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Phosphates from renewable raw materials for the functionalization of plastic consumer goods

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PURPOSE OF THE ABSTRACT
The element phosphorus (P) is a finite resource which is gained exclusively by rock mining outside Europe[1]. Phosphorus is used in various industrial sectors, applications and in numerous everyday products - often in the form of polyphosphate[2]. Due to the continuously growing demand, our consumption far exceeds the natural regeneration rates. Despite the importance of this element, few to no adequate recycling technologies have been used to date, resulting in a strong dependency associated with this scarce resource[3].
The Department of Biotechnology and the Institute of Applied Microbiology at RWTH Aachen University have developed and patented a two-step process for the biotechnological production of (bio)polyphosphate from deoiled seeds or bran[4]. The principle storage form of phosphate in plants is phytate (inositol hexakisphosphate). In the first process step, this stored phosphate is enzymatically mobilized from these renewable raw materials, which represent side streams of food industry. For the complete mobilization of all phosphates, a phytase blend is used. The enzymatic process allows to mobilize about 30 g P/kg deoiled rape seeds or rye bran. This is a P-content reduction by up to 90 %. In the second process step, the recovered phosphate is then accumulated and isolated using yeasts in the form of industrially relevant (bio)polyphosphate. Promising approaches for upscaling of the process as well as phytase production were investigated to coat bioplastic surfaces.
As part of the competence center Bio4MatPro, the two institutes, together with the DWI-Leibniz Institute for Interactive Materials, have set themselves the goal within the ProPhos project (BoostLab1-5) of using the biotechnologically produced (bio)polyphosphate in a novel application for the functionalization of everyday objects made of bioplastics, e.g. for bacteriostatic effectiveness. The developed processes thus contribute to the circular phosphorus (bio)economy.

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FIGURES

FIGURE 1

FIGURE 2

KEYWORDS
phytase | phosphorus recovery

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