Supplementary Information (SI) for Sustainable Food Technology.

Multifunctional cellulose phosphate-based food packaging films from biomass: Structure-functional relationship and environmental assessment studies

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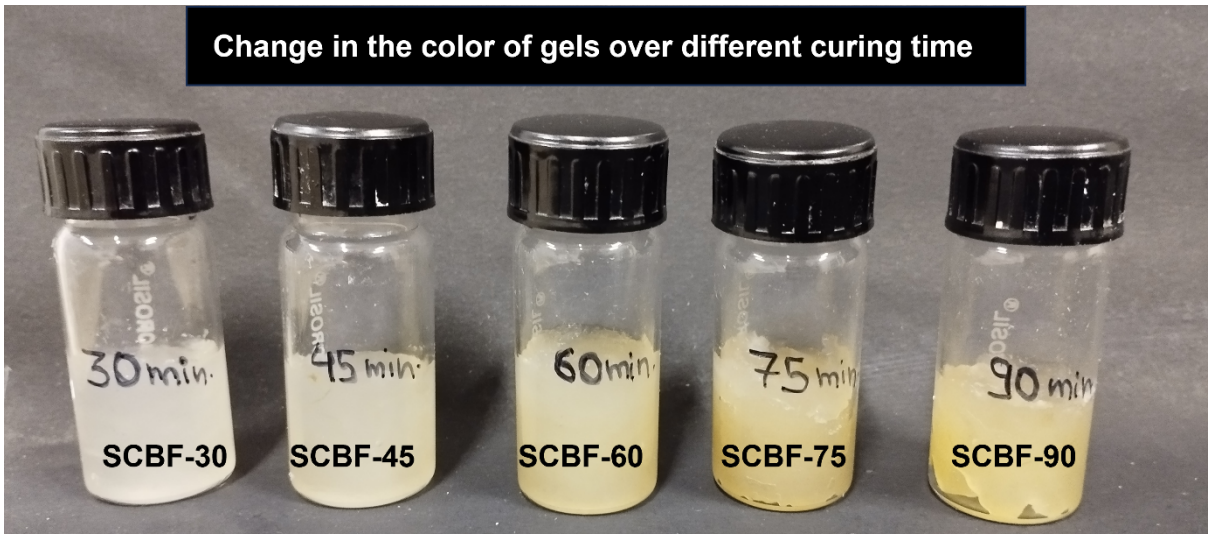

Figure S1: Colour of the gels produced at different curing time with DAHP and urea at 150°C

