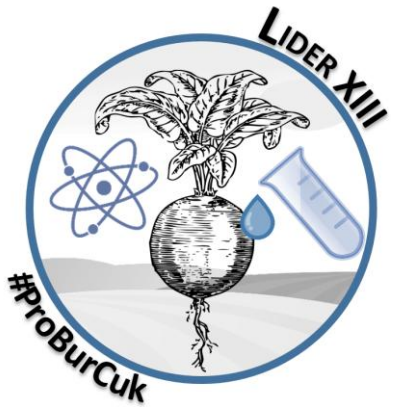




POZNAN UNIVERSITY OF TECHNOLOGY



***In harmony with nature in
agrochemistry and surfactants:
betaine as a promising raw material
for sustainable industry***

***Poznan University of Technology
Faculty of Chemical Technology***

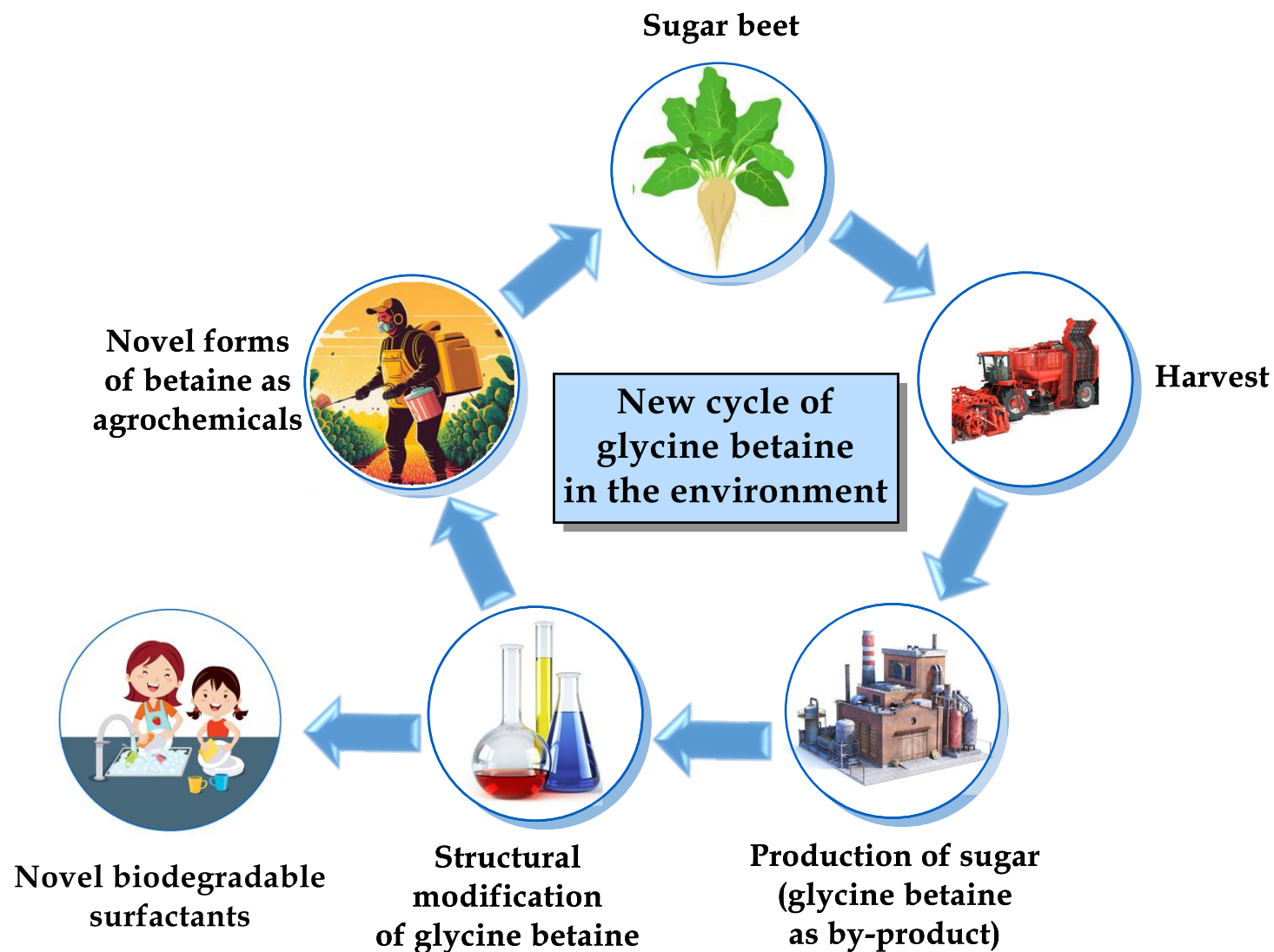
Michał Niemczak, DSc, Associate Professor

