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From Farm to Table: New Strategies for Phosphate Recovery

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PURPOSE OF THE ABSTRACT
Recently, we published a novel three-step production process to mobilize the phosphate from plant biomass waste streams and produce food-grade polyP [1]. In the first step of the process, the phosphate of plant biomass was mobilized using a phytase blend with a yield of 37.1 mg PO43-/g rye bran. The thereby produced soluble P-extract was then fed to starved Saccharomyces cerevisiae, which polymerize the phosphate to polyP. The polyP can then be extracted from the cells or applied directly in the form of polyP-rich yeast extract. Besides rye bran, further by-products of the food production process were successfully used for P-mobilization, such as deoiled seeds [2]. The obtained (bio-)phosphate has food-grade quality and thus may be incorporated into food preparations, for example as preservative, stabilizer, or texture improver (for instance for spreadability of cheese preparations or texture-improving property in sausage preparations). Such novel processes are needed for a sustainable resource management, since phosphorous is currently obtained exclusively through rock mining, even though it is a finite resource[3].

Within the P2Value project, the Institute of Biotechnology in cooperation with the Institute of Microbiology at RWTH Aachen University is focusing on phosphate mobilization from plant residues and by-products. Plants store phosphate in the form of phytic acid (inositol hexakisphosphate), which can hardly be metabolized by monogastric organisms [4]. Therefore, we aim to engineer phytases that can hydrolyze lower inositol-phosphates to further optimize the P-mobilization process [5, 6]. Furthermore, an enzymatic toolbox will be investigated for the valorization of novel biogenic waste streams. The enzyme production and P-mobilization will be further scaled up to take the first steps towards developing an industrial process. In this way, the (bio)phosphate extracted from food manufacturing side streams can be reintroduced into food preparations, contributing to sustainable phosphate management and a circular economy.

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FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

phytase | phosphate recovery | enzyme engineering | bioeconomy

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