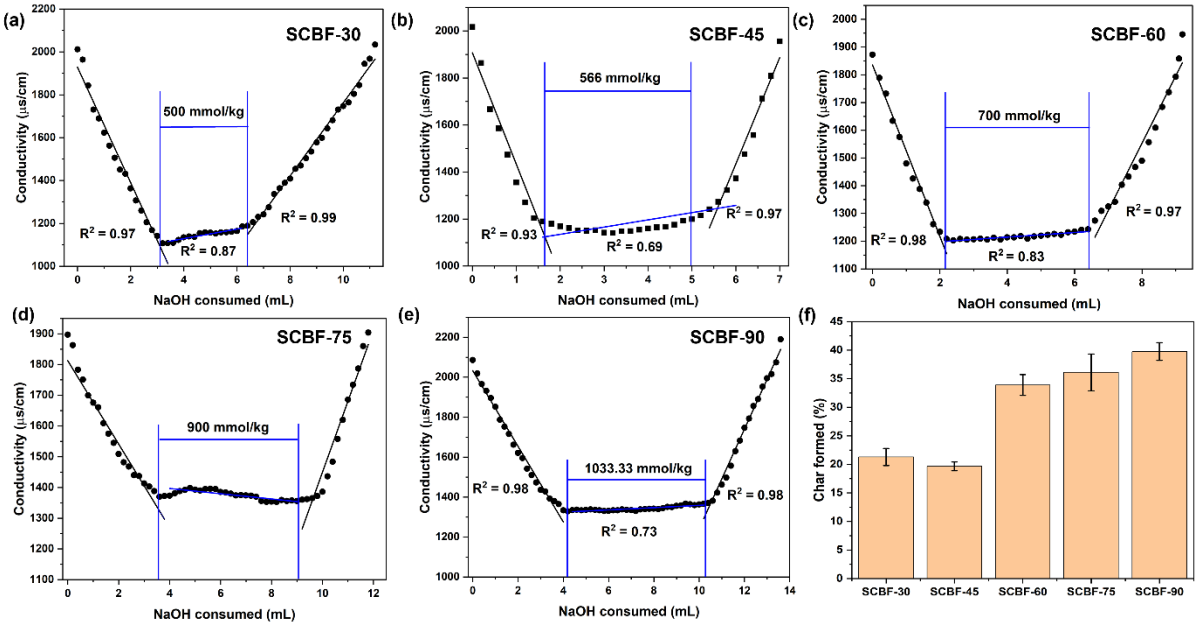

Figure S2: Present the charge content of the film produced after different curing times (30-90 minutes) (a) SCBF-30, (b) SCBF-45, (c) SCBF-60, (d) SCBF-75, (e) SCBF-90 and (f) the char residue formed after the flame test of the films.

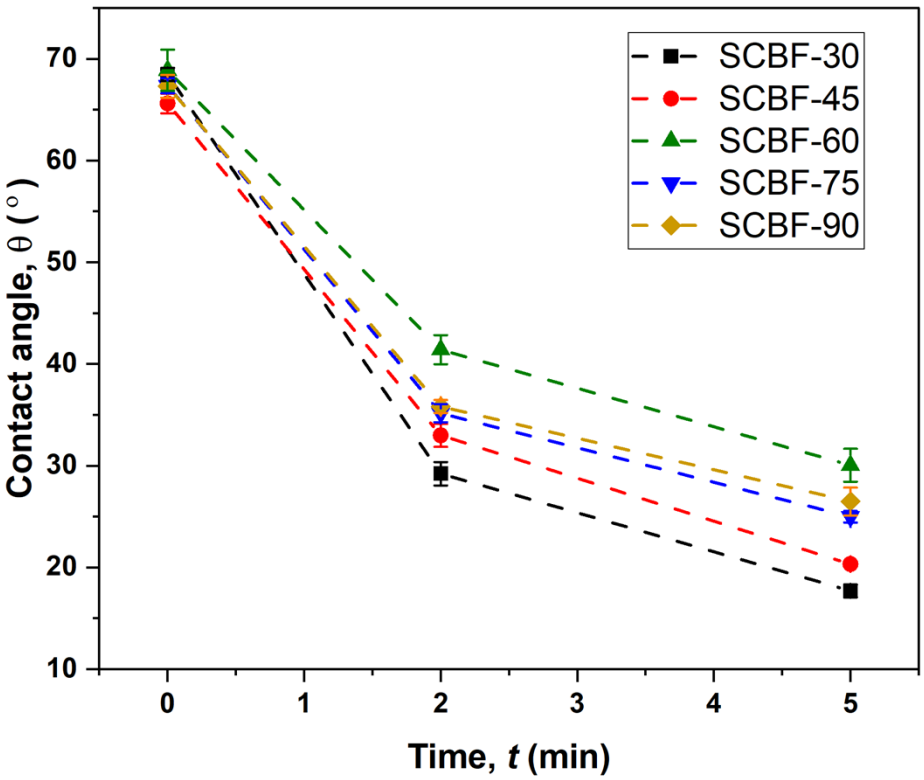

Figure S3: Represent the contact angle of the films between 0-5 minutes.