Keywords: glycine betaine, plant protection, cleaning products, biological activity, esterquats

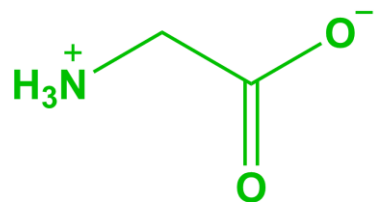


IDEA:

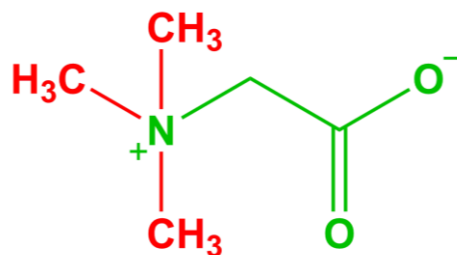
- Conversion of glycine betaine, known as the cost-effective and non-toxic for humans and the surrounding environment substance occurring naturally in cultivated plants, towards **novel agents for effective control of pests**
- Conversion of glycine betaine to **more environment-friendly surfactants** that will pose lower threat to aquatic life



Glycine - the simplest amino acid present in nature

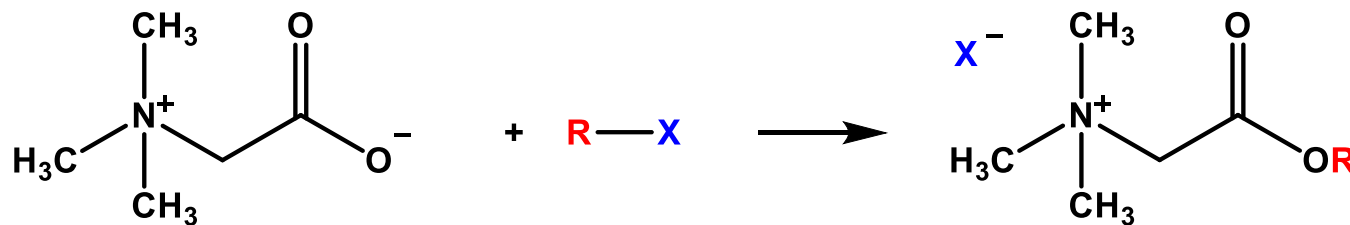


Glycine betaine - a derivative of glycine found in various plants, such as sugar beet



Glycine betaine is an attractive raw material for the synthesis of compounds with potential applications in various industries:

O-alkylation of glycine
betaine with
halogenoalkanes

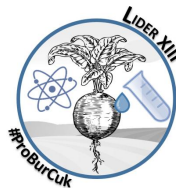


R = straight alkyl chain
X = Cl, Br

Obtained betaine esters belong
the group of quaternary
ammonium salts (QASs)



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dr hab. inż. Michał Niemczak, prof. PP
Speaker

Institute of Chemical
Technology and
Engineering



Grant LIDER13/0029/2022:

TITLE (ENG): *The use of glycine betaine, a waste in the sugar beet processing process, as a raw material for the production of environmentally friendly cleaning and disinfecting agents and herbicidal preparations*

Founder: The National Centre for Research and Development

The value of the project: 1,414,896.25 PLN

Time of realization: March 1, 2023 – March 1, 2026

Project contractors:

