Project title: **pH-sensitive graft copolymers based on cyclic acetal monomers from renewable resources for controlled agrochemical release**

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Function: Assistant Professor Biobased Materials

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Proposal (250 words):

Introduction:
Typical application of insecticides in crops is made by spraying an aqueous solution containing the active chemical compound. Up to 90 % of any conventional pesticide is generally lost to the air or soil during application. In this work, a solution will be offered which moreover makes use of renewable resources instead of finite fossil raw materials with undesirable environmental impact.

Hypothesis and Objectives:
In order overcome the enormous loss during pesticide application, new pH-sensitive [4] copolymers for controlled release applications will be made from biobased building blocks. The pH-triggered self-assembly and release behavior of the copolymers will also be studied.

Setting and Methods:
Acetal based building blocks [3] will be explored as versatile biobased platform molecules for the synthesis of completely new green polymers. Next to the use of cyclic acetal monomers as pH-sensitive groups, cyclic acetals can also be used for the synthesis of linear polyacetals, opening the way towards amphiphilic copolymers. In amphiphilic form, the polymers self-assemble in aqueous medium (pesticide solution) into micelles which encapsulate agrochemicals. Upon pH decrease (acid in soil), the cyclic acetal groups in the copolymer can be deprotected which renders the copolymer dihydrophilic, resulting in the controlled pH-triggered release of the agrochemicals.

Impact:
- Controlled release of agrochemicals considerably reduces pesticide loss, which not only decreases the financial cost but also reduces environmental pollution.
- New biobased acetal platform molecules become available to make green polymers of both hydrophilic and hydrophobic nature for multiple applications, which supports a sustainable bio-economy.

Requirements candidate: Highly motivated student with good English communication skills and proactive and resolute attitude. Chemistry fields: organic synthesis, polymer synthesis, chemical and physical characterization of monomers/polymers, supplemental: colloid chemistry

Keywords: amphiphilic copolymer synthesis; controlled polymerization; biobased, sustainable polymers; pH-sensitive polymers; agrochemicals; self-assembly; environmentally friendly.

Top 5 selected publications:

1. Wróblewska AA, Bernaerts KV, De Wildeman SMA. Rigid, bio-based polyamides from galactaric acid derivatives with elevated glass transition temperatures and their characterization, Polymer 2017; 124:252-262

2. Delgove MAF, Luchies J, Wauters I, Deroover GGP, De Wildeman SMA and Bernaerts KV. Increasing the solubility range of polyesters by tuning their microstructure with comonomers. Polymer Chemistry 2017; 8:4696-4706

3. Wroblewska AA, Lingier S, Noordijk J, Du Prez FE, De Wildeman SMA, Bernaerts KV. Polyamides based on a partially bio-based spirodiamine

4. Bernaerts KV, Willet N, Van Camp W, Jérôme R, Du Prez FE. pH-Responsive diblock copolymers prepared by the dual initiator strategy. Macromolecules 2006;39:3760-3769.

5. Bernaerts KV, Du Prez FE. Dual/heterofunctional initiators for the combination of mechanistically distinct polymerization techniques. Prog. Polym. Sci. 2006;31:671-722