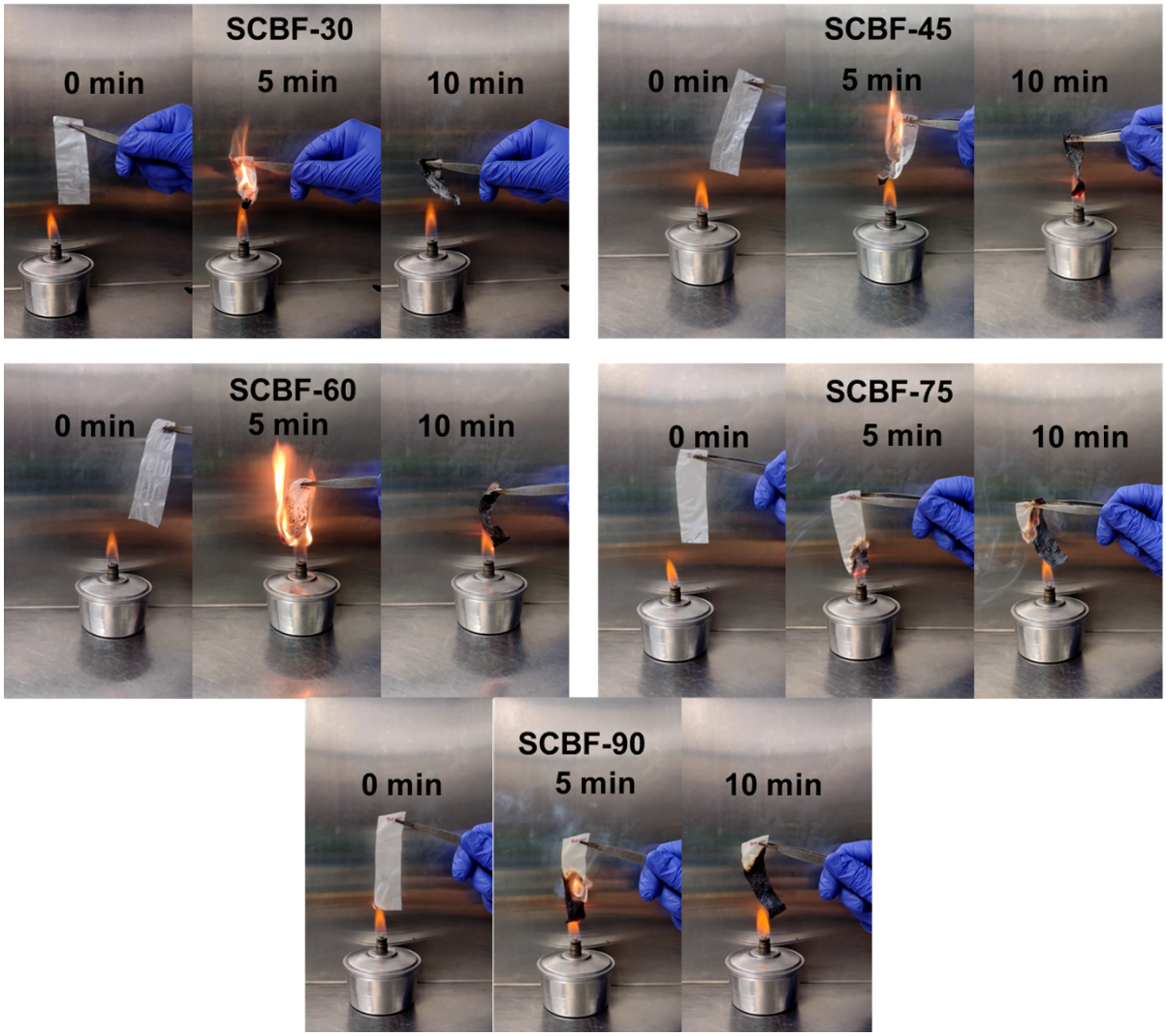

Figure S4: Flammability test of the films

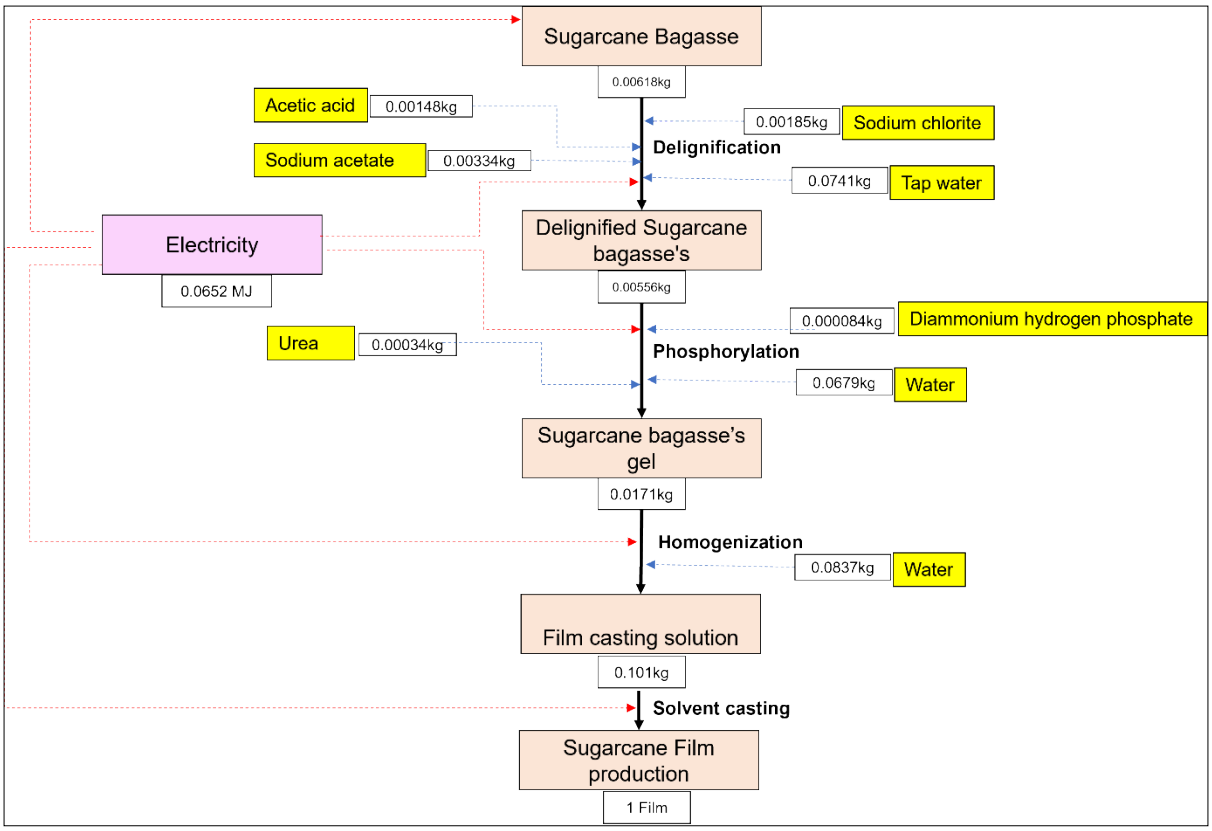

Figure S5: Present the flow chart for the production of 1 film weighing 4.7 g from the sugarcane bagasse waste via delignifcation, phosphorylation, homogenisation, casting and drying processes.

