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Combinatorial solid phase peptide synthesis of peptides on glass slides and thermographic investigation on CO_2-binding affinity

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Abstract:
In this research peptide arrays, synthesized with combinatorial solid-phase peptide synthesis (SPPS), have been used to detect CO_2 binding in an artificial CO_2 atmosphere by the technique of thermographic measurements using a high-resolution infrared thermographic camera. Thereby, endo- or exothermic reaction heat release can be detected in mk range indicating successful CO_2 binding to possible active peptides.

1 Introduction / Objectives

- Biocatalysts such as RubisCO play an important role in the conversion of CO_2 into organic molecules. Certain amino acids are crucial for CO_2 fixation in the binding site of carboxylases/oxygenases [1].

- To investigate this process, we performed a combinatorial peptide array synthesis of peptides on functionalized glass slides, followed by screening for CO_2-binding-affinity of the peptide library with an infrared camera in a CO_2 containing environment (see Figure 1).

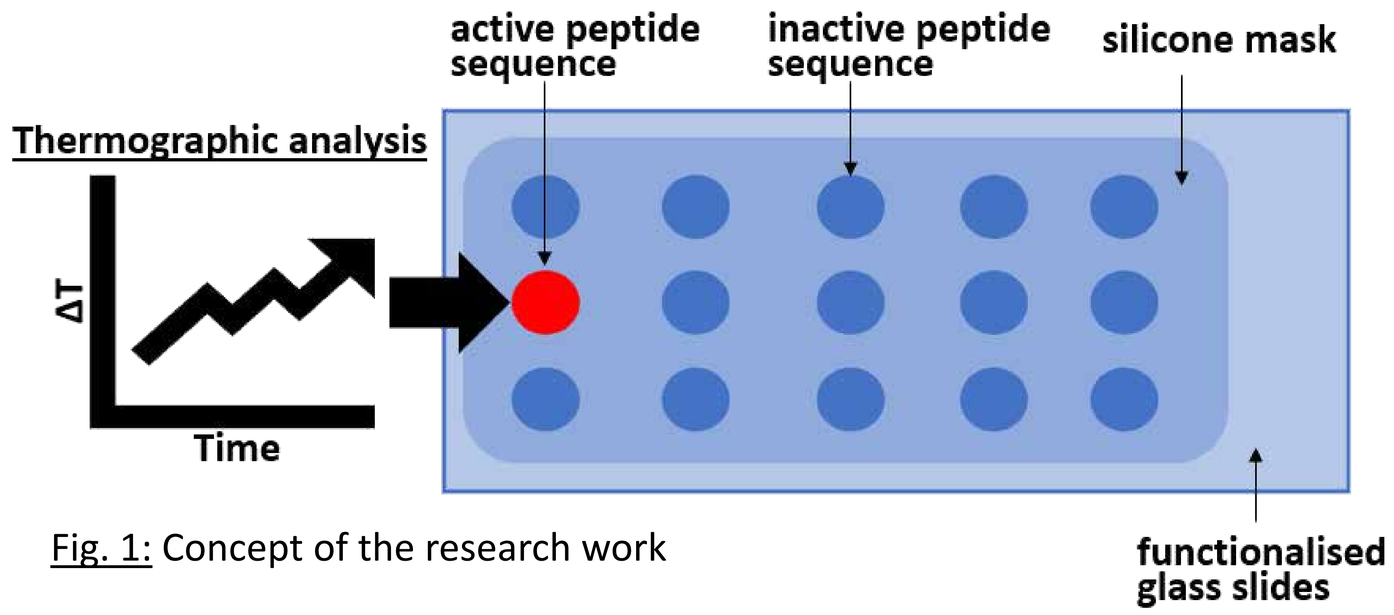

Fig. 1: Concept of the research work

2 Methods

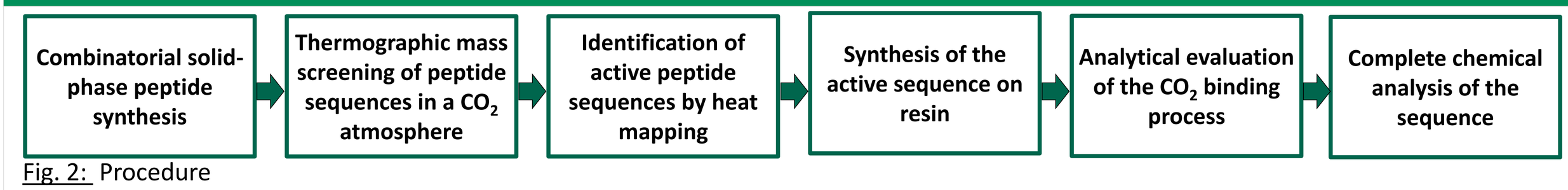

Fig. 2: Procedure

3 Results

- The temperature abnormality in the His-Phe-Asn sequence was reproducible.