Michał Niemczak- leader

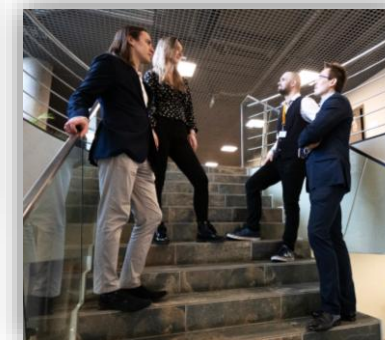
Tomasz Rzemieniecki – synthesis, scaling-up, formulation development

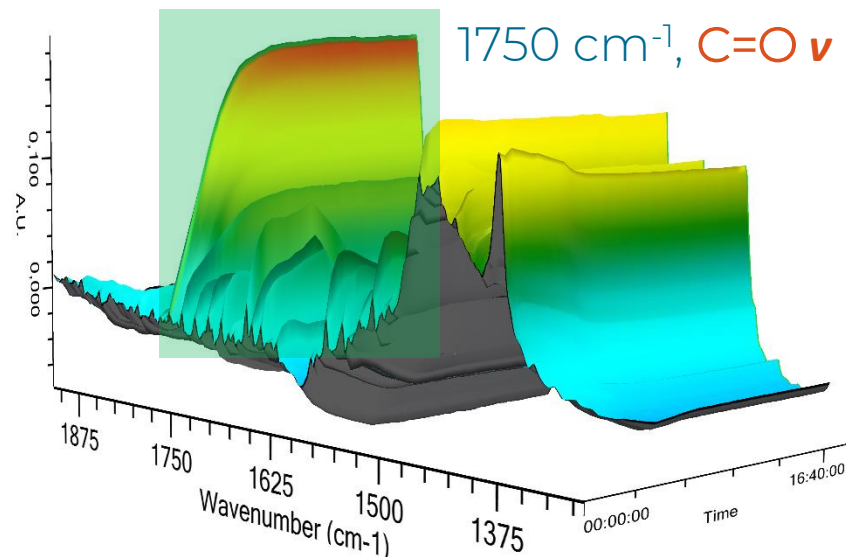
Damian Kaczmarek - analysis of phytotoxic effects and ecotoxicity

Witold Stachowiak – analysis of ecotoxicity, formulation development

Adriana Olejniczak – analysis of phytotoxic effects

Wiktoria Kozłowska – contacts with industry





➤ Development of optimal synthesis conditions on a laboratory scale

➤ Ecotoxicological tests

The REACH Regulation – production in quantities equal to or exceeding 1 tonne per year in EU territory requires to carry out a chemical safety assessment (human health and the environment)



