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Characterisation of polymer films for intravenous solvent bags packaging

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Context

- Pharmaceutical products consume large amounts of plastic.
- Chemotherapy production units use large quantities of medical devices, medicines, energy and single-use equipment and generate significant amounts of waste.
- Understanding how to reduce the climate impact of pharmaceutical products through an intravenous (IV) solvent bag.

Objectives

- Determine the technical properties of the primary and secondary packaging films used for IV solvent bags production.
- Identify alternative polymer films with similar technical specifications that would consume less energy in production or are potentially recyclable.

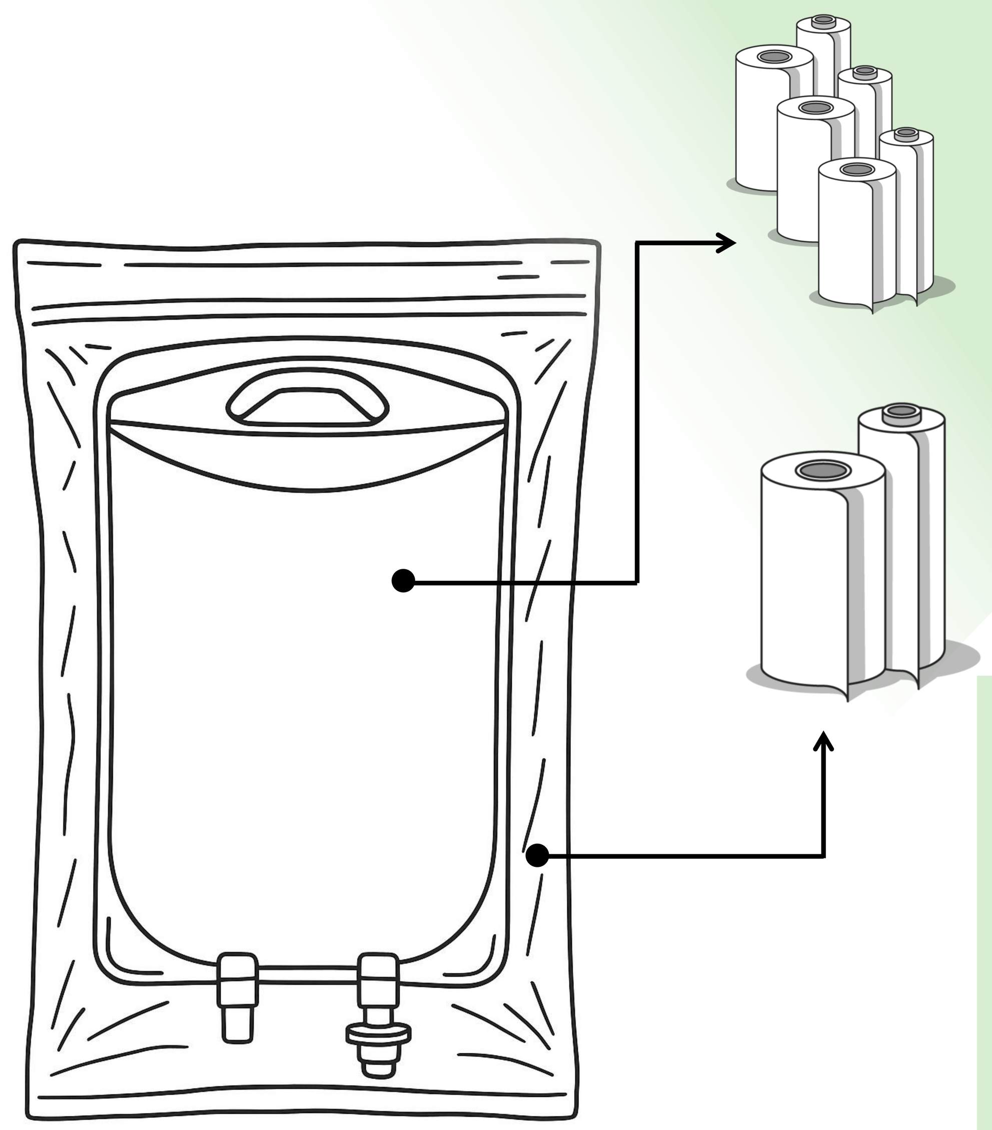
Conclusion

- The PP-based primary and secondary films studied have similar characteristics to standard films and could be potential candidates to replace current films.

Perspectives:

- Evaluating the impact of using PP-based films on the carbon footprint of IV solvent bags.
- Assessing the possibility of using recycled materials for primary and secondary packaging of IV solvent bags.

