Sugar Bags – Molecules for Mycotoxin Capture

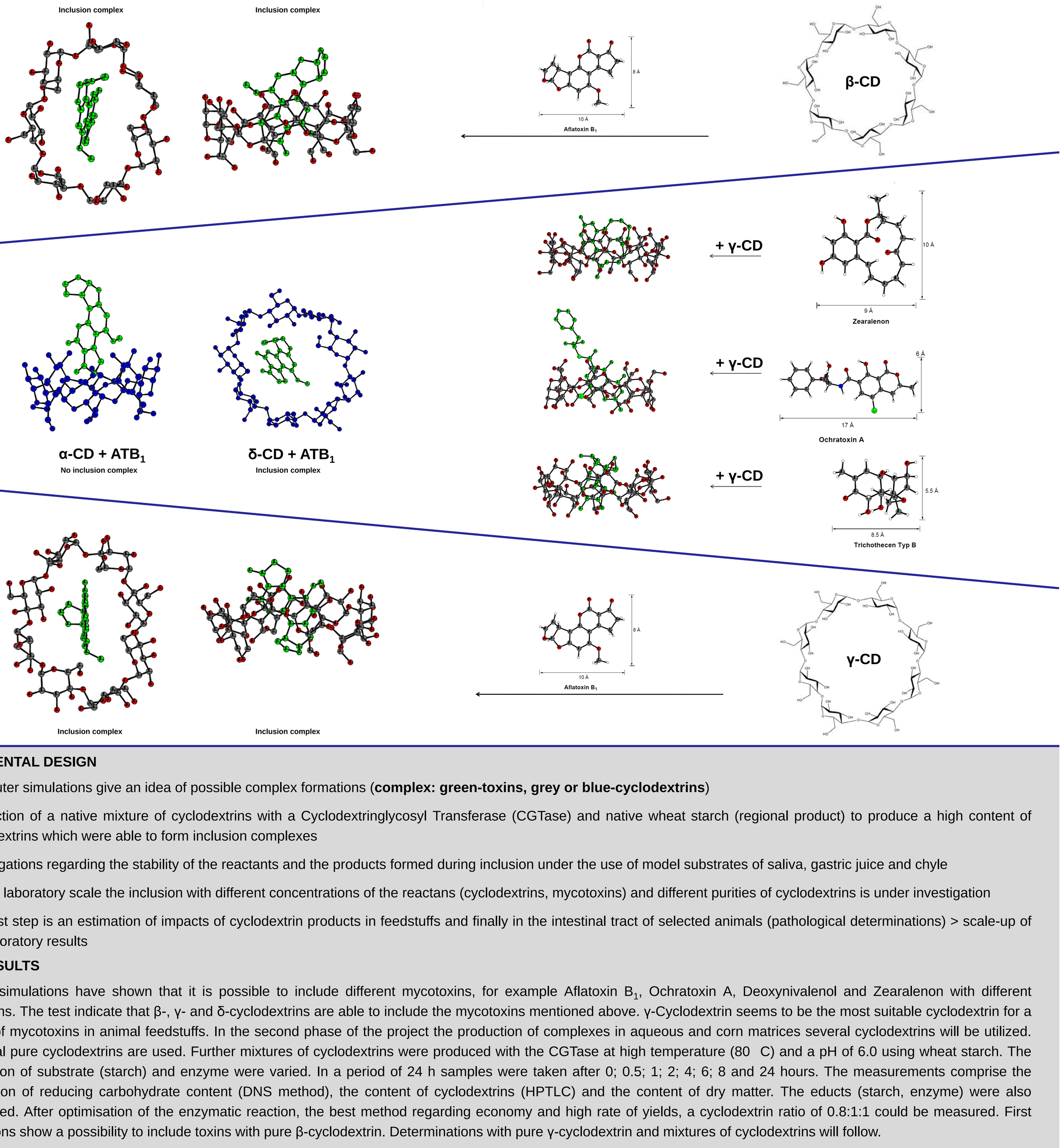
Schimpf U., Tschuikowa S., Ebner I., Stiel A.

