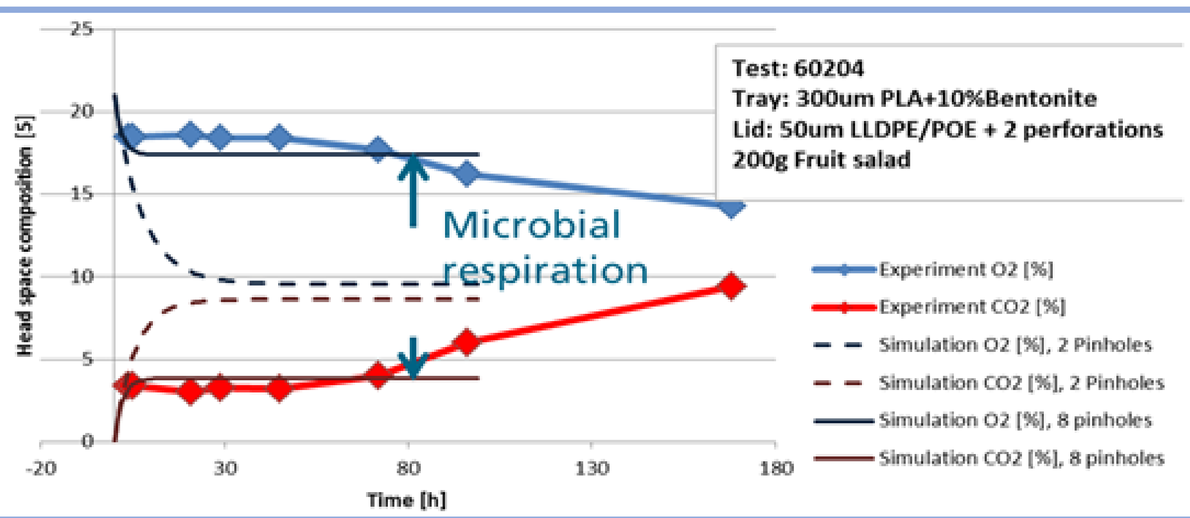
Most promising solutions:

Tray → PLA + bentonit (90/10)

Lid → LLDPE + POE

Step 4: Pilot production with the most promising biopolymers (tray + lid) and packaging of freshly cut fruits

→ Tailor-made package with an optimum O_2 and CO_2 permselectivity.



Conclusions: The concept for biobased and biodegradable packaging solution with permselective effect has been proven. There is still need for material development to reach the target permeabilities and permselectivity in order to prolong food freshness.

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