Methods



Characterisation of 7 polymer films (sterilised and non-sterilised):

- Primary packaging of solvent bags
  + 4 alternative primary packaging films made of polypropylene (PP)
- Secondary packaging of solvent bags
  + 1 alternative secondary packaging made of PP

Measured characteristics:

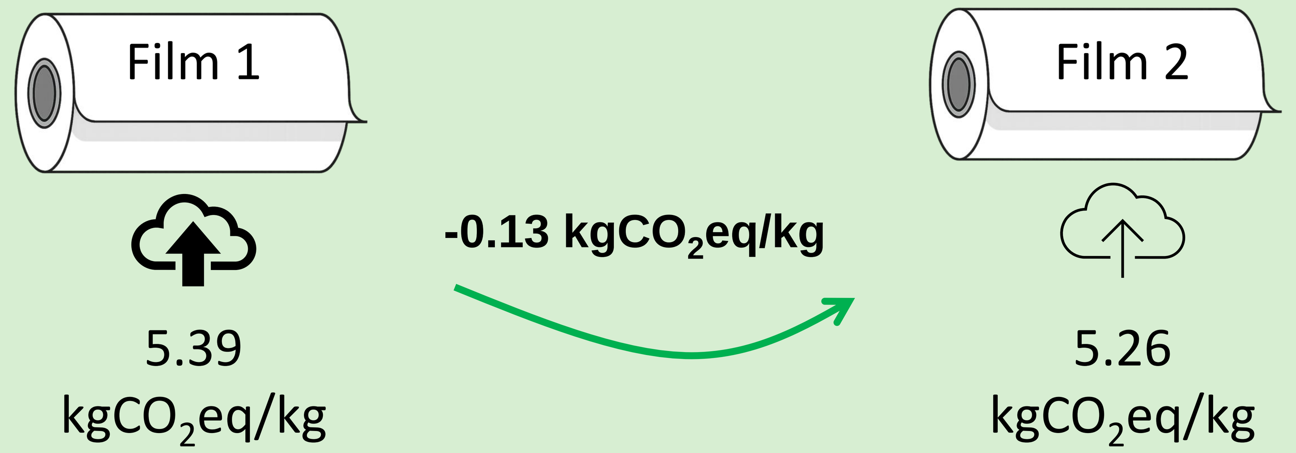
- Film thickness
- Polymer layer thickness
- Chemical composition by FTIR
- Thermal properties by DSC
- Mechanical properties by tensile strength
- Water vapour permeability by WVTR
- Transparency by haze measurement

Results

			Primary films					Secondary films	
Characteristics	**Unit**	**Target value**	**Film 1 (current)**	**Film 2**	**Film 3**	**Film 4**	**Film 5**	**Film 6 (current)**	**Film 7**
Film thickness	*µm ± σ*	***200 ± 20 ****	198.8 ± 2.8	203.9 ± 4.1	190.0 ± 1.3	194.5 ± 0.7	198.3 ± 6.1	127.9 ± 1.5	157.9 ± 5.0
Chemical composition	*Internal side*	***NA***	PP ; SEBS	PP ; SEBS	PP ; PP-PE	PP ; PP-PE	PP	PP-PE ; PE	PP
	External side	***NA***	Acrylate ; ETFE	PP	PP	PP	PP	Nylon	PP
Melting point	*°C*	***>121***	**92.19**	137.09 ; 164.79	61.01 ; 133.49 ; 160.97	133.31 ; 158.96 ; 232.72	158.93 ; 231.03	129.8 ; 148.4 ; 215.4 ; 239.1	129.7 ; 150.2 ; 222.7
Stiffness	*MPa ± σ*	***NA***	0.90 ± 0.18	5.25 ± 0.29	4.76 ± 0.13	4.52 ± 0.15	2.15 ± 0.80	7.19 ± 0.42	7.03 ± 0.18
Elasticity	*MPa ± σ*	***NA***	6.75 ± 0.15	15.63 ± 0.10	14.25 ± 0.19	13.74 ± 0.22	11.49 ± 0.21	23.93 ± 0.46	16.16 ± 0.63
Permeability (38°C, 100% HR)	*g/m2.day*	***<3.5***	**3.87 ± 0.13**	2.06 ± 0.10	2.31 ± 0.05	2.18 ± 0.08	2.67 ± 0.01	1.59 ± 0.05	1.72 ± 0.12
Transparency	*% ± σ*	***<15***	8.10 ± 1.53	9.61 ± 0.55	11.35 ± 2.30	13.27 ± 3.06	6.55 ± 0.73	14.47 ± 0.85	**22.42 ± 2.55**

*For primary films; SEBS : Styrene-Ethylene-Butylene-Styrene ; PE : polyethylene ; ETFE : Ethylene tetrafluoroethylene

Estimated carbon footprint of film 1 vs film 2:



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