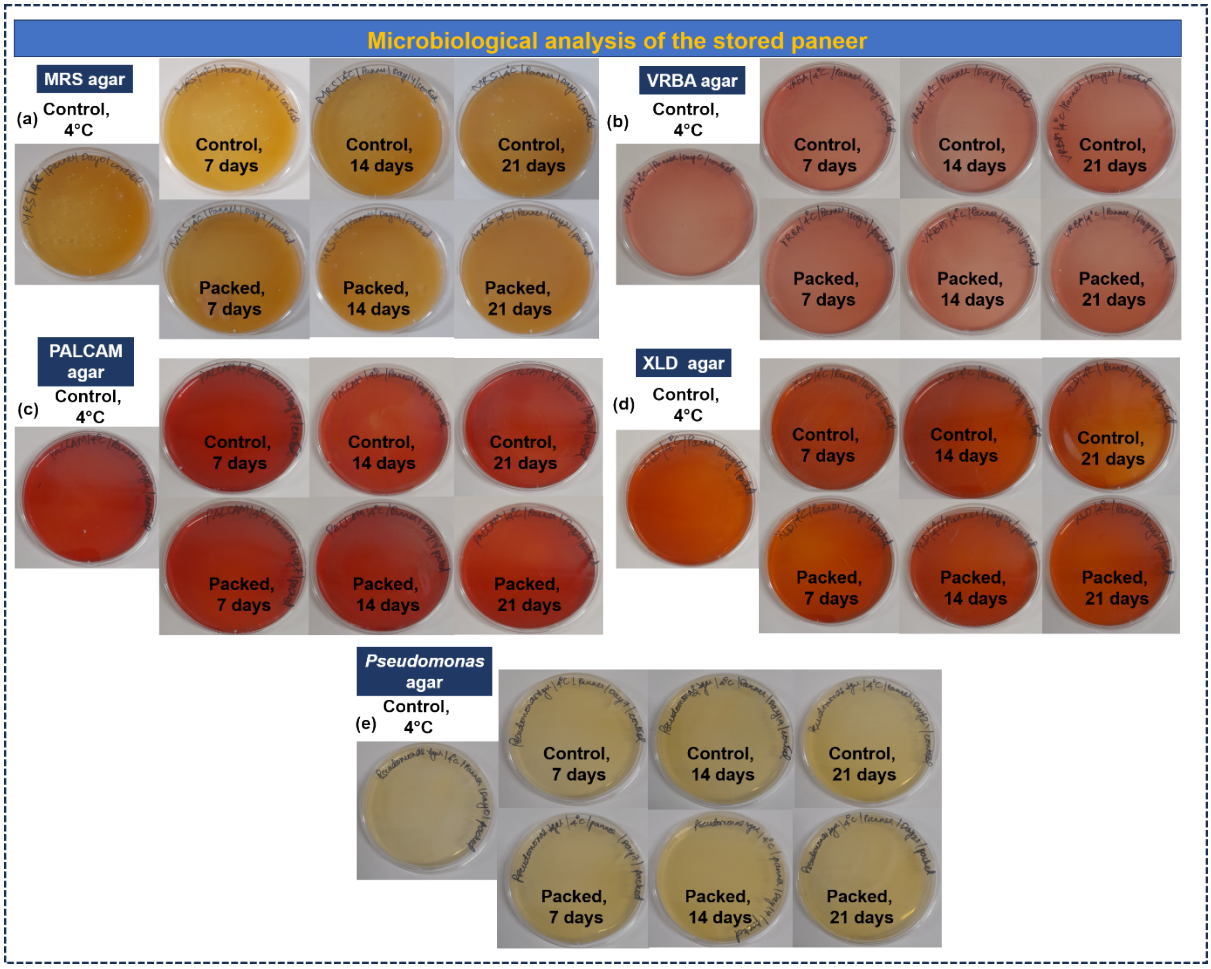

Figure S6: Microbiological analysis of the packaged and control samples in MRS, VRBA, PALCAM, XLD and Pseudomonas agar.

Table S1: List of assumptions considered during the LCA study

List of assumptions
Electricity sources considered in this study were considered from hard coal (GaBi)
10% weight loss was taken during the phosphorylation and delignification process.
A circular film of diameter 16 cm is produced.
Solvent evaporation is not considered in the calculation of LCA.
Liquid waste generated during the phosphorylation, washing, and delignification is not considered in the environmental impact calculation.
Sodium chlorite is replaced with sodium hypochlorite.
The study does not consider sugarcane bagasse production as it is regarded as waste.

Table S2: sensitivity analysis of the dominant categories from the normalised mid-point results

Categories	Electricity		Delignification		Phosphorylation	
	10% increase	8% decrease	10% increase	8% decrease	10% increase	8% decrease
Fossil depletion	9.63	-7.84	5.09	-4.13	1.79	-1.65
Photochemical ozone formation	10.00	-7.69	5.38	-3.85	2.31	-1.54
Terrestrial acidification	9.81	-7.48	5.61	-4.21	1.87	-1.40

