## Green Chemistry TechHub – A Trilateral Doctoral Program

The Green Chemistry TechHub is a joint doctoral training program established by TU Wien (TUW), the University of Natural Resources and Life Sciences (BOKU), and the University of Vienna (UV). Funded by the Austrian Research Promotion Agency (FFG) and supported by a robust network of industry partners, the program is dedicated to advancing innovation in sustainable and environmentally responsible chemistry through interdisciplinary research and academic–industry collaboration.

We are currently offering 8 fully-funded PhD positions across the three institutions:

- 4 Positions at TU Wien (TUW)
- 2 Positions at BOKU University (BOKU)
- 2 Positions at University of Vienna (UV)

Each doctoral researcher will engage in a four-year research program, spending **up to 3 years at the academic institution** and **1 year embedded with an industry partner or continued employment at the academic institution with a secondment placement at industry**, gaining valuable cross-sector experience in applied green chemistry and biotechnology. The positions are equivalent to part-time university assistantships (30 hours/week) and offer competitive remuneration according to FFG guidelines and the respective university's pay scale, including full social benefits.

### We offer:

- An interdisciplinary, applied research setting within the **Green Chemistry TechHub**
- Exposure to both academic excellence and real-world industrial challenges
- Hands-on experience with advanced tools and methodologies in sustainable biotechnology
- Competitive funding and access to professional development resources
- Diverse and cutting-edge research projects
- Continuing personal and professional education
- Additional optional training as a Green Chemistry Change Manager (GCCM)
- High-quality supervision by renowned scientists
- Ample opportunities for international networking, secondments, and research collaboration
- Courses on transferable skills
- Comprehensive social benefits (e.g., health insurance)
- Administrative support in study and organizational questions
- A central location in Vienna—consistently ranked as the city with the best quality of life
- A dynamic and inclusive working environment

### Applications:

**Application Process:** Applications will be reviewed on a rolling basis until the position is filled.

At the Green Chemistry TechHub consortium we are committed to equal opportunity and strive to increase the representation of women within scientific staff across all partner institutions. Therefore, we strongly encourage qualified women to apply. Female applicants will be given preferential consideration when their qualifications, aptitude, and professional performance are comparable to those of male applicants. Additionally, persons with disabilities are especially encouraged to apply.

Applications should be submitted online via the TU Wien job portal.

**Required Documents:**

- A **cover letter** listing three preferred PhD topics from the project list (ranked with motivation)
- A **curriculum vitae**, including publications, conference contributions, and other scientific activities (if applicable), preferably using the Europass template
- A **one-page summary** of the diploma/master's thesis
- **Transcripts** of records of the Bachelor- and Master-studies
- A **one-page outline** on how you would approach the proposed project

**Selection Process:**

Shortlisted candidates will be invited to participate in a **video or face-to-face hearings**, which will include:

- A presentation on previous research projects
- A short discussion of a thematically related publication (article sent one week in advance)
- A critical reflection on the proposed implementation of the selected project

This multi-stage process ensures a comprehensive evaluation of technical expertise, strategic thinking, and alignment with project objectives.
For further information about the open positions or the application procedure, please contact the Project Manager, Muhammad Farooq Zia (muhammad.zia@tuwien.ac.at), or reach out to one of the project leaders.

## Positions (English):

Position 1. Biotechnological methanol valorization (BOKU/New Path Bio)
Position 2. Production of biochemicals based on biodiesel and bioethanol waste (BOKU/Vogelbusch)
Position 3. Membrane separation process for $CO_2$ (TUW/VOESTalpine)
Position 4. Sustainable polymer processing (UV/BASF)
Position 5. Starch modification (TUW/Agrana)
Position 6. Sustainable isotope labeling (UV/Boehringer Ingelheim)
Position 7. Solvent-free reaction cascades using mechanochemistry (TUW/RDP)
Position 8: Development of a modular polysaccharide platform using click chemistry (TUW/Agrana)