- The temperature abnormality in the Phe-His-His sequence was not reproducible.

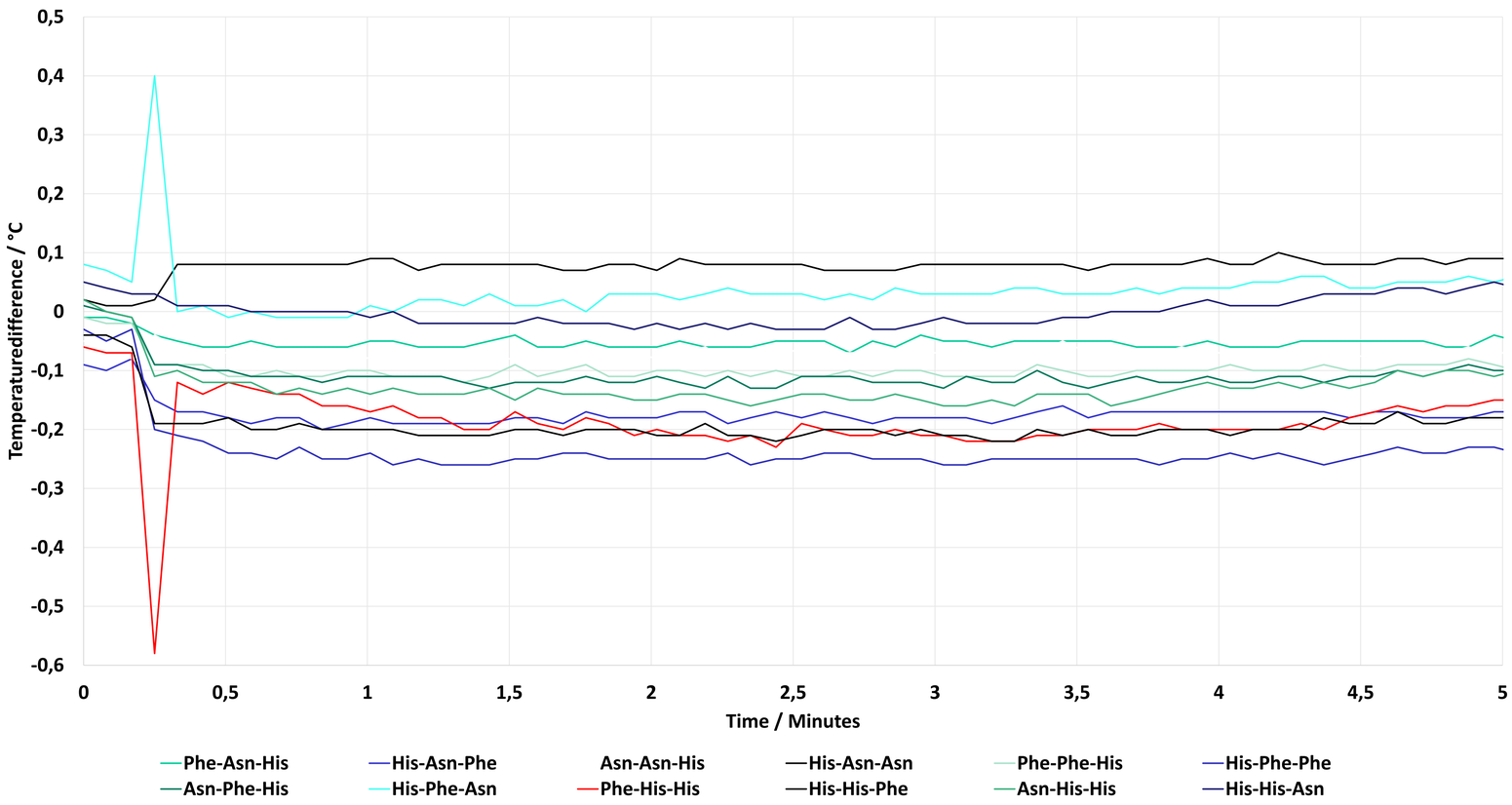

Fig. 3: Example of a thermographic examination of a slide with tripeptides

4 Outlook

- We are currently in the process of transferring the synthesis of the potential HIT sequence to resin beads.

- Gaining higher amounts of peptides for the evaluation of the CO_2 binding process.

- Technical applications of the sequence are to be tested.

5 Literature

[1] Stoffel, G. M. M., Saez, D. A., DeMirci, H., Vögeli, B., Rao, Y., Zarzycki, J., Yoshikuni, Y., Wakatsuki, S., Vöhringer-Martinez, E., & Erb, T. J. (2019). Four amino acids define the CO2 binding pocket of enoyl-CoA carboxylases/reductases. Proceedings of the National Academy of Sciences of the United States of America, 116(28), 13964–13969. https://doi.org/10.1073/pnas.1901471116