

Investigation of the behavior of cellulose nanocrystals in simulated human gastro-intestinal fluids by AF4 and TEM analysis

¹*Drexel, R., ²Dähnhardt-Pfeiffer, S., ³Herrmann, C., ³Metzger, C.,
³Briesen, H., ¹Meier, F.

*lead presenter

¹roland.drexel@postnova.com, Postnova Analytics GmbH, Germany

² Microscopy Services Dähnhardt GmbH, Germany

³ Technical University of Munich, Chair of Process Systems Engineering, Germany

Precise knowledge of the physical state of a nanomaterial is an essential prerequisite when it comes to potential application areas as well as for an accurate assessment of its toxicological potential. In this respect, it is usually not sufficient to study physico-chemical characteristics of a respective nanomaterial such as e.g. particle size distribution and agglomeration/ aggregation in its native state only, but also in the environment in which it is eventually applied and where a potential risk of exposure might exist [1].

Cellulose nanocrystals (CNC) are a bio-based nanomaterial with promising applications in many sectors including e.g. the food industry (packaging, dietary supplements) [2] as well as in medicine (drug delivery) [3]. Oral ingestion might therefore be the most prevalent exposure route with CNC being subjected to a vast variety of digestion conditions including pH range and exposure to different enzymes. Aim of this study was to investigate the behavior of CNC in human gastro-intestinal fluids thereby simulating their oral intake. The experimental procedure was based on an approach published by Peters et al. [4].

AF4-MALS and TEM were used to investigate size distribution, agglomeration as well as the shape of the CNC after each digestion step revealing that while preserving most of its native size distribution in saliva, CNC show strong agglomeration in gastric and especially in duodenal juice. Furthermore, TEM analysis revealed no significant enzymatic digestion of the CNC over the course of the experiment

The obtained findings clearly highlight the need for a better understanding of the behavior of CNC in complex matrices. Thus collected data may especially serve as a profound basis for further toxicological studies.

References

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