## Positions (German):

Position 1: Biotechnologische Methanol Valorisierung (BOKU/New Path Bio)
Position 2: Lentilactobacillus Plattform (BOKU/Vogelbusch)
Position 3: Membranseparationsprozess für $CO_2$ (TUW/VOESTalpine)
Position 4: Nachhaltige Polymer-Prozessierung (UV/BASF)
Position 5: Stärkemodifikation (TUW/Agrana)
Position 6: Nachhaltiges Isotopenlabelling (UV/Boehringer Ingelheim)
Position 7: Lösungsmittelfreie Reaktionskaskaden mittels Mechanochemie (TUW/RDP)
Position 8: Modulare Polysaccharid-Platform mittels Click Chemie (TUW/Agrana)

Position 8:

# Modular Polysaccharide-Platform based on Click chemistry

**The challenge: Reproducible and efficient design of libraries of modified polysaccharides**

Bio-based Polysaccharides like starch, cellulose, chitin, chitosan, pectin, alginate or guaran are extremely interesting renewable resources with great potential to replace synthetic polymers in various areas of applications. However, the petrol-based materials have been thoroughly optimized over the last century. Consequently, also the natural polysaccharides must undergo efficient finetuning of their native properties to be able to compete. **Scientists face major challenges to modify properties of these natural materials reliably and reproducibly**; also, monitoring the success in such modifications is generally analytically challenging and rarely general. The scope of such material libraries as well as the pace in which they can be prepared and characterized are insufficient. **Thus, the perspective of a successful replacement of industrially established plastics by bio-based alternatives is restricted.**

