

Eggshells and potato washing slurries as renewable lightweight fillers for polystyrene-based materials

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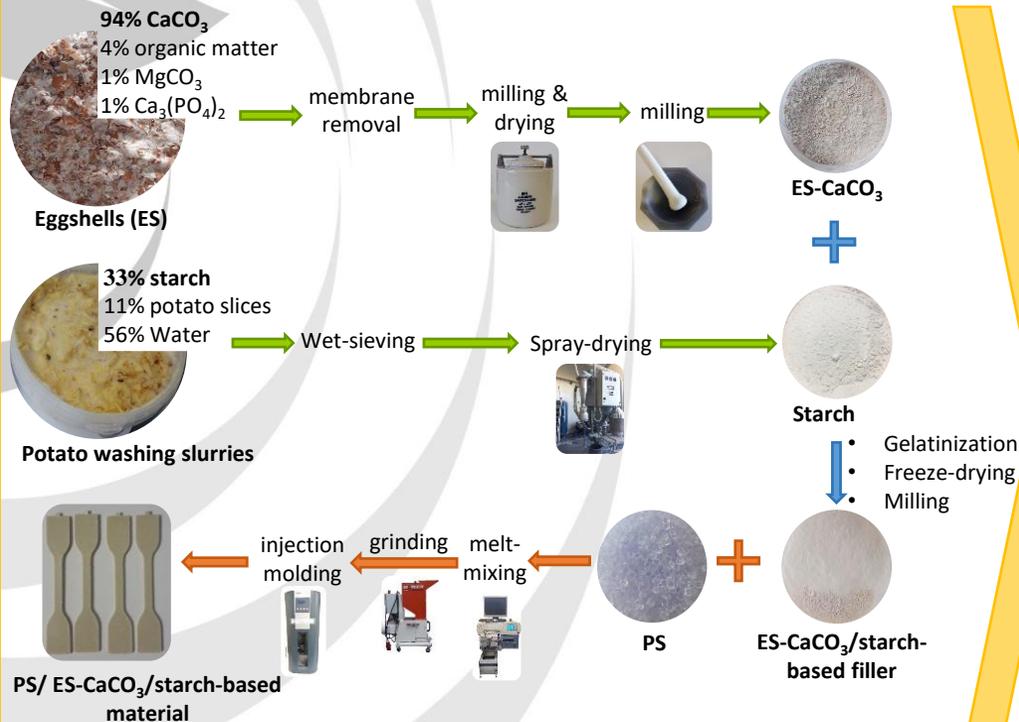
Introduction

Agri-food industry generates considerable amounts of byproducts that require proper disposal. As a source of valuable biomolecules, these byproducts can be valorized following a circular economy. Non-renewable calcium carbonate (CaCO₃), often used as filler for plastics, has high-density, limiting its dosage in plastics [1]. Eggshells are porous CaCO₃-rich byproducts [2]. In turn, potato washing slurries are starch-rich byproducts [3]. Following the starch consolidation approach used to decrease ceramics' density [4], in this work it is hypothesized that CaCO₃- and starch-derived from egg and potato byproducts can be considered to develop lightweight plastics.

Aim

In this study, the feasibility of using CaCO₃- and starch-derived from egg and potato byproducts to develop lightweight fillers compatible with polystyrene (PS)-based materials was studied.

Methods

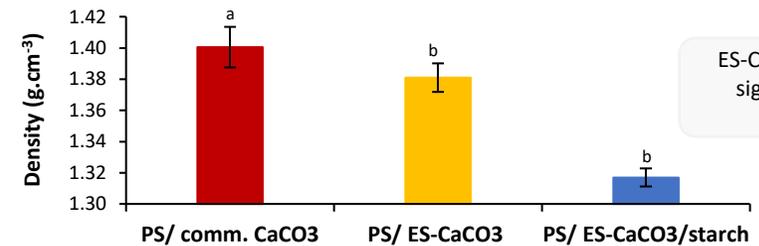


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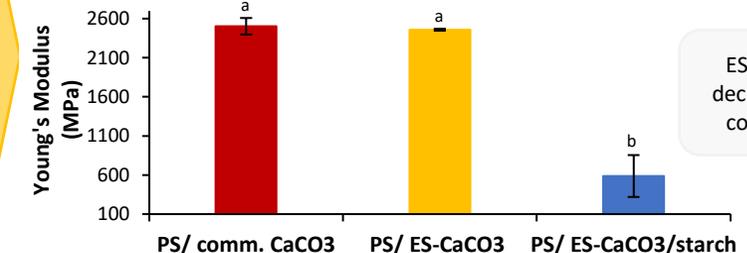
- [1] Thenepalli T., Jun A., Han C., Ramakrishna C., Ahn J., A strategy of precipitated calcium carbonate (CaCO₃) fillers for enhancing the mechanical properties of polypropylene polymers, *Korean J. Chem. Eng.*, 32(6): 1009–1022, 2015.
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Results

Density



Traction properties



Chromatic properties

	PS/ comm. CaCO ₃	PS/ ES-CaCO ₃	PS/ ES-CaCO ₃ /starch
\bar{L}^*	70.54 ± 1.20	72.23 ± 0.80	72.09 ± 0.61
\bar{a}^*	1.46 ± 0.22	-0.72 ± 0.08	0.51 ± 0.15
\bar{b}^*	13.36 ± 1.35	14.11 ± 0.85	15.28 ± 0.91

ES-CaCO₃ and ES-CaCO₃/starch slightly changed the control's color, but not perceptible to the human eye.

ΔE (PS/ ES-CaCO₃) = + 2.86
 ΔE (PS/ ES-CaCO₃/starch) = + 2.64

Conclusions

ES-CaCO₃- and ES-CaCO₃/starch-based conjugates revealed to be lightweight fillers suitable for PS-based plastics while conferring elasticity and a yellowish coloration to the materials. Therefore, eggshells and potato washing slurries can be considered as sources of renewable feedstocks for the development of lightweight fillers for plastics.