INTRODUCTION

- Mycotoxins have a high risk potential and can affect animal health acute or cronically.
- Therefor it is very likely to expect a high rate of casualties in terms of animal breeding.

OBJECTIVES

- For mycotoxicosis reduction sugar molecules, cyclodextrins, are proved to include mycotoxins. The aim is to form inclusion complexes of mycotoxins (Aflatoxin B_1-ATB_1, Ochratoxin A, Deoxynivalenol, Zearalenon) and cyclodextrins (pure cyclodextrins, native mixture of cyclodextrins) which results in a lower uptake of mycotoxins in the intestinal tract of animals, especially young animals like calves and piglets. Cyclodextrins (CD) are able to include different molecules because of their cavity which can have different sizes. Usually native cyclodextrins are composed of six, seven or eight glucose molecules (α-, β- or γ-cyclodextrin).
- Furthermore, the aim is to decrease the morbidity and death rates of young animals and to enhance the economy and performance of the livestock growing under the use of ***native*** and ***renewable*** materials.



EXPERIMENTAL DESIGN

- Computer simulations give an idea of possible complex formations (**complex: green-toxins, grey or blue-cyclodextrins**)
- Production of a native mixture of cyclodextrins with a Cyclodextringlycosyl Transferase (CGTase) and native wheat starch (regional product) to produce a high content of cyclodextrins which were able to form inclusion complexes
- Investigations regarding the stability of the reactants and the products formed during inclusion under the use of model substrates of saliva, gastric juice and chyle
- On the laboratory scale the inclusion with different concentrations of the reactans (cyclodextrins, mycotoxins) and different purities of cyclodextrins is under investigation
- The last step is an estimation of impacts of cyclodextrin products in feedstuffs and finally in the intestinal tract of selected animals (pathological determinations) > scale-up of the laboratory results

FIRST RESULTS

Computer simulations have shown that it is possible to include different mycotoxins, for example Aflatoxin B_1, Ochratoxin A, Deoxynivalenol and Zearalenon with different cyclodextrins. The test indicate that β-, γ- and δ-cyclodextrins are able to include the mycotoxins mentioned above. γ-Cyclodextrin seems to be the most suitable cyclodextrin for a decrease of mycotoxins in animal feedstuffs. In the second phase of the project the production of complexes in aqueous and corn matrices several cyclodextrins will be utilized. Commercial pure cyclodextrins are used. Further mixtures of cyclodextrins were produced with the CGTase at high temperature (80 C) and a pH of 6.0 using wheat starch. The concentration of substrate (starch) and enzyme were varied. In a period of 24 h samples were taken after 0; 0.5; 1; 2; 4; 6; 8 and 24 hours. The measurements comprise the determination of reducing carbohydrate content (DNS method), the content of cyclodextrins (HPTLC) and the content of dry matter. The educts (starch, enzyme) were also characterized. After optimisation of the enzymatic reaction, the best method regarding economy and high rate of yields, a cyclodextrin ratio of 0.8:1:1 could be measured. First investigations show a possibility to include toxins with pure β-cyclodextrin. Determinations with pure γ-cyclodextrin and mixtures of cyclodextrins will follow.

Project financed by the German Federal Ministry of Economy and Technology, Project executing organisation: EuroNorm GmbH, Project partner: PROTEKUM Umweltinstitut GmbH
Contact: Schimpf, Ulrike, Institute of Agricultural and Urban Ecological Projects affiliated to Berlin Humboldt University, Philippstraße 13, Haus 16, 10115 Berlin, Deutschland, Tel.: 0049-30-2093 9061,
Fax: 0049-30-2093 9065, Mail: ulrike.schimpf@agrar.hu-berlin.de/iasp@agrar.hu-berlin.de, Internet: www.iasp.asp-berlin.de