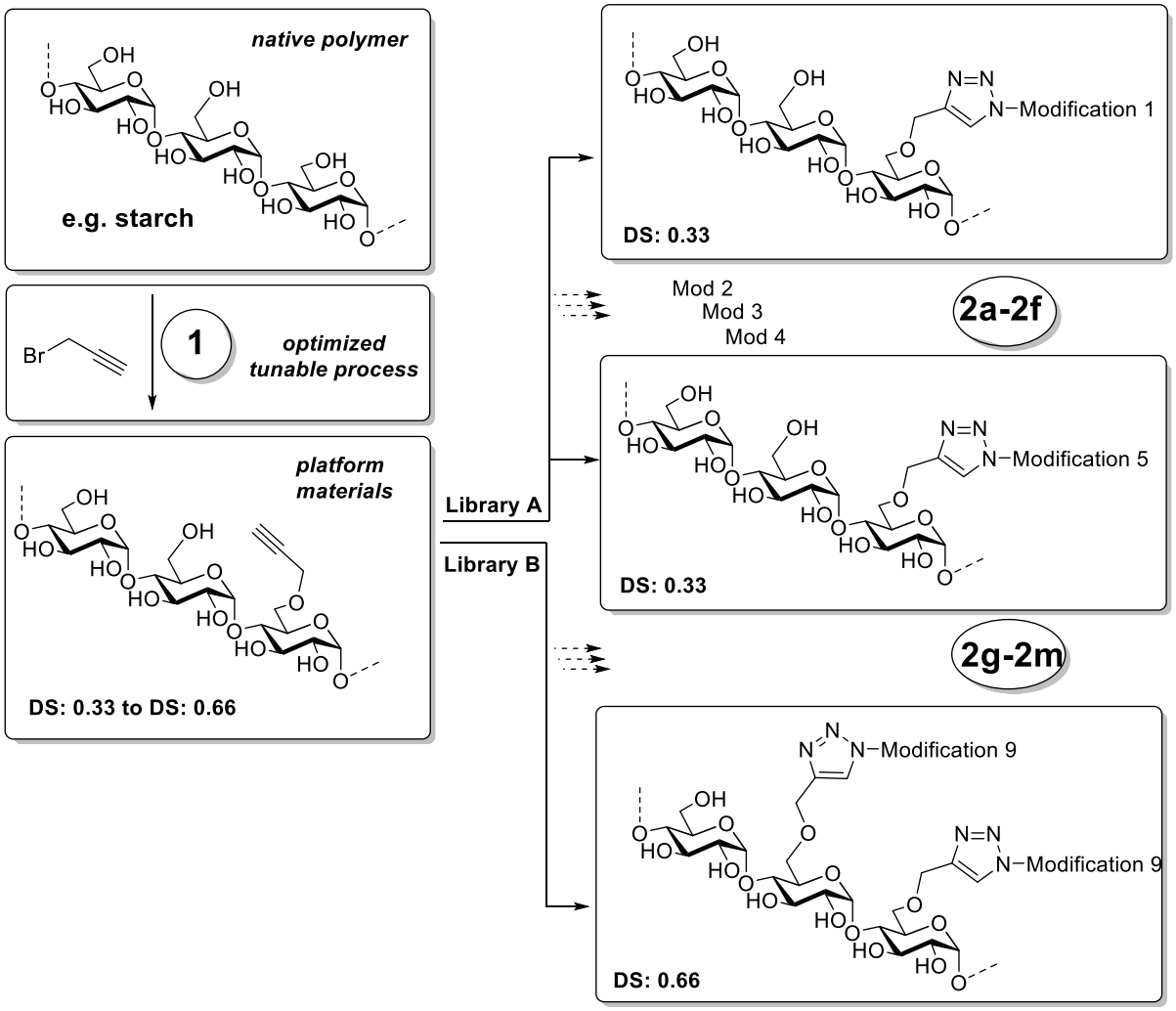


*Figure 1: Envisioned platform approach with starch and an alkynylation agent (left side) as examples to facility rapid library design of libraries of bio-based modified material with tailor made properties via click chemistry as the second step (right side).*

**Our envisioned solution: Clickable clearly defined polysaccharide platform**

We would like to separate the problem of finding an optimal modification in terms of structure activity relationship from the complex task of successfully attaching modifications onto polysaccharides, particularly in cost-efficient manner at industrial scale. We envision a two-step approach aiming at screenings at small amounts, thus saving labour, solvents, reagents and starting materials.

For the first step, we want to establish general protocols for the reproducible initial modification of natural polysaccharides with small anchor-groups allowing Cu-based click chemistry in water as the most established means for the second step.[1,2] The ideal process should yield materials in which the type and degree of substitution can be carefully tuned and easily analytically followed. In this light, different reagents to install alkynyl[3,4] and azide-functionality[5,6] onto polysaccharides will be evaluated on different polysaccharide materials.

These platform materials must proof to undergo Cu-based click chemistry reliably and with high efficiency in order to start from a platform material with e.g 30% DS of an alkynyl group and reliably end at 30% DS of different final modifications, which will be the focus of the second stage. This will facilitate screenings without the need of re-analysis of every single material. For this second stage of the actual modification, we want to exploit the chemical space and functional group compatibility within the biopolymer and the reagents for the coupling. Due to the orthogonality of Cu-Click to most other chemistry, our approach will allow a substantially larger variety of modifiers for evaluation as their structure can be optimized on the small molecule level and can then be combined as a library with the platform-polysaccharide library to achieve a high level of variation. We will also engage in establishing dual anchors (e.g. one alkyne and one azide) and to be able to graft two types of modifications onto the polymer matrix, further increasing the complexity of the material platforms.


1) Meng, X., & Edgar, K. J. (2016). “Click” reactions in polysaccharide modification. *Progress in Polymer Science*, *53*, 52-85.
2) Elchinger, P. H., Faugeras, P. A., Boëns, B., Brouillette, F., Montplaisir, D., Zerrouki, R., & Lucas, R. (2011). Polysaccharides: The “click” chemistry impact. *Polymers*, *3*(4), 1607-1651.
3) Tan, W., Li, Q., Dong, F., Qiu, S., Zhang, J., & Guo, Z. (2017). Novel 1, 2, 3-triazolium-functionalized starch derivatives: Synthesis, characterization, and evaluation of antifungal property. *Carbohydrate polymers*, *160*, 163-171.
4) Shey, J., Holtman, K. M., Wong, R. Y., Gregorski, K. S., Klamczynski, A. P., Orts, W. J., ... & Imam, S. H. (2006). The azidation of starch. *Carbohydrate polymers*, *65*(4), 529-534.
5) Uliniuc, A., Popa, M., Drockenmuller, E., Boisson, F., Leonard, D., & Hamaide, T. (2013). Toward tunable amphiphilic copolymers via CuAAC click chemistry of oligocaprolactones onto starch backbone. *Carbohydrate polymers*, *96*(1), 259-269.
6) Tankam, P. F., Müller, R., Mischnick, P., & Hopf, H. (2007). Alkynyl polysaccharides: synthesis of propargyl potato starch followed by subsequent derivatizations. *Carbohydrate Research*, *342*(14), 2049-2060.