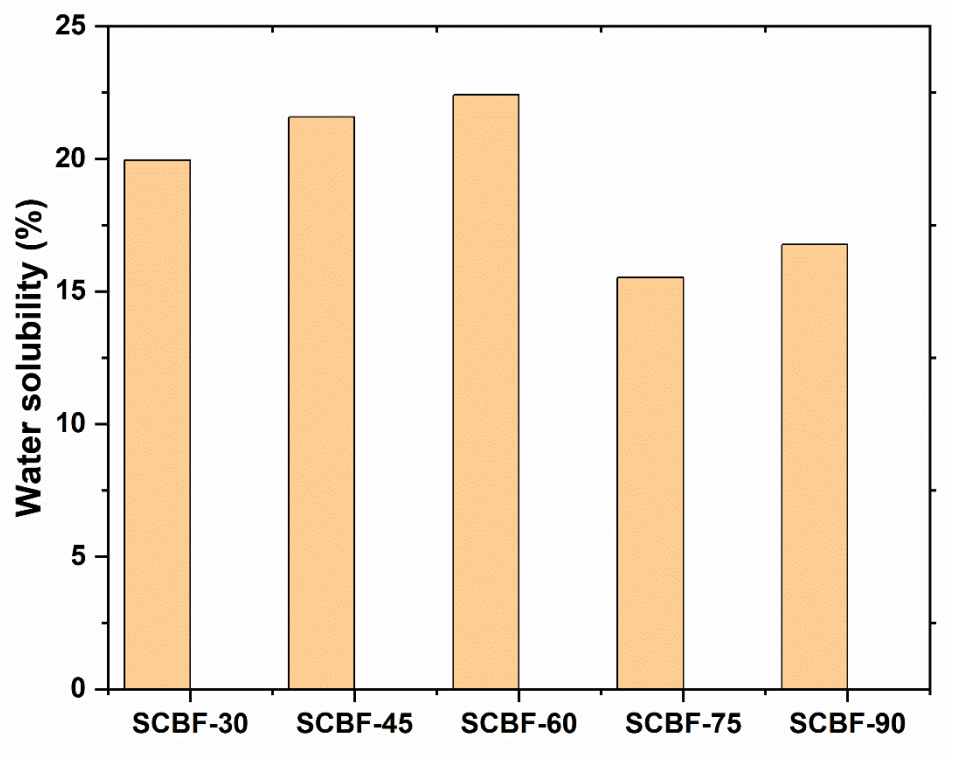

Figure S7: Water solubility of the developed phosphorylated SCB films at 30°C at pH-7 after 24 hours.

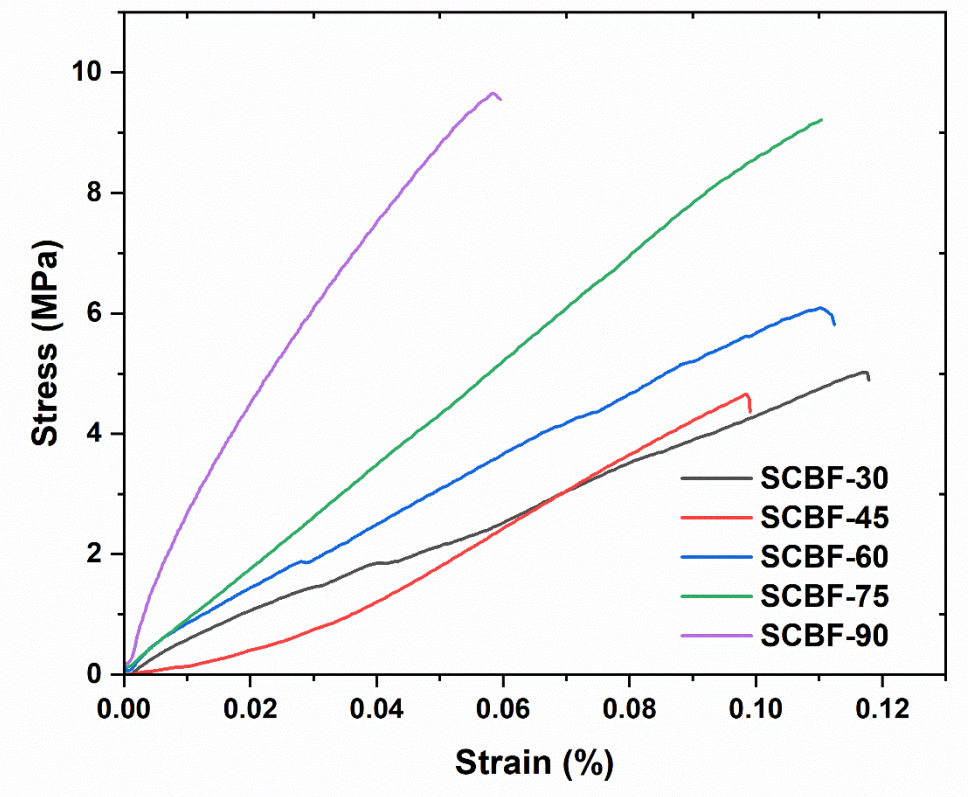

Figure S8: Mechanical properties of phosphorylated SCB films under wet conditions (Temperature 25°C, immersed in water for 30 minutes).

Table S3: WVTR and WVP of the films

Film	WVTR (g m^{-2}.24h)	WVP (10^{-12} gm/m^2·s·Pa)
SCBF-30	58.63	9.42
SCBF-45	43.65	7.02
SCBF-60	41.07	6.60
SCBF-75	40.08	6.44
SCBF-90	34.22	5.50