Health



Safety

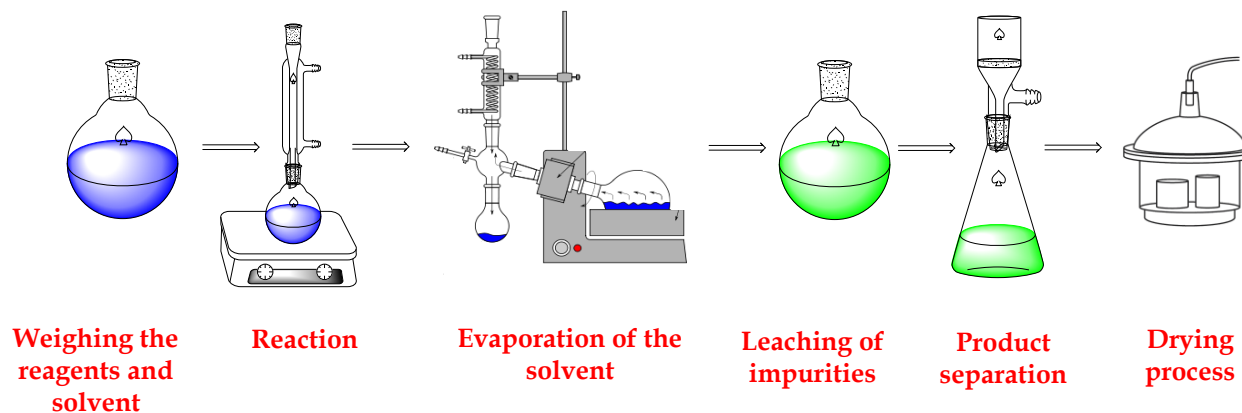


Environment

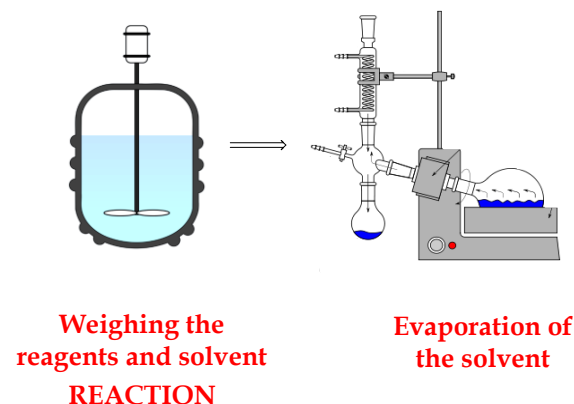
Simplifying a laboratory synthesis method for commercial scale production often involves optimizing various aspects such as:

- **Process Optimization:** number of steps should be minimized
- **Efficiency:** achieving reaction yields at least 90% is preferable
- **Scalability:** method should be effective also on a greater scale (rather kilograms or tonnes than grams)
- **Cost-effectiveness:** reactants should be easily available and cheap
- **Safety:** the process should take place in mild conditions

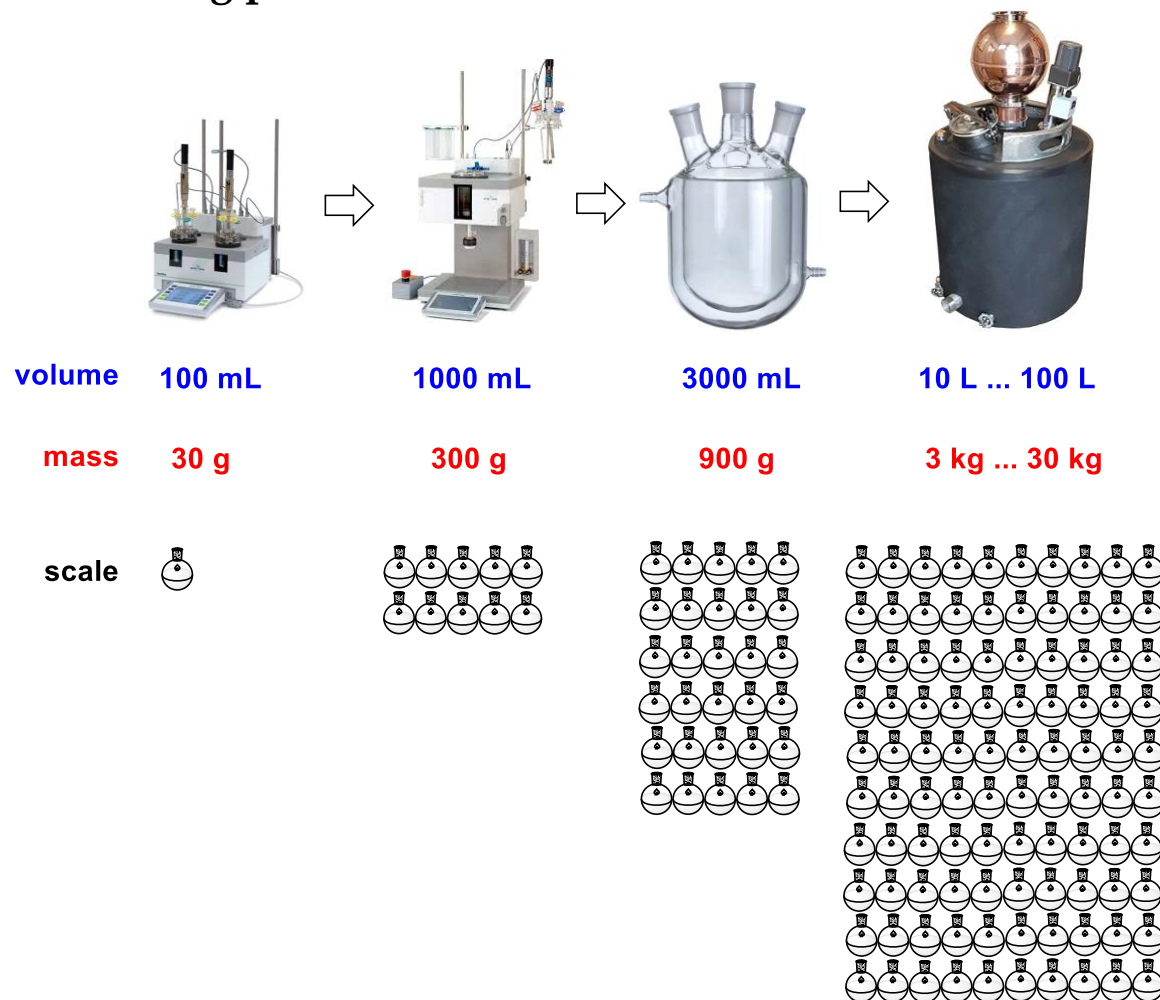
Laboratory-scale synthesis:



Commercial scale synthesis:



Increasing production scale:

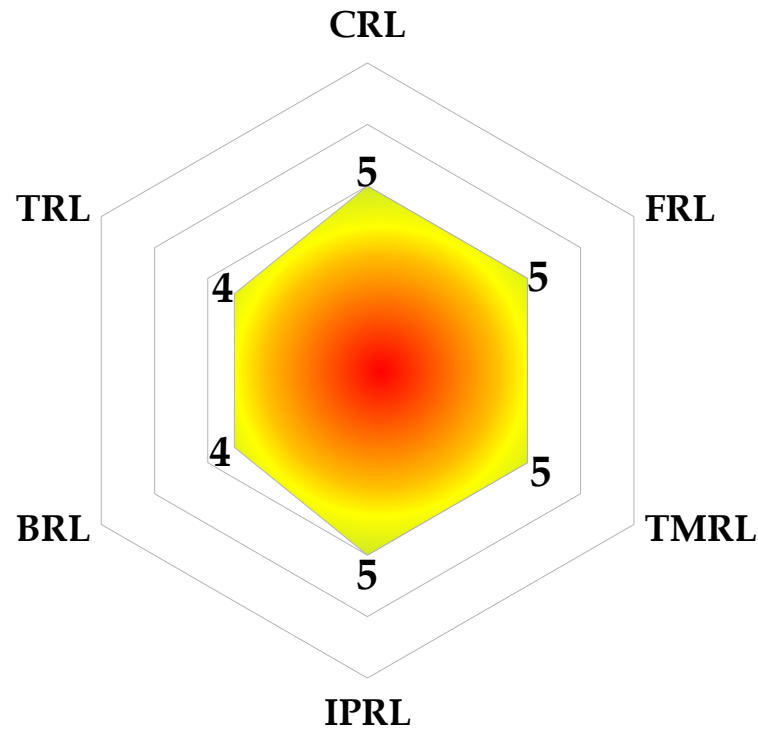


Development of commercial formulation:

Developed formulations contain not only the active substance, but also various additives

- **Solvents:** help dissolve the active substance and other ingredients
- **Stabilizers:** ensure the shelf life and stability of the formulation, especially during storage and transportation
- **Adjuvants:** allow to increase the effectiveness of the formulation
- **Viscosity regulators:** improve the viscosity of the formulation to make it easier to apply
- **Dyes, fragrances:** provide an appropriate aesthetic effect that promotes consumer interest

Innovation Readiness Profile



- CRL: 5 - Established interest and relations with customers
- TRL: 4 - Technology validation in laboratory
- BRL: 4 - First calculations indicate economically viable business model. First sustainability assessment of proposed business model
- IPRL: 5 - Draft of IPR strategy to create business value is in place. Filed first formal application/registration of key IPR
- TMRL: 5 - Initial founding team with main needed competencies and capacity. Team agrees on ownership, roles, goals, and visions
- FRL: 5 - Pitch for funding tested on relevant audience. Possible funding roadmap and first financial projections

We are seeking for:

1. Academic partners. 2. Industrial partners. 3. Venture capital firms interested in investing.



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Link: <https://proburcuk.put.poznan.pl>

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Minister of Science and Higher Education
Republic of Poland



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